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with detailed answer explanations
for banks, oil companies, multinationals,
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GMAT

**MOST RECENT TESTS
WITH KEY FACTS**



**VOLUME ONE 2007
EDITION**

VCD On Techniques And Strategies Of Passing Aptitude Tests Enclosed

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— ACKNOWLEDGMENTS —

I wish to express my gratitude to Almighty God for wisdom and inspiration towards writing this book. Writing this seventh edition of **MASTER JOB APTITUDE TESTS** has been a team effort. I've been fortunate to have the assistance of a very talented group of educators and writers in **IEC PUBLICATION BUREAU** who skillfully crafted significant portion of the manuscript, drawing on both their considerable knowledge and notable literary skills to complement my abilities beautifully.

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ENGR. CHRIS UGENYI
Managing Director
IEC CAREER INVESTMENT LTD.

— PREFACE —



We guarantee success

IEC CAREER INVESTMENT LIMITED is a Career Research and Testing Company established as **IEC Computer Bureau in 1999.**

We offer Human Resource Management, Employment Testing, Entrepreneurship Training and Foreign Education Services.

IEC specializes in conducting Seminars, Workshops and Training Job Seekers for Employment Tests and interviews in Banks, Oil companies, Multinational Companies, Private Companies etc.

Apart from enlightening job seekers on how they can get their dream jobs, we also conduct employment tests and interviews for companies and organizations.

Our expertise in the area of recruitment is second to none in the country. Our well-trained staff utilize world class standards coupled with skillful efficiency and effectiveness to ensure that the best candidates are selected for interview and ultimately employment.

We focus exclusively on the placement of highly skilled and talented individuals in all sector of the economy. Our recruitment team comprises of professionals with hands-on experience in recruiting at all levels.

This is achieved by using Aptitude Tests as well as Psychometric Tests questions that are tailored to the given job descriptions.

We have a record of over five thousand job seekers whose training under our Programmes, Seminars and Workshops have earned them very good employment.

Our Seminars and Workshops have also taught many unemployed Nigerians how to transform and refine raw business ideas into innovative and realistic ideas that have helped them set up small businesses of their own.

This is the first indigenous company in Nigeria to write and publish Textbooks on Employment Tests, Interviews and Self-Employment.

We contribute on employment matters in some major Newspapers, Radios and Television in the country.

We are a voluntary consultant to National Youth Service Corps (**NYSC**) on Employment issues and Skill Acquisition.

I. E. C. Career is a corporate member of Institute of Personnel Management of Nigeria (**IPMN**).

We are an associate of the Nigeria State and Local Government SMEs Development Scheme. (**NIGERSTALG**).



— PREPARING FOR AN ATTITUDE TEST —

Here are a few suggestions to help you use your study time effectively

1. **Study alone:** You will concentrate better when you work by yourself. Keep a list of questions that you cannot answer and points that you are unsure of to talk over with a friend who is preparing for the same exam. Plan to exchange ideas at a joint review session just before the test.
2. **Eliminate distractions:** Disturbances caused by family and neighbor activities (telephone calls, chit-chat, TV programs, and so on) work to your disadvantage. Study in a quiet, private room.
3. **Don't try to learn too much in one study period.** If your mind starts to wander, take a short break and then return to your work.
4. **Review what you have learned.** When you have studied something thoroughly, be sure to review it the next day so that the information will be firmly fixed in your mind.
5. **Answer all the questions in this book.** Don't be satisfied merely with the correct answer to each question. Do additional research on the other choices that are given. You will broaden your background and be more adequately prepared for the actual exam. It's quite possible that a question on the exam that you are going to take may require you to be familiar with the other choices.
6. **Tailor your study to the subject matter.** Skim or scan. Don't study everything in the same manner. Obviously, certain areas are more important than others.
7. **Organize yourself.** Make sure that your notes are in good order. Valuable time is unnecessarily consumed when you can't find quickly what you are looking for.
8. **Keep physical fitness.** You cannot retain information well when you are uncomfortable, when you have a headache, or when you are tensed. Physical health promotes mental efficiency.
9. **Work your way through this book, giving special concentration to your areas of weakness.** Never look at answers until you have completed answering a series of questions. Study answer explanations whenever they are supplied; they may give you extra insights, even into the questions that you answered correctly.
10. **On the evening before the exam, do something pleasant and go to bed early.**

POWER TO EXCEL IN APTITUDE TEST

God is the custodian of wisdom, knowledge and understanding of all things, hence believers stand a better chance to tap from the vast resources in all fields of human endeavour. You too can reject failure and embrace the spirit of excellence today. *Job 32:8 "But there is a spirit in man: and the inspiration of the Almighty giveth them understanding."*

The only source of true wisdom and intelligence is the Almighty. God has deposited His Spirit into each of His children and as many as will tap from that divine source cannot go wrong. It is recorded that God gave Daniel and the three Hebrew boys knowledge and skill in all learning and wisdom: and Daniel had understanding in all visions and dreams (*Daniel 1:17*). "*And in all matters of wisdom and understanding, that the king enquired of them he found them ten times better than all the magicians and astrologers that were in all his realm*" (*Daniel 1:20*).

When tested, Daniel and his colleagues excelled above all the others. They realised the true source of wisdom and they tapped from it. Child of God, you too have been given the spirit that will cause you to get a profitable employment. The spirit of God is in you and when you ask Him, He will teach you all things (*1 John 2:27*). He will give you understanding, and like the Psalmist, you can say, "I have more understanding than all my teachers" (*Psalms 119:99*).

Beloved, you have to study hard. Go through this book very well and pray hard. When you've prepared well, these prayers will cause you to excel in your aptitude test.

NOTE:

1. Repent of all your sins
2. Reject every spirit of fear arising from past failures
3. Believe God for great success in this test and that you have received already.
4. Continue to confess that you have passed
5. Do not engage in any malpractice
6. Resolve not to entertain any doubt and reject all thoughts of failure or dream manipulations
7. Always give thanks to God for the answers to your prayers

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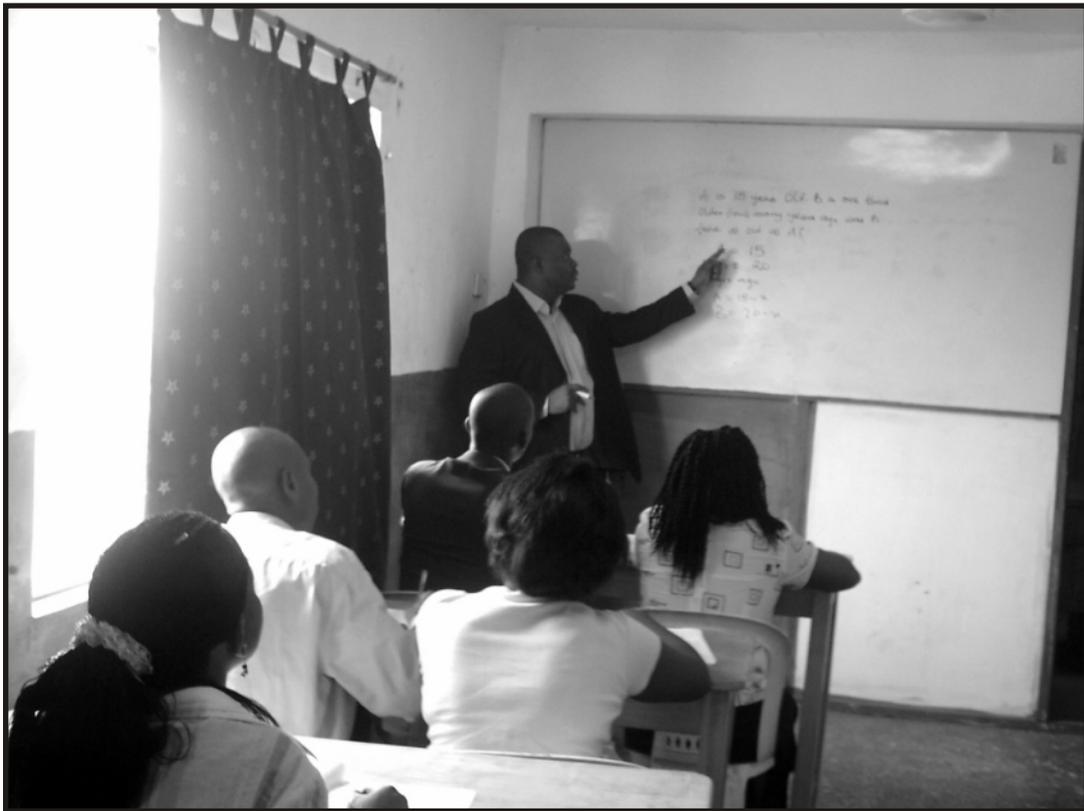
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PART ONE

QUANTITATIVE APTITUDE TESTS

**Relevant For All Company Aptitude Tests.
Study this section very carefully.**



IEC MONTHLY SEMINAR

QUANTITATIVE REASONING TEST 1

70 QUESTIONS

30 MINUTES

DIRECTIONS

Each problem in this test involves a certain amount of logical reasoning and thinking on your part. Read each problem carefully and choose the correct answer from the five choices that follow. Blacken the corresponding space on your answer sheet.

- Damilola had an average of 72 on his first four math tests. After taking the next test, his average dropped to 70. Which of the following is his most recent test grade?
(A) 60
(B) 62
(C) 64
(D) 66
(E) 68
- At a selling price N273, a refrigerator yield a 30% profit on the cost. What selling price will yield a 10% profit on the cost?
(A) N210
(B) N231
(C) N221
(D) N235
(E) N240
- If price are reduced 25% and sales increase 20%, what is the net effect on gross receipts?
(A) They increase by 5%
(B) They decrease by 5%
(C) They remain the same
(D) They increase by 10%
(E) They decrease by 10%
- If 95% of the residents of Ikorodu Estate live in private homes and 40% of these live in air-conditioned homes, what percent of the resident of Ikorodu Estate live in air-conditioned homes?
(A) 3%
(B) 30%
(C) 3.8%
(D) 40%
(E) 38%
- What single discount is equivalent to two successive discounts of 10% and 15%?
(A) 25%
(B) 24%
(C) 24.5%
(D) 23.5%
(E) 22%
- David received his allowance on Sunday. He spends $\frac{1}{4}$ of his allowance on Monday and $\frac{2}{3}$ of the remainder on Tuesday. What part of his allowance is left for the rest of the week?
(A) $\frac{1}{3}$
(B) $\frac{1}{12}$
(C) $\frac{1}{4}$
(D) $\frac{1}{2}$
(E) $\frac{4}{7}$

7. A sales person receives a salary of N100 a week and a commission of 5% on all sales. What must be the amount of sales of a week in which the salesperson's total weekly income is N360?
- (A) N6,200
(B) N5,200
(C) N2,600
(D) N720
(E) N560
8. How many of the numbers between 100 and 300 begin or end with 2?
- (A) 20
(B) 40
(C) 100
(D) 110
(E) 180
9. If a merchant makes a profit of 20% based on the selling price of an article, what percent does the merchant make on the cost?
- (A) 20
(B) 40
(C) 25
(D) 80
(E) None of these
10. There is enough food at a picnic to feed 20 adults or 32 children. If there are 15 adults at the picnic, how many children can still be fed?
- (A) 6
(B) 8
(C) 12
(D) 16
(E) 18
11. In a certain company, 55% of the workers are men. If 30% of the workers are full-time employees and 60% of these are women, what percentage of the full-time workers in the company are men?
- (A) 12%
(B) 40%
(C) 60%
(D) $66\frac{2}{3}\%$
(E) $77\frac{1}{9}\%$
12. How many digits are there in the square root of a perfect square of 12 digits?
- (A) 10
(B) 8
(C) 4
(D) 6
(E) 5
13. A is 15 years old. B is one-third older. How many years ago was B twice as old as A?
- (A) 3
(B) 5
(C) 7.5
(D) 8
(E) 10

14. A gasoline tank is $\frac{1}{4}$ full. After adding 10 gallons of gasoline, the gauge indicates that the tank is $\frac{2}{3}$ full. Find the capacity of the tank in gallons.
- (A) 15
(B) 18
(C) 24
(D) 30
(E) 20
15. If the ratio of $x:y$ is 9:7, what is the value of $x+y$?
- (A) 2
(B) 14
(C) 16
(D) 63
(E) it cannot be determined from the information
16. A 15-gallon mixture of 20% alcohol has 5 gallons of water added to it. The strength of the mixture, as a percent, is approximately.
- (A) $12\frac{1}{2}$
(B) $13\frac{1}{3}$
(C) 15
(D) $16\frac{2}{3}$
(E) 20
17. Village **A** has a population of 6,800, which is decreasing at a rate of 120 per year. Village **B** has a population of 4,200, which is increasing at a rate of 80 per year. In how many years will the population of the two villages be equal?
- (A) 9
(B) 11
(C) 13
(D) 14
(E) 16
18. Of 60 employees at the Asekoro Manufacturing Company, x employees are female. If $\frac{2}{3}$ of the remainder are married, how many unmarried men work for this company?
- (A) $40 - \frac{2}{3}x$
(B) $40 - \frac{1}{3}x$
(C) $40 + \frac{1}{3}x$
(D) $20 - \frac{2}{3}x$
(E) $20 - \frac{1}{3}x$
19. If 3 copier machines can copy 300 sheets in 3 hours, assuming the same rate, how long (in hours) will it take 6 such copiers to copy 600 sheets?
- (A) 4
(B) 3
(C) 5
(D) 6
(E) 2

20. If m men can paint a house in d days, how many days will it take $m + 2$ men to paint the same house?
- (A) $d + 2$
(B) $d - 2$
(C) $\frac{m + 2}{md}$
(D) $\frac{md}{m + 2}$
(E) $\frac{md + 2d}{m}$
21. A maths class has 27 students in it. Of those students, 14 are also enrolled in history and 17 are enrolled in English. What is the minimum percentage of the students in the maths class who are also enrolled in history and English?
- (A) 15%
(B) 22%
(C) 49%
(D) 63%
(E) 91%
22. The distance from City A to City B is 150 miles and the distance from City A to City C is 90 miles. Therefore, it is necessarily true that.
- (A) the distance between B to C is 60 miles
(B) six times the distance from A to B equals 10 times the distance from A to C
(C) the distance from B to C is 240 miles
(D) the distance from A to B exceeds by 30 miles twice the distance from A to C
(E) three times the distance from A to C exceeds by 30 miles twice the distance from A to B .
23. A merchant sells a certain item for a price that is a whole number of naira. If the cost of the item to her is N50, then which of the following could be her profit as a percentage of her cost?
- (A) 15%
(B) 25%
(C) $33\frac{1}{3}\%$
(D) 40%
(E) 75%
24. If the price of an item is increased by 10% and then decreased by 10%, the net effect on the price of the item is
- (A) an increase of 99%
(B) an increase of 1%
(C) no change
(D) a decrease of 1%
(E) a decrease of 11%
25. While researching a term paper, a student read pages 7 through 49 and pages 101 through 157 of a particular source book. Altogether, how many pages from this book did this student read?
- (A) 98
(B) 99
(C) 100
(D) 101
(E) 102

26. If 3 people working together at the same rate can do a job in $5\frac{1}{3}$ days, what fraction of that job can two of these people do in one day?
- (A) $\frac{1}{16}$
(B) $\frac{1}{8}$
(C) $\frac{3}{16}$
(D) $\frac{1}{2}$
(E) $\frac{2}{3}$
27. If one-half of the female students in a certain college eat in the cafeteria and one-third of the male students eat there, what fractional part of the student body eats in the cafeteria?
- (A) $\frac{5}{12}$
(B) $\frac{2}{5}$
(C) $\frac{3}{4}$
(D) $\frac{5}{6}$
(E) It cannot be determined from the information given
28. **3, 5, -5.....**
The first term in the sequence of numbers shown above is 3. Each even-numbered term is two more than the previous term and each odd-numbered term after the first is -1 times the previous term. For example, the second term is $3+2$, and the third term is $(-1) \times 5$. What is the 55th term of the sequence.
- (A) -5
(B) -3
(C) -1
(D) 3
(E) 5
29. If interest on a savings account is paid monthly at an annual rate of $6\frac{1}{4}$ percent and if the interest is not reinvested, then in how many years will the total amount of interest earned equal the amount of money saved in the account?
- (A) 36
(B) 24
(C) 18
(D) 16
(E) 12
30. Two ships leave from the same port at 11:30 A.M. If one sails due east at 20 miles per hour and the other due south at 15 miles per hour, how many miles apart are the ships at 2:30 P.M.?
- (A) 25
(B) 50
(C) 75
(D) 80
(E) 85
31. In IEC Career Investment Ltd, the ratio of upper management to middle management personnel is 4 : 3. If 75% of upper management has experience in the production line, what is the greatest proportion of the total of upper and middle management personnel who could have experience, on the production line?
- (A) $\frac{5}{7}$
(B) $\frac{3}{4}$
(C) $\frac{6}{7}$
(D) $\frac{7}{6}$
(E) $\frac{7}{4}$

32. Let the "CHRIS" of a number be defined as three less than three times the number. What number is equal to its "CHRIS"?
- (A) 1.5
(B) 2.0
(C) 3.5
(D) 1.0
(E) 2.5
33. If 15 cans of food are needed for seven adults for two days, the number of cans needed to feed four adults for seven days is
- (A) 15
(B) 20
(C) 25
(D) 30
(E) 35
34. There are x cookies in a jar. One child eats $\frac{1}{4}$ of all the cookies. A second child eats $\frac{1}{3}$ of the remaining cookies. If the remaining cookies are distributed among four other children, what fraction of the original number of cookies did each of the four children receive?
- (A) $\frac{7}{12}$
(B) $\frac{1}{2}$
(C) $\frac{5}{12}$
(D) $\frac{1}{6}$
(E) $\frac{1}{8}$
35. A is 300 miles from B . The path of all points equidistant from A and B can best be described as
- (A) a line \parallel to AB and 150 miles north of AB
(B) a transverse segment cutting through AB at a 45° angle
(C) a circle with AB as its diameter
(D) the perpendicular bisector of AB
(E) the line AB
36. John is now three times Pat's age. Four years from now John will be x years old. In terms of x , how old is Pat now?
- (A) $\frac{x+4}{3}$
(B) $3x$
(C) $x+4$
(D) $x-4$
(E) $\frac{x-4}{3}$
37. On an income of N15,000 a year, a clerk pays 15% in federal taxes and 10% of the remainder in state taxes. How much is left?
- (A) N9,750
(B) N11,475
(C) N12,750
(D) N13,500
(E) N14,125

38. At IEC High School, the ratio of girls to boys is 2:1. If $\frac{3}{5}$ of the boys are on a team and the remaining 40 boys are not, how many girls are in the school?
- (A) 50
(B) 200
(C) 150
(D) 100
(E) 250
39. If each of the dimensions of a rectangle is increased 100%, the area is increased.
- (A) 100%
(B) 200%
(C) 300%
(D) 400%
(E) 500%
40. If a discount of 20% off the marked price of a jacket results in a savings of N15, what is the discounted price of the jacket?
- (A) N35
(B) N60
(C) N75
(D) N150
(E) N300
41. The sum of an odd number and an even number is
- (A) sometimes an even number
(B) always divisible by 3 or 5 or 7
(C) always an odd number
(D) always a prime number (not divisible)
(E) always divisible by 2
42. Three times the first of three consecutive odd integers is 3 more than twice the third. Find the third integer.
- (A) 7
(B) 9
(C) 11
(D) 13
(E) 15
43. The vertices of a triangle are (3,1) (8, 1), and (8,3). What is the area of this triangle?
- (A) 5
(B) 10
(C) 12
(D) 14
(E) 20
44. If Ify has N5 more than Ugo, and if Ugo has N2 more than Obi, which of the following exchanges will ensure that each of the three has an equal amount of money?
- (A) Ify must give Obi N3 and Ugo N1
(B) Ugo must give Ify N4 and Ify must give Obi N5
(C) Obi must give Ify N1 and Ify must give Ugo N1
(D) Ify must give Obi N4 and Ugo must give Obi N5
(E) Either Ify or Obi must give Ugo N7

45. A person is standing on a staircase. He walks down 4 steps, up 3 steps, down 6 steps, up 2 steps, up 9 steps, and down 2 steps. Where is he standing in relation to the step on which he started?
- (A) 2 steps above
(B) 1 steps above
(C) the same place
(D) 1 steps above
(E) 4 steps above
46. An item costs 90% of its original price. If 90K is added to the discount price, the cost of the item will be equal to its original price. What is the original price of the item?
- (A) N.09
(B) N.90
(C) N9.00
(D) N9.90
(E) N9.99
47. On a certain day, a news vendor began the day with P papers. Between opening and noon, he sold 40 percent of the papers, and between noon and closing, he sold 60 percent of the papers which remained. What percent of the original P papers did he sell?
- (A) 0%
(B) 20%
(C) 24%
(D) 76%
(E) 100%
48. If the result obtained by multiplying a number, x by a number 1 less than itself is 4 less than multiplying x by itself, then $x =$
- (A) 1
(B) 2
(C) 3
(D) 4
(E) 5
49. Mr. Abu grosses N2,000 per month from his mail-order business. If 40 percent of that amount goes for business expenses and 10 percent of the remainder is reinvested in the business, how much of the gross receipts is reinvested in the business?
- (A) N80
(B) N100
(C) N110
(D) N120
(E) N200
50. Baba is 67. His son Ade is 29. In how many years will Ade be exactly half his father's age?
- (A) 2
(B) 5
(C) 7
(D) 9
(E) 12



51. If the numerator of a fraction is decreased 25 percent and the denominator of that fraction is increased 25 percent, then the difference between the resulting and the original fractions represents what percentage decrease?
- (A) 40%
(B) 45%
(C) 50%
(D) 60%
(E) 75%
52. A boy bought some packets of biscuits for N120. If the biscuits had been 3 Naira a packet cheaper, he would have received 2 more packets for his money. How many packets did he buy?
- (A) 12
(B) 8
(C) 6
(D) 10
(E) 15
53. The distance from Lagos to Ibadan is 160km. If a commercial bus were 16km/h slower, it would take 20 minutes longer on the journey. What is the average speed of the bus?
- (A) 80
(B) 45
(C) 74
(D) 96
(E) 120
54. In an office with 21 staff members, $\frac{1}{3}$ are men and $\frac{2}{3}$ are women. To obtain a staff in which $\frac{1}{4}$ are men, how many women should be hired?
- (A) 7
(B) 5
(C) 3
(D) 2
(E) 1
55. From March 1 to March 31 the price of a certain commodity fell by $\frac{1}{4}$, and from April 1 to April 30 the price fell by $\frac{1}{3}$. By what percentage would the price of the commodity have to increase during the month of May to bring it back up to the level of March 1?
- (A) $14\frac{2}{7}\%$
(B) 25%
(C) 50%
(D) $66\frac{2}{3}\%$
(E) 100%
56. On Monday, a depositor withdraws funds from his savings account equal to 10% of the amount on deposit, and on Friday he deposits N140. If there were no other transactions, and if the amount in the account following Friday's transaction was 125% of the original amount, how much money was originally in the account?
- (A) N125
(B) N175
(C) N400
(D) N500
(E) N540

51. If the numerator of a fraction is decreased 25 percent and the denominator of that fraction is increased 25 percent, then the difference between the resulting and the original fractions represents what percentage decrease?
- (A) 40%
(B) 45%
(C) 50%
(D) 60%
(E) 75%
52. A boy bought some packets of biscuits for N120. If the biscuits had been 3 Naira a packet cheaper, he would have received 2 more packets for his money. How many packets did he buy?
- (A) 12
(B) 8
(C) 6
(D) 10
(E) 15
53. The distance from Lagos to Ibadan is 160km. If a commercial bus were 16km/h slower, it would take 20 minutes longer on the journey. What is the average speed of the bus?
- (A) 80
(B) 45
(C) 74
(D) 96
(E) 120
54. In an office with 21 staff members, $\frac{1}{3}$ are men and $\frac{2}{3}$ are women. To obtain a staff in which $\frac{1}{4}$ are men, how many women should be hired?
- (A) 7
(B) 5
(C) 3
(D) 2
(E) 1
55. From March 1 to March 31 the price of a certain commodity fell by $\frac{1}{4}$, and from April 1 to April 30 the price fell by $\frac{1}{3}$. By what percentage would the price of the commodity have to increase during the month of May to bring it back up to the level of March 1?
- (A) $14\frac{2}{7}\%$
(B) 25%
(C) 50%
(D) $66\frac{2}{3}\%$
(E) 100%
56. On Monday, a depositor withdraws funds from his savings account equal to 10% of the amount on deposit, and on Friday he deposits N140. If there were no other transactions, and if the amount in the account following Friday's transaction was 125% of the original amount, how much money was originally in the account?
- (A) N125
(B) N175
(C) N400
(D) N500
(E) N540

57. At the beginning of a class, a classroom has 3 empty chairs and all students are seated. No student leaves the classroom, and additional students equal to 20 percent of the number of students already seated enter the class late and fill the empty chairs. What is the total number of chairs in the classroom?
- (A) 18
(B) 15
(C) 10
(D) 6
(E) 3
58. The value of a certain office machine depreciates in such a way that its value at the end of each year is $\frac{4}{5}$ of its value at the beginning of the same year. If the initial value of the machine is N5,000. What is its value at the end of 3 years?
- (A) N4,750.25
(B) N4,000.00
(C) N2,560.00
(D) N2,000.00
(E) N640.00
59. A man buys some shirts and some ties. The shirts cost N700 each and the ties cost N300 each. If the man spends exactly N8100 and buys the maximum number of shirts possible under these conditions, what is the ratio of shirts to ties?
- (A) 5:3
(B) 4:3
(C) 5:2
(D) 4:1
(E) 3:2
60. If the total sales for a business in a certain year were N150,000, what were sales in June, if June sales were half the monthly average?
- (A) N6,250
(B) N12,500
(C) N15,000
(D) N25,000
(E) N48,000
61. A man drives from Lagos to Shagamu, a distance of 48km, in 45 minutes. Where the road is good, he drives at 72 km/h, where the road is bad, at 48km/h. What is the distance he travelled on the good road?
- (A) 18
(B) 36
(C) 48
(D) 60
(E) 72
62. Yinka invested a sum of money at an annual simple interest rate of $10\frac{1}{2}\%$. At the end of 4 years the amount invested plus interest earned was N781.00. What was the naira amount of the original investment?
- (A) N231.84
(B) N318.16
(C) N550.00
(D) N750.00
(E) N781.84

63. One-half of the employees of Bayo And Sons earn salaries above N18,000 annually. One-third of the remainder earn salaries between N15,000 and N18,000. What part of the staff earns below N15,000?
- (A) $1/6$
(B) $2/3$
(C) $1/2$
(D) $1/10$
(E) $1/3$
64. David has a newspaper route for which he collects k naira each day. From this amount he pays out $k/3$ naira per day for the cost of the paper, and he saves the rest of the money. In terms of k , how many days will it take David to save N1000?
- (A) $k/1500$
(B) $k/1000$
(C) $1000/k$
(D) $1500/k$
(E) $1500k$
65. A salesperson earn 5% on all sales between N200 and N600, and 8% on all sales over N600. What is her commission in a week in which her sales total N800?.
- (A) N20
(B) N46
(C) N88
(D) N36
(E) N78
66. Stella invests N2,400 in the National Bank at 5%. How much additional money must she invest at 8% so that the total annual income will be equal to 6% of her entire investment?
- (A) N2,400
(B) N3,600
(C) N1,000
(D) N3,000
(E) N1,200
67. The value of a fraction is $2/5$. If the numerator is decreased by 2 and the denominator increased by 1, the resulting fraction is equivalent to $1/4$. Find the numerator of the original fraction.
- (A) 3
(B) 4
(C) 6
(D) 10
(E) 15
68. Every letter in the alphabet has a number value which is equal to its place in the alphabet; the letter A has a value of 1 and C a value of 3. The number value of a word is obtained by adding up the value of the letters in the word and then multiplying that sum by the length of the word. The word "DFGH" would have a number value of
- (A) 22
(B) 44
(C) 66
(D) 100
(E) 108

69. In a certain year, corporation X produced 40 percent of the total world production of a certain drug. If corporation X produced 18 kilograms of the drug, how many kilograms were produced by producers other than corporation X?
- (A) 22
(B) 27
(C) 36
(D) 40
(E) 45
70. During a sale, a certain item is sold at a price 40% below its usual selling price. If the naira savings on the item is N12, then what is its *sale price*?
- (A) N30
(B) N24
(C) N18
(D) N15
(E) N6

ANSWER KEY QUANTITATIVE REASONING TEST 1

- | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|
| 1. B | 11. B | 21. A | 31. C | 41. C | 51. A | 61. B |
| 2. B | 12. D | 22. B | 32. A | 42. E | 52. B | 62. C |
| 3. E | 13. E | 23. D | 33. D | 43. A | 53. D | 63. E |
| 4. E | 14. C | 24. D | 34. E | 44. A | 54. A | 64. D |
| 5. D | 15. E | 25. C | 35. D | 45. A | 55. E | 65. D |
| 6. D | 16. C | 26. B | 36. B | 46. C | 56. C | 66. E |
| 7. B | 17. C | 27. E | 37. B | 47. D | 57. A | 67. C |
| 8. D | 18. E | 28. A | 38. B | 48. D | 58. C | 68. D |
| 9. C | 19. B | 29. D | 39. C | 49. D | 59. E | 69. B |
| 10. B | 20. D | 30. C | 40. B | 50. D | 60. A | 70. C |

ANSWERS AND EXPLANATIONS

1. B Let x = Recent test grade

$$\frac{4(72)+x}{5} = 70$$

$$288 + x = 350$$

$$x = 62$$
2. B N273 represents 130% of the cost

$$1.30x = 273$$

$$13x = 2730$$

$$x = N210 = \text{cost}$$

The new price will add 10% of cost, or N21, for profit.
 New price = N210 + N21 = N231
3. E Let original price = p , and original sales = s . Therefore, original gross receipts = ps . Let new price = $.75p$, and new sales = $1.20s$. Therefore, new gross receipts = $.90ps$. i.e $1.20s \times .75p$ Gross receipts are only 90% of what they were.
4. E $40\% = 2/5$
 $2/5$ of 95% = 38%
5. D Work with a simple figure, such as 100.
 First sale price is 90% of N100, or N90.
 Final sale price is 85% of N90, or N76.50
 Total discount is N100 - N76.50
 $= N23.50$
 $\% \text{ of discount} = 23.50/100 \text{ or } 23.5\%$
6. D David spends $1/4$ on Monday and $2/3$ of the other $3/4$, or $1/2$ on Tuesday, leaving only $1/4$ for the rest of the week.
7. B Let s = sales

$$N100 + .05s = 360$$

$$.05s = 260$$

$$5s = 26,000$$

$$s = N5,200$$
8. D All the numbers from 200 to 299 begin with 2. There are 100 of these. Then all numbers like 102, 112, ..., 192 end with 2. There are 10 of these.
 Hence, there are 110 of such numbers.
9. C Use an easy amount of N100 for the selling price. If the profit is 20% of the selling price, or N20, the cost is N80. Profit based on cost is
 $20/80 = 1/4 = 25\%$
10. B If 15 adults are fed, $3/4$ of the food is gone. $1/4$ of the food will feed $1/4 \times 32$, or 8 children.
11. B This question can be solved using a table:

	Full-time	Part-time	Total
Men			
Women			
Total			



The table or matrix shows the possibilities. We begin to fill in the individual squares, or cells, by using the information provided:

	Full-time	Part-time	Total
Men			55%
Women			
Total	30%		

But we know that the total labor force is 100%, and this means that the percentages for full-time and part-time must equal 100 and that the percentages for Men and Women must equal 100. So we can fill in some further information.

	Full-time	Part-time	Total
Men			55%
Women			45%
Total	30%	70%	100%

Now, since we have totals indicated, we can use arithmetic to find the missing information:

	Full-time	Part-time	Total
Men	12%	43%	55%
Women	18%	27%	45%
Total	30%	70%	100%

Notice that all totals check out.

The final step is to use the information to answer the questions

$$\frac{\text{Men Full - Time}}{\text{Total Full - Time}} = \frac{.12}{.30} = \frac{2}{5} = 40\%$$

12. D For every pair of digits in a number, there will be one digit in the square root 6
Answer is 6

13. E $A = 15$
 $B = 15 + 1/3(15) = 20$
 $15 - n$ is A's age n years ago
 $20 - n$ is B's age n years ago
 $(20 - n) = 2(15 - n)$
 $20 - n = 30 - 2n$
 $n = 10$

14. C Let x = capacity of tank
 10 gallons is $2/3 - 1/4$ of the tank
 $2/3 - 1/4 = 8 - 3 = 5/12$
 $\frac{5}{12}$
 $5/12x = 10$
 $5x = 120$
 $X = 24$

15. E Remember, a ratio is a fraction. If x is 18 and y is 14, the ratio $x : y$ is 9:7, but $x + y$ is 32. The point of this problem is that x and y can take on many possible values, just as long as the ratio 9:7 is preserved. Given the multiplicity of possible values, it is not possible here to establish one definite value for the sum of x and y .

16. C The new solution is $3/20$ pure alcohol or 15%

17. C Let x = no of years for 2 of the populations to be equal

$$\text{Then } 6800 - 120x = 4200 + 80x$$

$$2600 = 200x$$

$$x = 13 \text{ years}$$

18. E 60 - x employees are male
1/3 of these are unmarried
 $1/3(60 - x) = 20 - 1/3x$

19. B The number of sheets is directly proportional to the number of machines and also directly proportional to the amount of time. Mathematically this can be expressed as:

Sheets		Sheets
(Number of machines) (time)	=	(Number of machines) (time)
$\frac{300}{3}$	=	$\frac{600}{6(t)}$
$100t$	=	300
t	=	3

Reduce the fractions and then cross-multiply:

$$\frac{100}{3} = \frac{100}{t}$$

$$100t = 300$$

$$t = 3$$

20. D This is inverse variation

$$m \times d = (m + 2) \times x$$

$$\frac{md}{m+2} = x$$

21. A $14 + 17 = 31$. Therefore, there are 4 students who must be enrolled in all three courses, $4/27$ is slightly larger than $4/28$. The answer must be slightly larger than $1/7$, which is $14\frac{2}{7}\%$.

22. B Cities A, B, and C need not be on a straight line; therefore, one cannot add or subtract miles. Six times the distance between A and B is $150 \times 6 = 900$, which is 10 times the distance between A and C, $10 \times 90 = 900$.

23. D Since the question stem has the form "which of the following could be....?", The proper approach is the test choices until you find one that works. Since her cost is N50, we test (A):

$$\frac{x}{N50} = .15$$

$$x = N7.50$$

But a naira profit or markup of N7.50 would generate a selling price of N57.50 - not a whole number. (B), (C), and (E) also yield fractional amounts. (D), however, yields a markup of N20 for a whole naira selling price.

24. D If we wish to compute the answer, let us start by saying that the original price of the item is x . A 10% increase in that price will be one-tenth of x , or $.1x$. When we add the increase to the original price, we find our



increased price is $1.1x$. We must then take away 10% of that. Ten percent of $1.1x$ is $.11x$, and subtracting $.11x$ from $1.1x$, we get $.99x$. We started with x ; we ended with $.99x$, so we lost $.01x$, which is 1%.

25. C This problem cannot be solved by simply doing subtraction. To give an example: if you read pages 1 and 2 of a book, how many pages have you read? The answer is obviously 2; we can conclude then that we do not obtain the answer by subtracting 1 from 2. Instead we subtract 1 from 2 and add 1.

$$49 - 7 + 1 = 43$$

$$157 - 101 + 1 = 57$$

$$43 + 57 = 100$$

26. B If 3 people take $5\frac{1}{3}$ days, then one person would take 3 times as long, or 16 days. Thus one person can do $\frac{1}{16}$ of a job in a day. Two people can do twice as much of a job, or $\frac{1}{8}$, in a day.
27. E There is no indication as to the exact percentage of students who eat in the cafeteria, since we do not know how many boys or girls there are.

28. A From the analysis of the question, the sequence is 3, 5, -5, -3, 3, 5, -5, -3..... It is obvious that each four term is continuous
:- $\frac{55}{4} = 13\frac{3}{4}$ term
 $\frac{3}{4}$ is the 3rd term and also the
55th term = -5

29. D We simply want to find how long it will take to amass interest equal to 100 percent of the original amount saved. So we must divide 100 percent by the rate of interest per year, $6\frac{1}{4}$ percent, to get the number of years:

$$\frac{100}{6\frac{1}{4}} = 16$$

30. C In 3 hours, one ship went 60 miles, the other 45 miles. This is a 3-4-5 triangle as $45 = 3(15)$, $60 = 4(15)$. The hypotenuse will be $5(15)$, or 75.
31. C First of all, (D) and (E) are impossible on logical grounds since they are greater than 1, and the proportion of something that has a characteristic cannot be greater than 1. That would be like saying., We need the total of upper and middle management with production line experience. The ratio 4:3 tells us that the total number of middle and upper management personnel in the company can be divided into 7 equal parts, with 4 of them in upper management and 3 in middle management. Of the 4 parts in upper

management, 75%, or $\frac{3}{4}$, have experience on the production line. Three quarters of 4 part amounts to 3 part ($\frac{3}{7}$ of the total). You are not told how many of the middle management personnel have production line experience, but the key word "greater" tells you that you should consider all of the middle management personnel as having production line experience. This means that there are 3 parts from the upper management personnel who have production line experience and that there are 3 more part from the middle management personnel that are assumed to have production line experience, for a total of 6 parts out of 7, or $\frac{6}{7}$.

32. A "CHRIS" = $3n - 3$

$$n = 3n - 3$$

$$-2n = -3$$

$$n = \frac{3}{2} = 1.5$$

33. D Each adult needs 15 cans/7 adults = $\frac{15}{7}$ cans in two days, or $(\frac{1}{2})(\frac{15}{7}) = \frac{15}{14}$ cans per adults per day. Multiply this by the number of adults and by the number of days.

$$(\frac{15}{14})(4 \text{ adults})(7 \text{ days}) = 30 \text{ cans of food}$$

34. E The first child leaves $\frac{3}{4}$ of the cookies. The second child eats $\frac{1}{3}$ of $\frac{3}{4}$ and that leaves $\frac{1}{2}$. if the $\frac{1}{2}$ is divided among four

children, then $\frac{1}{2}$ divided by 4 is $\frac{1}{8}$.

35. D The path of all points equidistant from two points is the perpendicular bisector of the segment which connects the two points. Therefore, the line that is perpendicular to AB and intersects it at 150 miles from A is the perpendicular bisector of AB (Remember, A and B are 300 miles apart).

36. B Let's substitute J for John and P for Pat

$$(J \text{ is 3 times } P) \quad J = 3P$$

$$(J \text{ in four years}) \quad x = J + 4$$

$$J = x - 4$$

$$x - 4 = 3P \text{ (since } J = 3P)$$

$$P = \frac{x - 4}{3}$$

37. B After the 15% deduction, N12,750 is left. After the 10% is deducted from N12,750, N11,475 is left. Note that you cannot simply deduct 25% from the N15,000.

38. B $\frac{2}{5}(\text{Boys}) = 40$

$$\text{Boys} = 100$$

There are twice as many girls as boys.

$$\text{girls} = 200$$

39. C If each of the dimensions is doubled, the area of the new rectangle is four times the size of the original one. The increase is three times, or 300%

40. B Let x = amount of marked price. Then

$$\frac{1}{5}x = 15$$

Go on to the next page 

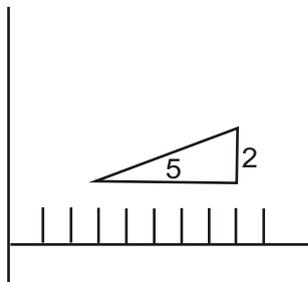
$$x = 7$$

$$75 - 15 = N60$$

41. C If $2n$ is an even number, $2n + 1$ is odd.

42. E Let x = first integer
 $x + 2$ = second integer
 $x + 4$ = third integer
 $3(x) = 3 + 2(x + 4)$
 $3x = 3 + 2x + 8$
 $x = 11$
 \therefore Third integer = $11 + 4 = 15$

43. A.



$$\text{Right triangle area} = \frac{1}{2} \times 5 \times 2 = 5$$

44. A Let Obi have Nx
 \square Ugo has $N(x + 2)$
 and Ify has $N(x + 2 + 5) = N(x + 7)$
 Average = $\frac{x + x + 2 + x + 7}{3}$
 $= \frac{3x + 9}{3}$

\square Each person gets $N(x + 3)$
 Ify must give Obi $N3$ and Ugo $N1$ so that each person has $N(x + 3)$

45. A Probably the easiest way to solve this problem is just to count the steps on your fingers, but the same process can be expressed mathematically. Let those steps he walks down be assigned negative values, and those steps he walks up be positive. We then have: $-4 + 3 - 6 + 2 + 9 - 2 = +2$. So the

person comes to rest two steps above where he started.

46. C Let original amount = x
 Cost of item = $0.9x$ (90%)
 If 90k is added
 $.9x + 0.9 = x$
 \square $x - 0.9x = 0.9$
 $0.1x = 0.9$
 $x = \frac{0.9}{0.1}$
 $x = N9.00$

47. D Between opening and noon he sold $0.4p$
 Remaining $0.6p$
 Between noon and closing he sold
 0.6 of $0.6p = 0.36p$
 Total sales = $0.4p + 0.36p = 0.76p$
 $\% \text{ sales} = \frac{0.76p}{p} \times 100\%$
 $= 76\%$

48. D Translated into algebra, the question reads:
 $x(x) - x(x-1) = 4$
 $X^2 - x^2 + x = 4$
 $x = 4$

49. D 40 percent of $N2000$, or $N800$, goes for business expenses. That leaves $N1200$. 10 percent of the remaining $N1200$, or $N120$, is reinvested.

50. D In x years ago
 Baba ages $67 - x$
 Ade's age. $29 - x$
 For Ade to be half his fathers age
 $2(29 - x) = 67 - x$
 $58 - 2x = 67 - x$
 $2x - x = 67 - 58$
 $x = 9$

51. A
 Let the original fraction = $\frac{4}{8}$
 \therefore original numerator = 4
 Original denominator = 8
 Decreased numerator (0.75 of 4) = 3
 increased denominator (1.25 of 8) = 10
 \therefore New fraction = $\frac{3}{10}$
 Difference = $\frac{4}{8} - \frac{3}{10} = \frac{1}{5}$
 $\% \text{ decrease} = \frac{1}{5} \times \frac{4}{8} \times 100\%$
 $= \frac{1}{5} \times \frac{8}{4} \times 100\%$
 $= 40\%$
52. B Let x be number bought for N1.20
 \therefore 1 packet = $\frac{120}{x}$
 3 naira cheaper = $\frac{120}{x} - 3$
 but he would then have received (x + 2) packets
 so each would have cost = $\frac{120}{x+2}$
 equating these two prices
 $= \frac{120}{x} - 3 = \frac{120}{x+2}$
 $\therefore x = 8 \text{ or } -10$
 A negative answer is unacceptable so
 x = 8 packets of biscuits.
53. D
 Let the speed = xkm/h
 The time taken to travel 160km = $\frac{160}{x}$ hours
 The time for 16km/h slower = $\frac{160}{x-16}$ hours
 But this is 20 minutes or $\frac{1}{3}$ hours more than traveling at xkh/h
 $\frac{160}{x-16} - \frac{160}{x} = \frac{1}{3}$
 $x = 96 \text{ or } -80$
 The negative speed is not acceptable, so the average speed = 96km/h
54. A If the office has 21 staff members there are 7 men, and 14 women. Since the office did not have more men.
 $\therefore \frac{1}{4}$ of the new staff total = 7
 i.e $\frac{1}{4}x = 7$
 $x = 28$
 $28 - 7 = 21$ women
 Since there are 14 women already 7 more will be hired.
55. E One way of answering the question is to assign an arbitrary number to represent the price of the commodity on March 1. Let us assume it was N100. First, the price falls by $\frac{1}{4}$, from N100 to N75. Then it falls another $\frac{1}{3}$ to N50. To return to its original level, the price must increase by N50, and N50 is 100% of N50.
56. C Let the amount on deposit = Nx
 If 10% of the amount is withdrawn
 N0.9x will remain
 $\square N0.9x + N140 = N1.25x$
 $N1.25x - N0.9x = N140$
 $N0.35x = N140$
 $x = \frac{140}{0.35}$
 $x = N400$
57. A Let total no of chairs in the class at the beginning = x
 20% of x = 3 empty chairs
 $0.2x = 3$
 $x = \frac{3}{0.2}$
 $x = 15$ chairs
 $\square \text{Total no of chairs} = 15 + 3 = 18$

58. C The machine depreciates by 20% yearly
 \square 1st year $N5000 \times \frac{20}{100} = N1000$
 Remaining N4000
 2nd year = $N4000 \times \frac{20}{100} = N800$
 Remaining N3200
 3rd year = $N3200 \times \frac{20}{100} = N640$
 Value at the end of 3 yrs = N2560
59. E Let s = number of shirts and t = number of ties, where s and t are integers: Dividing all figures through by 100,
 Then $7s + 3t = 81$
 $7s = 81 - 3t$
 $S = \frac{81 - 3t}{7}$
 Since s is an integer, t must have an integral value such that $81 - 3t$ is divisible by 7. Trial shows that $t = 6$ is the smallest such number, making
 $s = \frac{81 - 18}{7} = 63/7 = 9$
 Hence, s : t = 9 : 6 = 3 : 2.
60. A monthly average sales = $\frac{N150,000}{12}$
 = N12,500
 Since June is half of the monthly average
 \square June sales = $\frac{N12,500}{2} = N6,250$
61. B Suppose there are x km of good road then there are $48 - x$ of bad road. He drives x km at 72km/h on good road.
 Time = $\frac{x}{72}$
 And he drives $(48 - x)$ km at 48km/h
 Time = $\frac{48 - x}{48}$
 Total time taken = 45 mins. = $\frac{3}{4}$ hours
 $\therefore \frac{x}{72} + \frac{48 - x}{48} = \frac{3}{4}$
 $= 36$
62. C Let original investment = Nx
 10.5% interest for 4 years = $10.5 \times 4 = 42\%$
 \square $Nx + 42\%$ of x = N781
 = 142% of x
 $\frac{142x}{100} = 781$
 $142x = 78100$
 $X = \frac{78100}{142}$
 X = N550
63. E One-half earn over N18,000. One-third of the other 1/2, or 1/6, earn between N15,000 and N18,000. This accounts for $\frac{1}{2} + \frac{1}{6}$, or $\frac{3}{6} + \frac{1}{6} = \frac{4}{6} = \frac{2}{3}$ of the staff, leaving 1/3 to earn below N15,000.
64. D Amount saved = $k - \frac{k}{3} = \frac{2k}{3}$
 $\therefore 1 \text{ day} = \frac{2k}{3}$
 x days = N1000
 Where x = number of days to save N1000
 This is a direct variation
 $\frac{1}{X} = \frac{2k/3}{1000}$
 $\frac{2k}{3} = 1000$
 $X = 1000 \times \frac{3}{2k}$
 $X = \frac{1500}{K}$
65. D 5% of sales between N200 and N600 is .05(400) = N20.
 8% of sales over N600 is .08(200) = N16.
 Total commission = N20 + N16 = N36.
66. E If Stella invests x additional naira at 8%, her total investment will amount to 2400 + x naira.
 $.05(2400) + .08(x) = .06(2400 + x)$
 $5(2400) + 8(x) = 6(2400 - x)$
 $1200 + 8x = 14400 + 6x$
 $2x = 2400$
 $x = 1200$

67. C
Let $2x$ = original numerator
 $5x$ = original denominator
- $$\frac{2x-2}{5x+1} = \frac{1}{4}$$
- Cross-multiply:
 $8x-8 = 5x+1$
 $3x = 9$
 $x = 3$
Original numerator is $2(3)$, or 6
68. D $D = 4$, $F = 6$, $G = 7$, and $H = 8$ so the sum of the letters would be 25. 25 multiplied by 4 (the length of the word) is 100.
69. B
40% is to 18kg
60% is to xkg
Set up a proportion
- $$\frac{40\%}{18} = \frac{60\%}{x}$$
- $$x = \frac{18 \times 60}{40}$$
- $$x = 27$$
70. C If the item is sold at a 40% discount, then the naria savings is equal to 40% of the usual price:
 $.40 \times \text{Usual Price} = \text{N}12$
- $$\text{Usual Price} = \frac{\text{N}12}{.40} = \text{N}30$$
- This is the usual selling price. The sale price is N12 less, or N18.

QUANTITATIVE REASONING TEST 2

75 Questions

30 Minutes

DIRECTIONS

Each problem in this test involves a certain amount of logical reasoning and thinking on your part. Read each problem carefully and choose the correct answer from the five choices that follow. Blacken the corresponding space on your answer sheet.

- What is the average of a student who received 90 in English, 84 in Algebra, 75 in French, and 76 in Music, if the subjects have the following weights: English 4, Algebra 3, French 3, and Music 1?
(A) 81
(B) $81\frac{1}{2}$
(C) 82
(D) $82\frac{1}{2}$
(E) 83
- Chidi is 15 years older than his brother Peter. However, y years ago Chidi was twice as old as Peter. If Peter is now b years old and $b > y$, find the value of $b - y$.
(A) 13
(B) 14
(C) 15
(D) 16
(E) 17
- A woman bought 12 hens at N1500 each. At the end of the year she obtained 24,000 eggs from them, which she sold at N40 a dozen. The cost of feeding for the year was N30,000. At the end of the year she sold 10 surviving hens for N1,250 each. What is her percentage profit?
(A) 63%
(B) 80%
(C) 100%
(D) 87.5%
(E) 92.7%
- When the price of petrol is increased by 5%, a driver reduces her annual distance traveled by 5%. As a consequence, she finds that she saves N100 on her annual petrol bill. What was her annual petrol bill before the increase?
(A) N50,000
(B) N25,000
(C) N40,000
(D) N80,000
(E) N60,000
- A cement mixture is composed of 3 elements: By weight, $\frac{1}{3}$ of the mixture is sand, $\frac{3}{5}$ of the mixture is water, and the remaining 12 pounds of the mixture is gravel. What is the weight of the entire mixture in pounds?
(A) 11.2
(B) 12.8
(C) 36
(D) 60
(E) 180

6. A man was standing 40 feet behind his car when a second car arrived and parked 90 feet from the first car. If the man is standing between the two cars how much closer is he to the first car than the second?
- (A) 30 feet
(B) 50 feet
(C) 10 feet
(D) 70 feet
7. At a photocopy centre, the first 10 copies cost x kobo each. Each of the next 50 copies costs 50kobo less per copy. From the 61st copy on, the cost is 2 kobo per copy. In terms of x , how much does it cost in kobo to have 200 copies made?
- (A) $60x + 30$
(B) $50x - 10$
(C) $50(x - 5)$
(D) $60x - 10$
(E) $10x + 490$
8. Four men working together can dig a ditch in 42 days. They begin, but 1 man works only half-days. How long will it take to complete the job?
- (A) 48 days
(B) 45 days
(C) 43 days
(D) 44 days
9. Half the graduating class of a college was accepted by a business school. One-third of the class was accepted by a law school. If one-fifth of the class was accepted to both types of school. What fraction of the class was accepted only by a law school?
- (A) $1/60$
(B) $2/15$
(C) $1/3$
(D) $1/2$
(E) $4/5$
10. Exactly three years before the year in which Anna was born, the year was 1980- x . In terms of x , on Anna's twentieth birthday, the year will be
- (A) $1977 + x$
(B) $1997 + x$
(C) $2003 - x$
(D) $2003 + x$
(E) $2006 + x$
11. A and B together earn N2,100. If B is paid one-fourth more than A, how much should B receive?
- (A) N1,166.66
(B) N1,162.66
(C) N1,617.66
(D) N1.167.66
12. A man insures 80% of his property and paid a $2\frac{1}{2}\%$ premium amounting to N348. What is the total value of his property?
- (A) N19,000
(B) N18,400

- (C) N18,000
(D) N17,400
(E) N13,920
13. A tank is $\frac{3}{4}$ full. Pipe A can fill the tank in 12 minutes. Pipe B can empty it in 8 minutes. If both pipe are open, how long will it take to empty the tank?
(A) 14 min.
(B) 22 min.
(C) 16 min.
(D) 18 min.
14. If a certain chemical costs N50 for 30 gallons, then how many gallons of the chemical can be purchased for N625?
(A) 12.5
(B) 24
(C) 325
(D) 375
(E) 425
15. If N300 is invested at simple interest so as to yield a return of N18 in nine months, the amount of money that must be invested at the same rate of interest so as to yield a return of N120 in six months is
(A) N3000
(B) N3300
(C) N2000
(D) N2300
16. If $\frac{1}{2}x$ years ago John was 12 and $\frac{1}{2}x$ years from now he will be $2x$ years old, how old will he be $3x$ years from now?
(A) 18
(B) 24
(C) 30
(D) 54
(E) It cannot be determined from the information given
17. Two ships are 1,550 miles apart sailing towards each other. One sails at the rate of 85 miles per day and the other at 65 miles per day. How far apart will they be at the end of nine days?
(A) 180 miles
(B) 200 miles
(C) 220 miles
(D) 240 miles
18. A salesperson works 50 weeks each year and makes an average (arithmetic mean) of 100 sales per week. If each sale is worth an average (arithmetic mean) of N1,000, then what is the total value of sales made by the salesperson in a year?
(A) N50,000
(B) N100,000
(C) N500,000
(D) N1,000,000
(E) N5,000,000

19. Today Jim is twice as old as Fred, and Sam is 2 years younger than Fred. Four years ago Jim was 4 times as old as Sam. How old is Jim now?

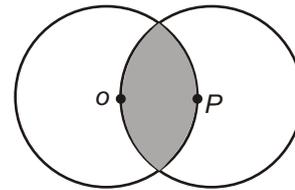
- (A) 8
- (B) 12
- (C) 16
- (D) 20
- (E) 24

20. A student worked 30 days at a part-time job. He paid two-fifths of his earnings for room and board and had N81 left. What was his daily wage?

- (A) N4.50
- (B) N5.00
- (C) N5.50
- (D) N6.25

21. Bola borrowed N240, interest free from her parents to pay for her college education. If she pays back $2\frac{1}{2}$ percent of this amount quarterly, and has already paid N42, for how many months has she been paying back her loan?

- (A) 6
- (B) 7
- (C) 19
- (D) 21
- (E) 24



22. In the figure above, if the radius of the circles is 1, then what is the perimeter of the shaded part of the figure?

- (A) $\frac{1}{6}\pi$
- (B) $\frac{2}{3}\pi$
- (C) $\frac{4}{3}\pi$
- (D) $\frac{3}{2}\pi$
- (E) cannot be determined from the information given.

23. Two trains running on the same track travel at the rates of 25 and 30 miles an hour. If the first train starts out an hour earlier, how long will it take the second train to catch up with it?

- (A) 2 hr.
- (B) 3 hr.
- (C) 4 hr.
- (D) 5 hr.

24. The owner of a boutique decide to calculate the percentage of customers who purchase hats. If 40 percent of the stores customers decide to purchase items, and of those customers 15 percent purchase hats what percent of the store's customers purchase hats?

- (A) 4%
(B) 6%
(C) 15%
(D) 24%
(E) 55%
25. On a list price of N200, the difference between a single discount of 25 percent and successive discounts of 20 percent and 5 percent is
(A) N0
(B) N48
(C) N8
(D) N2
26. A store raised the price of an item by exactly 10 percent. Which of the following could NOT be the resulting price of the item?
(A) N5.50
(B) N7.60
(C) N11.00
(D) N12.10
(E) N75.90
27. In 1997, a particular item A cost N2,500. In 1998, the price of A went up 20% because of inflation while in early 1999 there was a 10% increase in the price of A over its 1998 price. In June of 1999, A was put on sale with a 30% decrease in price. What was the sale price of A?
(A) 2500
(B) 2400
(C) 2310
(D) 2110
28. When the principal is N600, the difference over the course of one year between simple interest of 12% per annum and interest compounded semiannually at 12% per annum is
(A) N2.16
(B) N21.60
(C) N.22
(D) N0.00
29. In Tejuosho market, a woman sells $\frac{1}{3}$ as many peppers as onions, and $\frac{1}{2}$ as many tomatoes as peppers. If there are equal numbers of fishes and tomatoes. What percent of food stuffs in her shop are onions?
(A) 10%
(B) 33%
(C) 40%
(D) 50%
(E) 60%
30. Six gross of special drawing pencils were purchased for use in a department. If the pencils were used at the rate of 24 a week, the maximum number of weeks that the six gross of pencils would last is.
(A) 6 weeks
(B) 12 weeks
(C) 24 weeks
(D) 36 weeks

31. A tank holding 1m^3 of water is filled in 10 minutes by a circular pipe of diameter 2cm. What is the speed of the water in the pipe?
- (A) 7.62
(B) 3.90
(C) 6.25
(D) 5.30
(E) 8.41
32. A car averages 40 miles per hour for the first 6 hours of a trip and averages 60 miles per hour for each additional hour of travel time. If the average speed for the entire trip is 55 miles per hour, how many hours long is the trip?
- (A) 8
(B) 12
(C) 16
(D) 18
(E) 24
33. If the following were arranged in order of magnitude, which term would be the middle number in the series?
- (A) $3^8/3^6$
(B) $3^3 - 1$
(C) 3^0
(D) 3^{27}
(E) $3(3^2)$
34. How many integers between 100 and 150, inclusive, can be evenly divided by neither 3 nor 5?
- (A) 33
(B) 28
(C) 27
(D) 26
(E) 24
35. A Bank department employs 1400 people, of whom 35 percent are cash officers and one-eighth are marketing officers. The number of employees in the bank who are neither cash officers nor marketing officers is
- (A) 640
(B) 665
(C) 735
(D) 750
36. If Dupe had 3 times as many oranges as she actually has, she would have $1/3$ as many oranges as Dele has. What is the ratio of the number of oranges Dupe has to the number of oranges Dele has?
- (A) $1/9$
(B) $1/3$
(C) $1/1$
(D) $3/1$
(E) $9/1$
37. Two cylindrical tanks have the same height, but the radius of one tank equals the diameter of the other. If the volume of the larger is $k\%$ more than the volume of the smaller, $k =$
- (A) 50
(B) 100
(C) 200
(D) 300
(E) 400
38. A and B do a job together in 2 hours. Working alone, A does the job in 5 hours. How long will it take B to do the job alone?
- (A) $3\frac{1}{3}$ hours
(B) $2\frac{1}{4}$ hours
(C) 3 hours
(D) 2 hours

39. A sequence of numbers begins 1, 1, 1, 2, 2, 3 and then repeats this pattern forever. What is the sum of the 135th, 136th, and 137th numbers in the sequence?
- (A) 3
(B) 4
(C) 5
(D) 6
(E) 7
40. A lady withdraws from her savings account 10% of the original sum in the bank. If she must add N900 to bring the amount in the bank back up to the original sum, what was the original sum in the bank?
- (A) N10,000
(B) N19,000
(C) N80,000
(D) N90,000
(E) N90,900
41. Uche purchased some shares of stock at N10 per share. Six months later the stock was worth N20 per share. What was the percent increase in the value of Uche's investment?
- (A) 20%
(B) 50%
(C) 100%
(D) 200%
(E) the answer depends on the number of shares purchased.
42. A man's taxable income is N14,280. The state tax instructions tell him to pay 2% on the first N3000 of his taxable income, 3% on each of the second and third N3000, and 4% on the remainder. What is the total amount of income tax that he must pay?
- (A) N265.40
(B) N309.32
(C) N451.20
(D) N454.62
43. In a certain group of people, $\frac{3}{8}$ of the people are men, and $\frac{2}{3}$ of the men have brown eyes. If $\frac{3}{4}$ of the people have brown eyes, then what fraction of the group are women who do not have brown eyes?
- (A) $\frac{1}{8}$
(B) $\frac{3}{16}$
(C) $\frac{1}{4}$
(D) $\frac{5}{16}$
(E) $\frac{3}{8}$
44. A junior salesman gets a commission of 14 percent on his sales. If he wants his commission to amount to N140, he will have to sell merchandise totalling.
- (A) N1,960
(B) N10
(C) N1,000
(D) N100
45. A man is standing between a bank and a drug store. He is 60 feet away from the bank and the drug store is 100 feet away from the bank. How many feet nearer is the man to the bank than the drug store is to the bank?
- (A) 60 feet
(B) 40 feet
(C) 50 feet
(D) 20 feet

46. If, in five days, a clerk can copy 125 pages of thirty-six lines each, with eleven words to the line, how many pages of thirty lines each and twelve words to the line can he copy in 6 days?
- (A) 145
(B) 155
(C) 160
(D) 165
47. The cost of manufacturing a car is made up of three items: cost of materials, labour and overheads. In 1974, the cost of these items were in the ratio 4:3:2. In 1975, the cost of materials rose by 10%, the cost of labour increased by 8% but the overheads reduced by 5%. Find the increase percent in the price of a car.
- (A) 6%
(B) 5%
(C) 1%
(D) 10%
(E) 9%
48. The estate of a wealthy man was distributed as follows: 10% to his wife, 5% divided equally among his three children, 5% divided equally among his five grandchildren, and the balance to a charitable trust. If the trust received N1,000,000, how much did each grandchild inherit?
- (A) N10,000
(B) N 12,500
(C) N20,000
(D) N62,500
(E) N100,000
49. A car completes a 10-mile trip in 20 minutes. If it does one half the distance at a speed of 20 miles an hour, then its speed for the remainder of the distance must be
- (A) 30 mph
(B) 40 mph
(C) 50 mph
(D) 60 mph
50. A certain pole casts a shadow 24 feet long. At the same time another pole 3 feet high casts a shadow 4 feet long. How high is the first pole, given that the heights and shadows are in proportion?
- (A) 18 ft.
(B) 19 ft.
(C) 20 ft.
(D) 21 ft.
51. Two people start at the same point and walk in opposite directions. If one walks at the rate of 2 miles per hour and the other walks at the rate of 3 miles per hour, in how many hours will they be 20 miles apart?
- (A) 2
(B) 3
(C) 4
(D) 5
52. A school's honor society has 100 members: 40 boys and 60 girls, of whom 30 are junior and 70 are seniors. What is the smallest possible number of senior boys in the society?
- (A) 0
(B) 5
(C) 10
(D) 15
(E) 20

53. Mr. Sule receives a salary of N3000 per week plus 2 percent commission on sales. What were his total earnings for a week in which his sales were N58,460?
- (A) N4069.20
(B) N4169.92
(C) N4269.92
(D) N4369.20
54. Each integer from 1 to 50 whose units digit is a 7 is written on a separate slip of paper. If the slips are placed in a box and one is picked at random, what is the probability that the number picked is prime?
- (A) $\frac{1}{2}$
(B) $\frac{2}{3}$
(C) $\frac{4}{5}$
(D) $\frac{3}{4}$
(E) $\frac{3}{5}$
55. How many times between midnight and noon of the same day will the minute hand and the hour hand of a clock form a right angle?
- (A) 20
(B) 22
(C) 21
(D) 25
(E) 24
56. Ngozi created a sequence of five numbers. She chose a number for the first term and got each successive term by using the following rule: alternately add 6 to the preceding term and double the preceding term. The second term of Ngozi's sequence was 6 more than the first, the third term was double the second, the fourth term was 6 more than the third, and the fifth term was double the fourth. If the fifth number was 1996, what number did Ngozi chose for the first term?
- (A) 100
(B) 490
(C) 190
(D) 200
(E) 300
57. There are 12 men on a basketball team, and in a game 5 of them play at any one time. If the game is 1 hour long, and if each man plays exactly the same amount of time, how many minutes does each man play?
- (A) 10
(B) 12
(C) 24
(D) 25
(E) 30

58. A certain family spends 30 percent of its income for food, 8 percent for clothing, 25 percent for shelter, 4 percent for recreation, 13 percent for education, and 5 percent for miscellaneous items. The weekly earnings are N500. Assuming that any money left over is put into savings, what is the number of weeks it would take this family to save N15,000?
- (A) 100
(B) 150
(C) 175
(D) 200

$$\begin{array}{r} AB \\ + CD \\ \hline AAA \end{array}$$

59. In the addition problem above, A, B, C, and D are positive integers. What is the value of C?
- (A) 1
(B) 3
(C) 7
(D) 9
(E) it cannot be determined from the information given
60. $x + y = 10$ $y + z = 15$ $x + z = 17$
What is the average (arithmetic mean) of x, y, and z?
- (A) 7
(B) 14
(C) 15
(D) 21
(E) it cannot be determined from the information given
61. A number of people boarded a bus at the terminal. At the first stop, half of the passengers got off and 1 got on. At the second stop, $\frac{1}{3}$ of the passengers on the bus got off and 1 got on. If the bus then had 15 passengers, how many were there when the bus left the terminal?
- (A) 40
(B) 48
(C) 58
(D) 60
(E) 62
62. If c carpenters can complete a job in d days, how many days will it take e carpenters, working at the same rate, to complete p% of the job?
- (A) $cdp/100e$
(B) $ep/100cd$
(C) $100cd/pe$
(D) $cep/100d$
(E) $cdep/100$
63. A can type 500 form letters in 5 hours. B can type 400 of these forms in 5 hours. If A and B are to work together, the number of hours it will take them to type 540 form letters is most nearly.
- (A) 2
(B) 3
(C) 4
(D) 5

64. In a particular company, 2 employees received hourly wages of N450, 3 employees received hourly wages of N415, and 5 employees received hourly wages of N475. The average hourly wage of this group of employees is
- (A) N437
(B) N447
(C) N452
(D) N463
65. A circle graph shows that 32 percent of the tourists to a city are German, 28 percent are Spanish, 20 percent are English, 10 percent are miscellaneous, and the rest are French. How many degrees of the circle should be devoted to the French?
- (A) 12
(B) 24
(C) 30
(D) 36
66. Kunle has the same number of red and blue marbles. He puts them in two jars so that the ratios of the number of red marbles to blue marbles in jar 1 is 2:5 and in jar II is 9:5. If there are 84 marbles in jar 1, how many are there in jar II?
- (A) 126
(B) 120
(C) 100
(D) 130
(E) 115
67. A motorist travels 15km to the litre of petrol and 600km to the litre of oil- he estimates that an annual distance of 6000km will cost him N204 in petrol and oil. In fact he used twice as much oil as he estimated and the cost was N216. Find the cost of a litre of petrol?
- (A) 50
(B) 84
(C) 30
(D) 48
(E) 4
68. What is the remainder when 5^{20} is divided by 100?
- (A) 0
(B) 5
(C) 10
(D) 25
(E) 50
69. 10% more than 10% less than x is what percent of $10x$?
- (A) 9%
(B) 9.9%
(C) 10%
(D) 99%
(E) 100%
70. If it is now 1:15, what time will it be when the hour hand has moved through an angle of 10° ?
- (A) 1:25
(B) 1:35
(C) 2:15
(D) 3:15
(E) 11:15

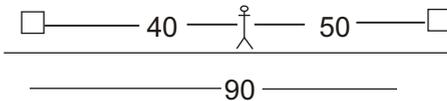
71. Aaron was 24 when his daughter Sarah was born. If Aaron is now 3 times as old as Sarah, how many years ago was Aaron 4 times as old as Sarah?
- (A) 4
(B) 6
(C) 8
(D) 12
(E) 18
72. A cube whose edges are 3 inches is painted blue. The cube is then cut into smaller cubes, all of which have edges that are 1 inch long. How many of the small cubes have no paint on them?
- (A) 0
(B) 1
(C) 3
(D) 4
(E) 9
73. Femi spent N125 for a camera and some film. The camera cost N100 more than the film. What percent of the cost of the two items did Femi spend for the camera?
- (A) 40%
(B) 90%
(C) 60%
(D) 100%
(E) 20%
74. Ali, Buba, Shehu, and Ahmed shared a N1000 prize, Buba got twice as much as Ali, Shehu got 3 times as much as Ali, and Ahmed got N100. How much, in naria, did Ali get?
- (A) 150
(B) 100
(C) 200
(D) 250
(E) 300
75. If the perimeter of square I and the diagonal of square II have the same length, what is the ratio of the area of square I to the area of square II?
- (A) 12:5
(B) 5:12
(C) 1:8
(D) 3:4
(E) 2:1

ANSWER KEY

QUANTITATIVE REASONING TEST 2

1.	E	21.	D	41.	E	61.	A
2.	C	22.	C	42.	C	62.	A
3.	E	23.	D	43.	A	63.	B
4.	C	24.	B	44.	C	64.	C
5.	E	25.	D	45.	B	65.	D
6.	C	26.	B	46.	D	66.	A
7.	A	27.	C	47.	A	67.	D
8.	A	28.	A	48.	B	68.	D
9.	B	29.	E	49.	D	69.	B
10.	C	30.	D	50.	A	70.	B
11.	A	31.	D	51.	C	71.	A
12.	D	32.	E	52.	C	72.	B
13.	D	33.	B	53.	B	73.	B
14.	D	34.	C	54.	C	74.	A
15.	A	35.	C	55.	B	75.	C
16.	D	36.	A	56.	B		
17.	B	37.	D	57.	D		
18.	E	38.	A	58.	D		
19.	D	39.	C	59.	D		
20.	A	40.	D	60.	A		

ANSWERS AND EXPLANATIONS TEST 2

1. $(90 \times 4) + (84 \times 3) + (75 \times 3) + (76 \times 1) = 360 + 252 + 225 + 76 = 913$
 Weight = $4 + 3 + 3 + 1 = 11$
 $913 \div 11 = 83$ average (E)
2. $b =$ Peter's age now
 $b + 15 =$ Chidi's age now
 $b - y =$ Peter's age y years ago
 $b + 15 - y =$ Chidi's age y years ago
 $b + 15 - y = 2(b - y)$
 $b + 15 - y = 2b - 2y$
 $15 = b - y$ (C)
3. 12 hens cost = $12 \times 1500 = 18000$
 2400 eggs divided by 12
 Multiply by N40 = N80,000
 Cost of feeding = N30,000
 Selling price of 10 hen at N1,250 = N12,500
 Total cost = $18,000 + 30,000 = 48,000$
 Total sales = $80,000 + 12,500 = 92,500$
 Profit = $92,500 - 48,000 = 44,500$
 Percentage profit = $\frac{44,500}{48,000} \times 100\% = 92.7\%$ (E)
4. Let the initial price of petrol = Nx
 Let initial distance travelled = y km
 5% increase in petrol price = $\frac{105}{100} \times x = 1.05x$
 5% decrease in distance travelled = $\frac{95}{100} \times y = 0.95y$
 New petrol bill = $1.05x$ multiply by $0.95y = 0.9975xy$
 old petrol bill = xy
 Difference = $0.9975xy - xy = N100$
 $xy = N40,000$ (C)
5. If the weight of the mixture = x
 $\frac{1}{3}$ of the mixture = $\frac{x}{3}$ (quantity of sand)
 Water = $\frac{3x}{5}$
 $\therefore \frac{x}{3} + \frac{3x}{5} + 12 = x$
 $\frac{x}{3} + \frac{3x}{5} = x - 12$
 $5x + 9x = (x - 12) 15$
 $14x = 15x - 180$
 $\therefore -15x - 14x = 180$
 $x = 180$ (E)
6. 
 The second car is $90\text{ft} - 40\text{ft} = 50\text{ft}$ from the man. The first car is 40ft from the man. The first is $50\text{ft} - 40\text{ft} = 10\text{ft}$ closer than the first car. (C)
7. Pick a number for x . How about 8? The first 10 copies = $10 \times 8 = 80$ kobo.
 The next 50 copies each cost 5 kobo less than the first 10, so each of these copies cost $8 - 5 = 3$ kobo.
 The next 50 copies = $50 \times 3 = 150$ kobo
 From now on, the cost is 2 kobo for any additional copies. We need a total of 200 copies. So far we've done 60 copies. We need an additional 140 copies.
 The final 140 copies = $140 \times 2 = 280$ kobo

$$\begin{array}{r} 80 \text{ kobo} \\ 150 \text{ kobo} \\ + 280 \text{ kobo} \\ \hline 510 \text{ kobo} \end{array}$$

 All we have to do is find out which answer choices equals 510. Start with choice (A), $60x + 30$, remember $x = 8$
 $60(8) + 30 = 510$. A is the answer (Try other choices if you are not convinced) (A)
8. It would take 1 man $42 \times 4 = 168$ days to complete the job, working alone. If $3\frac{1}{2}$ men are working (one man works half days, the other 3 work full days), the job would take $168 \div 3\frac{1}{2} = 48$ days. (A)

9. One number that is evenly divisible by 2, 3, and 5 is 30. So let's plug in 30 for the number of people in the graduating class.

One half of the class got into business school.

$$(\frac{1}{2} \text{ of } 30 = 15)$$

One third of the class got into law school.

$$(\frac{1}{3} \text{ of } 30 = 10)$$

One fifth of the class got into both

$$(\frac{1}{5} \text{ of } 30 = 6)$$

Ten people were accepted by a law school, but 6 of those 10 were also accepted by a business school. Therefore 4 people out of 30 were accepted only by a law school. Reduced, $\frac{4}{30}$ is $\frac{2}{15}$ (B)

10. Create a formula. Anna was born three years after 1980 - x, so she was born in 1980 - x + 3. 20 years later the year will be 1980 - x + 3 + 20 = 2003 - x. (C)

11. Let A equal the amount A earned, and B equal the amount B earned.

Together, they earned $A + B = N2,100$(i)

B's salary = $\frac{5}{4}$ of A's

i.e $B = \frac{5}{4}A$(ii)

From equ.(i)

$$A = 2100 - B$$

Substitute in equ.(ii)

$$B = \frac{5}{4}(2100 - B)$$

$$B = 2625 - \frac{5}{4}B$$

$$B + \frac{5}{4}B = 2625$$

$$\frac{9}{4}B = 2625$$

$$B = 2625 \times \frac{4}{9}$$

$$B = 1,166.66 \quad (A)$$

12. Let value of property = x
 $0.8x \times 0.025 = 348$

$$0.8x = \frac{348}{0.025}$$

$$= 13,920$$

$$x = \frac{13,920}{0.8}$$

$$= 17,400 \quad (D)$$

13. Pipe A can fill the tank in 12 min or fill $\frac{1}{12}$ of the tank in 1 minute. Pipe B can empty the tank in 8 minutes or empty $\frac{1}{8}$ of the tank in 1 minute. In 1 minute, $\frac{1}{8} - \frac{1}{12}$ of the tank is emptied (since $\frac{1}{8}$ is greater than $\frac{1}{12}$)

$$\frac{1}{8} = \frac{3}{24}$$

$$\frac{1}{12} = \frac{2}{24}$$

$$\left(\frac{3}{24}\right) - \left(\frac{2}{24}\right) = \frac{1}{24} \text{ of the tank is emptied per minute}$$

It would take 24 minutes to empty whole tank, but it is only $\frac{3}{4}$ full:

$$\frac{3}{4} \times 24 = 18 \text{ minutes} \quad (D)$$

14. $\frac{N50}{30} = \frac{N625}{x}$

Cross-multiply: $50x = 18,750$

$$\text{Divide by } 50: x = 375 \quad (D)$$

15. Principal = N300

Interest = N18

$$\text{Time} = \frac{9}{12} \text{ years} = \frac{3}{4} \text{ year}$$

$$N300 \times \frac{3}{4} = N225$$

$$N18 - 225 = .08$$

Rate is 8%

To yield N120 at 8% in 6 months:

$$\text{Interest} = N120$$

$$\text{Rate} = .08$$

$$\text{Time} = \frac{1}{2} \text{ year}$$

$$.08 \times \frac{1}{2} = .04$$

$$N120 \div .04 = N3000 \text{ must be invested} \quad (A)$$

16. Since $\frac{1}{2}x$ years ago John was 12, he is now $12 + \frac{1}{2}x$; and $\frac{1}{2}x$ years from now he will be $12 + \frac{1}{2}x + \frac{1}{2}x = 12 + x$.

But we are told, at that time he will be 2x years old,

$$\text{So } 12 + x = 2x$$

$$x = 12$$

$$\therefore \text{He is now } 12 + 6 = 18$$

$$3x \text{ or } 36 \text{ years from now he will be } 36 + 18 = 54. \quad (D)$$

17. $85 \text{ m} \times 9 \text{ days} = 765 \text{ m}$
 $5 \text{ m} \times 9 \text{ days} = 585 \text{ m}$
 $= 1350 \text{ m}$

$1550 \text{ m} - 1350 \text{ m} = 200 \text{ miles}$ apart at the end of nine days. (B)

18. E This is essentially a bookkeeping problem, and all you need to do is multiply the numbers to find the total value of sales: $50 \text{ weeks} \times 100 \text{ sales per week} = 5,000 \text{ sales}$; $5,000 \text{ sales} \times \text{N}1,000 \text{ per sale} = \text{N}5,000,000$.

19. Let Fred's age now = x
 \therefore Jim's age now = $2x$
 and Sam's age now = $x - 2$
 Jim's age 4 years ago = $2x - 4$
 Sam's age 4 years ago = $x - 2 - 4$
 $= x - 6$

$\therefore 2x - 4 = 4(x - 6)$
 $2x - 4 = 4x - 24$
 $4x - 2x = 24 - 4$
 $2x = 20$
 $x = 10$

\therefore Jim's age now = $2 \times 10 = 20 \text{ years}$ (D)

20. If two-fifth of his salary was used, then three-fifth was left; three-fifth of his salary is N81. Now, since his salary is unknown, let x represent it:

$\frac{3}{5} \times x = \text{N}81$

divide both sides by $\frac{3}{5}$

$x = \text{N}81 \times \frac{5}{3}$

$x = \text{N}81 \times \frac{5}{3}$

$x = \text{N}135$

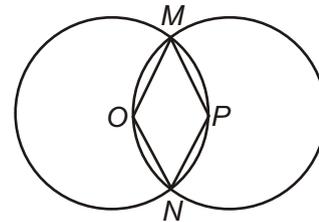
His salary is N135 for 30 days of work. To find the daily wage, divide the salary by 30:

$\text{N}135 \div 30 \text{ days} = \text{N}4.50 \text{ day}$

Daily wage = N4.50 (A)

21. Bola is paying back 2.5 percent of the loan each quarter of the year. 2.5% of N240 is N6.00. If she has already paid N42.00, that means she has paid that N6.00 for seven quarters. How many months is that? Each quarter of the year is 3 months. The correct answer is choice (D).

22.



The triangles are equilateral (OM, ON, PM, PN, and OP are all radii), and angles MON and MPN are both 120° . So each arc is 120° , or $\frac{1}{3}$ of the circle. Since the radius of the circle is 1, the circumference of each circle is $2\pi(1) = 2\pi$.

Therefore, each arc is $\frac{1}{3}$ of 2π , or $\frac{2\pi}{3}$. Together, they total $\frac{2\pi}{3} + \frac{2\pi}{3} = \frac{4\pi}{3}$. (C)

23. $30 \text{ m} - 25 \text{ m} = 5 \text{ m gain per 1 hr.}$

During the first hour, the first train travels 25 miles

$25 \text{ m} \div 5 \text{ mph} = 5 \text{ hrs}$ (D)

24. Let's say there were 100 customers. 40 of them purchase something. The problem says that 15% of the 40 purchase hats. 15% of 40 is 6. (B)

25. $25\% \text{ of N}200 = .25 \times \text{N}200 = \text{N}50$
 Next, find the 20% discount on N200:

$0.20 \times \text{N}200 = \text{N}40$

The list price is $\text{N}200 - \text{N}40 = \text{N}160$

Now take 5% of N160:

$0.05 \times \text{N}160 = \text{N}8$

The discount is N48 when taken at 20% and 5% successively.

$\text{N}50 - \text{N}48 = \text{N}2$ (D)

26. In this back solving question, four of the five choices could be the result of raising a price by 10%. One of them could not. You might have noticed that it was relatively easy to figure out two of the choices. Choice (A) N5.50 was clearly the result of adding 10% of N5.00 (50 kobo) to N5.00. Choice (C) was clearly the result of adding 10% of N10.00 (or N1) to N10.00. Thus, we could eliminate (A) and (C). If this was as far as you could get, it made sense to guess among the remaining answer choices. Remember, if you can eliminate even one choice, you should

guess. To eliminate the other two answer choices was tougher, and it helped to try to extrapolate from one of the choices that was easier to see. For example, we knew that choice (C) was the result of adding 10% of N10 (or N1) to N10. Mathematically, what did we do? We took an amount x , added 10% of x to that and set it equal to N11.00:

$$X + .1(x) = N11$$

And x turned out to equal N10, a round number.

Let's try this with choice (D) N12.10:

$$x + .1(x) = N12.10$$

If you do the math, x turns out to equal N11.00, a round number. We can eliminate choice (D).

Let's try it with choice (B) N7.60. This time, x is not a round number at all; it works out to about N6.9090....., A repeating decimal. (B)

27. Sales price (1999) = N2,310
 1997: cost of A = N2,500
 1998: cost of A = $N2500 + \left(\frac{20}{100} \times 2500\right)$
 = N3000
 1999: cost of A = $3000 + \left(\frac{10}{100} \times 3000\right)$
 = N3300
 Sales price (1999) = $N3300 - \left(\frac{30}{100} \times 3300\right)$
 = N2310 (C)

28. Simple interest: = $600 \times 0.12 \times 1$
 = N72
 Compound interest for first period
 = $600 \times 0.1.2 \times 1/2$
 = 36
 New principal = 636
 Compound interest for second period
 = $636 \times 0.1.2 \times 1/2$
 = N38.16
 New principal = N674.16
 Total interest = N74.16
 Difference = N74.16 - N72
 = N2.16 (A)

29. Let onions = 30
 :- Pepper = 10 i.e 1/3 of 30
 Tomatoes = 5 (1/2 of 10)
 Fishes = 5 (equal with Tomatoes)
 Total = $30 + 10 + 5 + 5 = 50$
 % of onion = $\frac{30}{50} \times 100\%$
 = 60% (E)

30. One gross = 144 pencils
 6 gross = $144/\text{gross} \times 6 \text{ gross} = 864$ pencils
 (on hand)
 If 24 pencils are used each week, divide to find the number of weeks they will last:
 864 divided by 24/week = 36 weeks
 Supplies would last 36 weeks. (D)

31. The area of cross section of the pipe
 = $\cancel{v} \text{cm}^2 = \frac{\cancel{v}}{100 \times 100} \text{m}^2$
 If $V \text{m/s}$ is the speed of water in the pipe,
 The volume discharged per second
 = $\frac{\cancel{v}}{100 \times 100} \text{m}^2$
 But 1m is discharged in 10 minutes
 :- $\frac{1}{10 \times 60} \text{M}^2$ are discharged per second
 :- $\frac{\cancel{v}}{100 \times 100} = \frac{1}{10 \times 60}$, $V = 5.30$

32. Distance for first 6 hrs
 = $6 \times 40 = 240$ miles
 Let x = additional hours
 :- distance = $X \times 60 = 60$ miles
 Total distance = $240 + 60x$
 Total time = $60 + x$
 Average speed = $\frac{\text{distance}}{\text{Time}} = 55 \text{m/h}$

$$= \frac{240 + 60x}{6 + x} = 55$$

 $240 + 60x = 330 - 55x$
 $60x - 55x = 330 - 240$
 $5x = 90$
 $x = 18 \text{hrs}$
 :- Total time = $18 + 6 = 24$ hrs (E)

33. We can order the elements by clarifying the exponents:
 (A) $\frac{3^8}{3^6} = 3^{8-6} = 3^2 = 9$
 (B) $3^3 - 1 = 27 - 1 = 26$
 (C) $3^0 = 1$
 (D) 3^{27} is too large to compute here, but it obviously the greatest quantity in the group
 (E) $3(3^2) = 3^3 = 27$
 The order is (C), (A), (B), (E), (D); so (B) is the middle term (B)
34. There are 51 integers between 100 and 150, 100, 105, 110, 115, 120, 125, 130, 135, 140, 145, 150 are numbers that are evenly divisible by 5 i.e 11 numbers.
 102, 105, 108, 111, 114, 117, 120, 123, 126, 129, 132, 135, 138, 141, 144, 147, 150 are numbers divisible by 3 i.e 17 numbers.
 But 105, 120, 135, 150 appears twice and cannot be counted twice.
 $\therefore 11 + 17 - 4 = 24$
 and numbers that can be divisible by neither 3 nor 5 is $51 - 24 = 27$ (C)
35. Total employees = 1400
 35% cash officers = $1400 \times 0.35 = 490$
 1/8 marketing officers = $1400 \times 1/8 = 175$
 Together ($490 + 175 = 665$), there are 665 cash and marketing officers. To find how many employees are neither, subtract:
 $1400 - 665 = 735$ (C)
36. Let x be the number of oranges that Dupe has. Then 3x is 1/3 the number of orange Dele has, so Dele has 9x orange. The ratio is x:9x or 1:9.
 Pick an easy-to-use number. Assume that Dele has 1 orange. If he had 3 times as many, he would have 3; and if 3 is 1/3 the number that Dele has, Dele has 9. The ratio is 1:9. (A)
37. The volume of the small tank is $\pi r^2 h$, and the volume of the large tank is $\pi(2r)^2 h$, which equals $4\pi r^2 h$, so the large tank is 4 times the size of the small one. Be careful! This is an increase of 300% not 400%. (4 is 3 more than 1, so is 300% more than 1). Therefore, k = 300. (D)
38. If A can do the job alone in 5 hours, A can do 1/5 of the job in 1 hour. working together, A and B can do the job in 2 hours, therefore in 1 hour they do 1/2 the job, in 1 hour, B alone does
 $\frac{1}{2} - \frac{1}{5} = \frac{5}{10} - \frac{2}{10}$
 $= \frac{3}{10}$
 It would take B $10/3$ hours = $3\frac{1}{3}$ hours to do the whole job alone. (A)
39. Since the pattern has six digits, divide 135 by 6. The quotient is 22, and the remainder is 3. Since $22 \times 6 = 132$, the 132nd number completes the pattern for the 22nd time. Then the 133rd, 134th, and 135th numbers are 1's, and the 136th and 137th are 2's; and their sum is $1 + 2 + 2 = 5$. (C)
40. In simple English, the N900 the lady must replace to bring the amount back up to its original amount is 10% of the original amount. Expressed in notation that is:
 $N900 = .10 \text{ of } x$
 $N90,000 = x$ (D)
41. The percent increase in Uche's investment is
 $\frac{\text{Actual increase}}{\text{Original value}} \times 100\%$. Each share was Originally worth N10, and the actual increase In value of each share was N10.
 percent increase in value =
 $\frac{10}{10} \times 100\% = 100\%$ (E)
42. First N3000: $02 \times N3000 = N60.00$
 Second N3000: $03 \times N3000 = N90.00$
 Third N3000: $04 \times N5280 = N90.00$
 Remainder ($N14,280 - N9000$);
 $.04 \times 5280 = \underline{N211.20}$
Total Tax = N451.20 (C)

Master Job Aptitude Test

Quantitative Reasoning Test 2

43. A table will help us organize the information:

	Brown	Not-Brown	Total
Men			
Women			
Total			

Filling the information given:

	Brown	Not-Brown	Total
Men	1/4		3/8
Women			
Total	3/4		

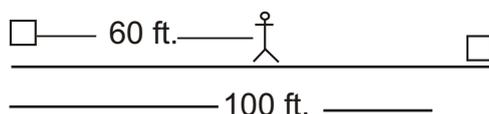
Notice that we enter 1/4 in the square for men with brown eyes. This is because 2/3 of the 3/8 of the people who are men have brown eyes. Finally, we complete the table:

	Brown	Not-Brown	Total
Men	1/4	1/8	3/8
Women	1/2	1/8	5/8
Total	3/4	1/4	1

A

44. $14\% \text{ of } x = N140$ (Let x be the total sales)
 $0.04 \times x = N140$
 $x = 1000$ (divide by 0.04) (C)

45. To determine how many feet nearer the man is to the bank than the drug store is to bank, use a diagram.



The total distance from the bank to the drug store is 100 feet. Subtract to find the distance from the man to the drug store.

$$100 \text{ feet} - 60 \text{ feet} = 40 \text{ feet}$$

The man is 40 feet nearer to the bank than the drug store is to the bank. (B)

46. $36 \text{ lines} \times 11 \text{ words} = 396 \text{ words on each page}$
 $125 \text{ pages} \times 396 \text{ words} = 49,500 \text{ words in 5 days.}$

$$49,500 \div 5 = 9,900 \text{ words in 1 day}$$

$$12 \text{ words} \times 30 \text{ lines} = 360 \text{ words on each page}$$

$$9,900 \div 360 = 27\frac{1}{2} \text{ pages in 1 day}$$

$$27\frac{1}{2} \times 6 = 165 \text{ pages in 6 days} \quad (D)$$

47. Let the cost be N900
 $\therefore \text{Material} = \frac{4}{9} \times N900$
 $= N400$
 $\text{Labour} = \frac{3}{9} \times N900$
 $= N300$
 $\text{Overheads} = \frac{2}{9} \times N900$
 $= N200$

In 1975

$$\text{Material} = N400 \times 1.10$$

$$= N440$$

$$\text{Labour} = N300 \times 1.08$$

$$= N324$$

$$\text{Overheads} = N200 \times 0.95$$

$$= N190$$

$$\text{Total cost in 1975} = N954$$

$$\% \text{ increase} = \frac{54}{900} \times 100\%$$

$$= 6\% \quad (A)$$

48. The trust received 80% of the estate (10% went to the man's wife, 5% to his children, and 5% to his grandchildren). If E represents the value of the estate, then

$$.80E = 1,000,000$$

$$E = 1,000,000 \div 0.80 = 1,250,000$$

Each grandchild received 1% (one-fifth of 5%) of the estate, or N12,500. (B)

49. First part of trip = $\frac{1}{2}$ of 10 miles = 5 miles

$$\text{Time for first part} = 5 \div 20$$

$$= \frac{1}{4} \text{ hour}$$

$$= 15 \text{ minutes}$$

Second part of trip was 5 miles, completed in 20 - 15 minutes or 5 minutes.

$$5 \text{ minutes} = \frac{1}{12} \text{ hour}$$

$$\text{Rate} = 5 \text{ miles} \div \frac{1}{12} \text{ hr}$$

$$= 60 \text{ mph} \quad (D)$$

50. If f is the height of the first pole, the proportion is:

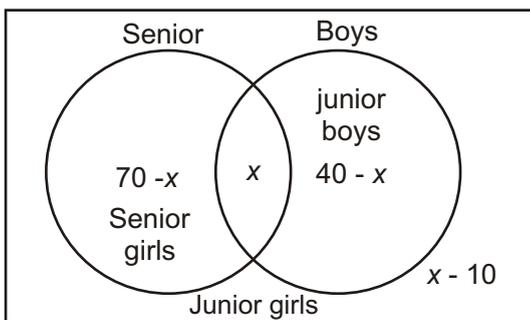
$$\frac{f}{24} = \frac{3}{4}$$

$$f = \frac{24 \times 3}{4}$$

$$= 18 \text{ ft.} \quad (\text{A})$$

51. After 1 hour, they will be 5 miles apart.
20 miles 5 miles = 4 hr. (C)

52. Draw a Venn diagram and label each region. Let x be the number of senior boys. Then $40 - x$ is the number of boys who are not seniors (i.e., are junior, and $70 - x$ is the number of seniors who are not boys (i.e., are girls). Then



number of junior girls =

$$100 - [(40 - x) + x + (70 - x)] =$$

$$100 - [110 - x] = x - 10$$

Since the number of junior girls must be at least 0, $x - 10 \geq 0$ $x \geq 10$ (C)

53. Commission = 2% of N58,460
= $.02 \times \text{N}58,460$
= N116.92
Salary + commission = N3000 + N1169.20
= N4169.20 (B)

54. There are five integers less than 50 whose units digit is 7: 7, 17, 27, 37, and 47. Of these, four (all but 27) are prime. Then, the probability of drawing a prime is $\frac{4}{5}$ (C)

55. Be careful. It may seem as though a right angle is formed 24 times - twice each hour (e.g at about 12:15 and 12:45, actually at $12:16\frac{4}{11}$ and $12:49\frac{1}{11}$).

In fact, a right angle is formed twice each hour; but between 2:00 and 3:00 this occurs at about 2:27 and 3:00 exactly 3:00 and about 3:33. Therefore, 3:00 gets counted twice and so does 9:00. This answer, then, is 22. (B)

56. Let x be the number Ngozi chose. Then the other terms are as follows:

Term	2	3	4	5
Expression	$x + 6$	$2(x + 6) = 2x + 12$	$2x + 12 + 6 = 2x + 18$	$2(2x + 18) = 4x + 36$

$$\text{Finally, } 4x + 36 = 1996$$

$$4x = 160$$

$$x = 40$$

(B)

57. Since the game takes 1 hour, or 60 minutes, and there are always 5 men playing, there is a total $5 \times 60 = 300$ man-minutes of playing time. If that amount of time is evenly divided among the 12 players, each one plays $300 \div 12 = 25$ minutes. (D)

58. The family spends a total of 85 percent of its income. Therefore, $100\% - 85\%$, or 15%, remains for savings.

$$15\% \text{ of N}500 = .15 \times \text{N}500$$

$$= \text{N}75 \text{ per week}$$

$$\text{N}15,000 \div \text{N}75 = 200 \text{ weeks} \quad (\text{D})$$

59. The sum of 2 two-digit numbers must be less than 200, so $A = 1$ and the sum is 111. Since B and D are positive, $B + D$ cannot be 1, and so must be 11, which means that a 1 is carried into the tens column. In the tens column we must add 1 (for A), the 1 we carried, and C, and the sum is 11. Then $1 + 1 + C = 11$, and $C = 9$. (D)

$$\begin{array}{r} 1B \\ + CD \\ \hline 111 \end{array}$$

B, D can be any digits whose sum is 11.

$$C = 9$$

Go on to the next page

60. When you have more than two equations, Add them.
- $$\begin{array}{r} x + y = 10 \\ y + z = 15 \\ + x + z = 17 \\ \hline 2x + 2y + 2z = 42 \\ \\ x + y + z = 21 \\ \hline \frac{x + y + z}{3} = \frac{21}{3} = 7 \end{array}$$
- Divide by 2:
To get the average, divide the sum by 3:

(Note: You could solve for x, y, z, but you shouldn't) (A)

61. Let x = the number of passengers originally on the bus, and keep track of the comings and goings. At the first stop half the people got off, leaving $\frac{1}{2}x$ on the bus, and 1 more got on: $\frac{1}{2}x + 1$. At the second stop $\frac{1}{3}$ of the passengers got off, leaving two-thirds on the bus, and 1 person got on
- $$\frac{2}{3} \left(\frac{1}{2}x + 1 \right) + 1$$
- This simplifies to $\frac{1}{3}x + \frac{2}{3} + 1$, which equals 15, so
- $$\frac{1}{3}x + \frac{2}{3} = 14 \quad x + 2 = 42 \quad x = 40 \quad (A)$$

62. If c carpenters can complete a job in d days, then 1 carpenter will take c times as long, or cd days, to complete the job and $\frac{p}{100}cd = \frac{cdp}{100}$ days to complete p% of the job,
- Finally, if the work is divided up among e Carpenters, they will take $\frac{cdp}{100e} = \frac{cdp}{100e}$ days. (A)

63. A can type 500 \div 5 = 100 letters per hour
B can type 400 \div 5 = 80 letters per hour
Together they can type 180 letters per hour.
- $$540 \div 180 = 3$$
- It will take 3 hours to type 540 letters (B)

64. $2 \times N450 = N9.00$
 $3 \times N415 = 12.45$
 $5 \times 475 = + 23.75$
-
- N45.20
- N45.20 \div 10 = N4.52 (C)

65. The total must be 100 percent

German	32%
Spanish	28%
English	20%
Miscellaneous	10%
	90%

Therefore, 100% - 90%, or 10% are French.

A circle contains 360°

$$\begin{aligned} 10\% \text{ of } 3600 &= .10 \times 3600 \\ &= 360 \end{aligned} \quad (D)$$

66. Since the 84 marbles in jar 1 are divided in the ratio of 2:5, we get $84 = 2x + 5x = 7x$ $x = 12$. Then, jar 1 contain 24 red and 60 blue marbles.

	Red	Blue	Total
Jar I	24	60	84
Jar II	9w	5w	14w
Total	24+9w	60+5w	

Since the total number of red and of blue marbles is the same,

$$24 + 9w = 60 + 5w = 36 \quad w = 9.$$

Therefore, jar II contains $14 \times 9 = 126$ marbles. (A)

67. Let cost of petrol = x kobo
and cost of oil = y kobo
- Assuming he used 400 litres of petrol and 10 litres of oil
- The cost is $(400x + 10y)$ kobo
 $\therefore -400x + 10y = 20400 \dots\dots\dots(i)$
- He actually used 20 litres of oil
 $\therefore -400x + 20y = 21600 \dots\dots\dots(ii)$
- Subtract (i) from (ii)
 $= 10y = 1200$
 $y = 120$
- Substitute in (i)
 $400x + 600 = 20400$
 $400x = 19,800$
 $x = 49.5$ (D)

68. When an integer is divided by 100, the remainder is just the last two digits of that integer (100 goes into 273 2 times with a remainder of 73). Except for 5 itself, every power of 5 ends in the digits **25**: 25, 125, 625, 3125, ... (D)
69. Substitute a simple number for x . Since this is a percent problem, choose 10 or 110. Let $x = 10$: 10% less than 10 is 9, and 10% more than 9 is 9.9. Now, what percent of 100 ($10x$) is 9.9? The answer is 9.9%. (B)
70. Every hour the hour hand moves through 30° ($1/12$ of 360°). It will move through 10° in $1/3$ hour, or 20 minutes; and 20 minutes after 1:15 the time is 1:35. (B)
71. Organize the data in a table. Assume Aaron was 4 times as old as Sarah after x years and 3 times as old after y years.

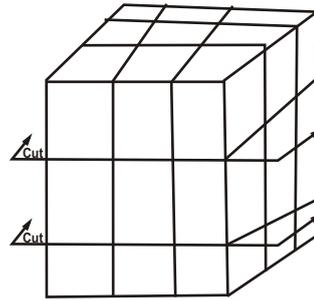
Time	Aaron's Age	Sarah's Age
When Sarah was born	24	0
x years later	$24+x$	x
y years later	$24+y$	y

$$24 + x = 4x \quad 3x = 24 \quad x = 8;$$

$$24 + y = 3y \quad 2y = 24 \quad y = 12$$

Aaron was 4 times as old as Sarah 4 years ago. (They are now 36 and 12; 4 years ago they were 32 and 8). (A)

72. This question just require good visualization. Think of the cube as being cut into three slices, as in the figure below. All 9 little cubes in the top row and in the bottom row are painted, and all but the centre cube in the middle row is painted. Only 1 small cube is unpainted. (B)



73. If $x =$ the cost of the film, then $100 + x =$ price of the camera, and

$$125 = x + (100 + x) = 2x + 100$$

$$2x = 25 \quad x = 12.5,$$

Which is 10% of the total cost of 125. The camera cost 90% of the total. (B)

74. Since Ahmed got N100, the other three shared the remaining N900. If x represents Ali's share, then Buba got $2x$ and Shehu got $3x$. Then.

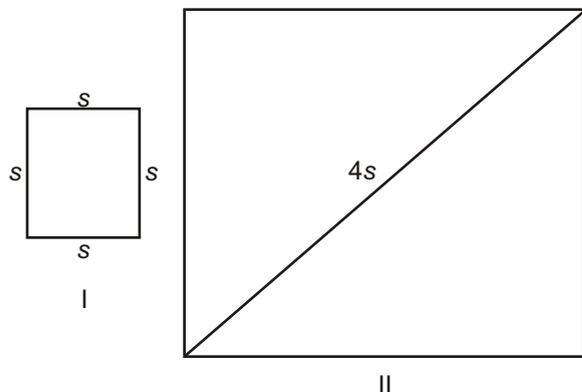
$$900 = x + 2x + 3x = 6x \quad x = 150 \quad (A)$$

75. Draw and label a diagram. Let s Represent a side of square I. Then the perimeter of square I and the diagonal of square II are each $4s$, and the area of square I is s^2 . The easiest way to get the area of square II is to use the formula

$$A = 1/2d^2$$

$$A = 1/2(4s)^2 = 1/216s^2 = 8s^2$$

Then, the ratio of the two areas is $s^2/8s^2 = 1/8$ or .125 (C)



QUANTITATIVE REASONING TEST 3

70 QUESTIONS

30 MINUTES

DIRECTIONS

Each problem in this test involves a certain amount of logical reasoning and thinking on your part. Read each problem carefully and choose the correct answer from the five choices that follow. Blacken the corresponding space on your answer sheet.

- I am 10% older than my wife. What % is my wife younger than me?
(A) 8.99%
(B) 10.00%
(C) 9.09%
(D) 11.11%
(E) 10.99%
- A sells to B at a gain of 20%; B sells to C at the price A paid. What does B lose as a percentage?
(A) 20%
(B) 17%
(C) 15%
(D) $16\frac{2}{3}\%$
(E) 12%
- The price of a share rose 25% yesterday and fell 25% today. What is the total rise or fall percent?
(A) 25% fall
(B) 50% rise
(C) 25% rise
(D) $6\frac{1}{4}\%$ fall
(E) No change
- A shopkeeper marks her goods to gain 35%. She allows 10% discount for cash. Find her percentage profit when sold for cash.
(A) 135%
(B) 13.50%
(C) 121.50%
(D) 50%
(E) 21.5%
- A man buys eggs at 55kobo a score. He finds that 10% of the eggs are unsaleable but sells the rest at 60kobo per dozen. Find his percentage profit.
(A) 63.6%
(B) 58.4%
(C) 12.10%
(D) 19.8%
(E) 33%
- A motorist reduces his annual distance traveled by $x\%$ when the price of petrol is increased by $y\%$. Find the increase percent in his petrol bill.
(A) $(y-x)\%$
(B) $xy/100\%$
(C) $(x-xy)/100\%$
(D) $(y-x -xy/100)\%$
(E) $xy\%$
- A bookseller makes a profit of 20% by selling a certain book for 90 kobo. When she has sold 90% of her stock, she finds she has to sell the rest at a sale price of 60 kobo each. What percentage profit does she make on the transaction?
(A) 18%
(B) 16%
(C) 15%
(D) 17%
(E) 14%

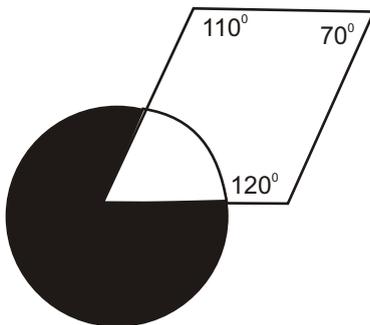
8. By selling an article for N5.35, a shopkeeper gain 7%. What should the selling price be for a profit of 15%?
(A) N5.50
(B) N5.75
(C) N5.00
(D) N5.20
(E) N5.60
9. A wholesaler sells goods to a retailer at a profit of 20%. The retailer sells to a customer at a profit of 80% more than the cost to the wholesaler. What is the retailer's percentage profit?
(A) 60%
(B) 30%
(C) 80%
(D) 70
(E) 50%
10. I sold 12 eggs at the price for which I bought 20 eggs. What is my percentage profit?
(A) 66.67%
(B) 57.6%
(C) 47.9%
(D) 12%
(E) 20%
11. A circle is inscribed in a square. Express the area of the circle as a percentage of the area of the square.
(A) 30%
(B) 85.7%
(C) 78.5%
(D) 50%
(E) 100%
12. A train is scheduled to cover a certain distance in a certain time. Owing to stoppages, the train driver estimates that he must cover the distance in 75% of the scheduled time. By what percent must he increase his speed?
(A) $33\frac{1}{3}\%$
(B) 30%
(C) 35%
(D) $38\frac{3}{4}\%$
(E) $21\frac{1}{2}\%$
13. A man has four biros of different colours. He takes at least one to work each day. For how many consecutive days can he take a different selection to work?
(A) 12
(B) 20
(C) 15
(D) 30
(E) 18
14. Chidi does as much work in three hours as Peter does in four hours. Peter's son works half as fast as Peter. If the three working together are paid N8.50k, how much should Peter's son receive.
(A) N2.00
(B) N4.50
(C) N3.00
(D) N1.50
(E) N2.20
15. If A is half as old as B and B is half as old as C and the sum of their three ages is 114 years, find the age of A.
(A) 36
(B) 50
(C) 63
(D) 54
(E) 45
16. If Ann lends N400 for 9 months, Yinka lends N300 for 8 months and the interest paid is N25, how much should Ann receive?
(A) N15
(B) N12
(C) N18
(D) N10
(E) N17
17. If $x:y = 3\frac{1}{2} : 2\frac{1}{3}$
and $y:z = 1\frac{1}{4} : 2\frac{1}{7}$
Find $x : y : z$
(A) 3 : 4 : 5
(B) 11 : 13 : 10
(C) 15 : 10 : 7
(D) $1\frac{1}{2} : 2\frac{2}{3} : 7/8$
(E) 21 : 14 : 24

18. Two partners Silas and Uche invested N3000 and N1800 respectively in a business. It is agreed that Uche should take 30% of the profits for running the business and that the remaining profit should be divided between them in the ratio of the capital investments. What percentage of the profits will Silas receive?
- (A) 54%
(B) $62\frac{1}{2}\%$
(C) 43.75%
(D) 37.5%
(E) 45%
19. The cost of printing a book was N5000 for 4000 copies. The publisher sold to a bookshop at a profit of 15% and the bookseller sold the book at N2.10. What is the bookseller's profit percent?
- (A) $33\frac{1}{2}\%$
(B) $41.\frac{2}{3}\%$
(C) 46.1%
(D) 37.8%
(E) 60%
20. If the price of an electronics is N22,000. To this must be added VAT at 15%, what is the selling price?
- (A) N25,300
(B) N3,300
(C) N28,600
(D) N22,000
(E) N20,000
21. An investigator rented a car for four days and was charged N200. The car rental company charged N10 per day plus N.20 per mile. How many miles did the investigator drive the car?
- (A) 800
(B) 950
(C) 1,000
(D) 1,200
(E) none of these
22. In a government office, $\frac{1}{6}$ of the employee favored abandoning a flexible work schedule system. In a second office that had the same number of employees, $\frac{1}{4}$ of the workers favored abandoning it. What is the average of the fractions of the workers in the two offices who favored abandoning the system?
- (A) $\frac{1}{10}$
(B) $\frac{1}{5}$
(C) $\frac{5}{24}$
(D) $\frac{5}{12}$
23. A man had his personal computer repaired at a cost of N49.20. This amount included a charge of N22 per hour for labor and a charge for a new switch that cost N18 before a 10% discount was applied. How long did the repair job take?
- (A) 1 hour 6 minutes
(B) 1 hour 11 minutes
(C) 1 hour 22 minutes
(D) 1 hour 30 minutes
(E) none of these
24. In a large postal agency where mail is delivered in motorized carts, two tyres were replaced on a cart at a cost of N34 per tyres. If the agency had expected to pay N80 for the two tyres, what percent of its expected cost did it save?
- (A) 7.5%
(B) 17.6%
(C) 57.5%
(D) 75.0%
(E) none of these
25. An inter-agency task force has representatives from three different agencies. Half of the task force members represent Agency A, one-third represent Agency B, and three represent Agency C. How many people are on the task force?
- (A) 12
(B) 15
(C) 18
(D) 24
(E) none of these
26. It has been established in recent productivity studies that, on the average, it takes a filing clerk 2 hours and 12 minutes to file four drawer of a filing cabinet. At this rate, how long would it take two clerks to file 16 drawers?
- (A) 4 hours
(B) 4 hours 20 minutes
(C) 8 hours
(D) 8 hours 40 minutes
(E) none of these

27. It costs N60,000 per month to maintain a small medical facility. The basic charge per person for treatment is N40, but 50% of those seeking treatment average charge of N20 per person. How many patients per month would the facility have to serve in order to cover its costs?
(A) 1,000
(B) 1,200
(C) 1,500
(D) 2,000
(E) none of these
28. An experimental antipollution vehicle powered by electricity traveled 33 kilometers (km) at a constant speed of 110 kilometers per hour (km/h). How many minutes did it take this vehicle to complete its experimental run?
(A) 3
(B) 10
(C) 18
(D) 20
(E) none of these
29. It takes two typists three 8-hours work days to type a report on a word processor. How many typists would be needed to type two reports of the same length in one 8-hour work days?
(A) 4
(B) 6
(C) 8
(D) 12
(E) none of these
30. A clerk is able to process 40 unemployment compensation claims in one hour. After deductions of 18% for benefits and taxes, the clerk's net pay is N6.97 per hour. If the clerk processed 1,200 claims, how much would the government have to pay for the work, based on the clerk's hourly wage before deductions?
(A) N278.80
(B) N255.00
(C) N246.74
(D) N209.10
(E) none of these
31. If the average of x , y , and 30 is 10, then the average of x and y is
(A) 0
(B) 5
(C) $7\frac{1}{2}$
(D) 10
(E) 30
32. All of the 120 seniors in a High School are members of the chess club, the pep club, or both. If 90 seniors are in the pep club and 70 seniors are in the chess club, how many seniors are in both clubs?
(A) 10
(B) 20
(C) 30
(D) 40
(E) 50
33. If a and b are positive integers and $a^3 b^2 = 72$, then $a + b =$
(A) 36
(B) 17
(C) 8
(D) 6
(E) 5
34. Which of the following fractions is closest to 1 given that $a > b > 1$?
(A) $\frac{a}{b}$
(B) $\frac{(a+2)}{(b+2)}$
(C) $\frac{(a+1)}{(b+1)}$
(D) $\frac{(a+1)}{b}$
(E) $\frac{(a-1)}{(b-1)}$
35. If I invest N2000 at $x\%$ and N2500 at $y\%$, my annual income is N160. If I had invested N2,500 at $x\%$ and N2000 at $y\%$, my income would have been N155. Find x and y .
(A) 2, 3
(B) 3, 4
(C) 4, 5
(D) 5, 6
(E) 6, 7

36. If cylinder A has three times the height and one-third the diameter of cylinder B, what is the ratio of the volume of A to the volume of B? (Volume of cylinder = $\pi r^2 h$)
- (A) 3 : 1
(B) 1 : 1
(C) 1 : 3
(D) 1 : 9
(E) 1 : 27
37. A jogger desires to run a certain course in $\frac{1}{4}$ less time than she usually takes. By what percent must she increase her average running speed to accomplish this goal?
- (A) 20%
(B) 25%
(C) $33\frac{1}{3}\%$
(D) 50%
(E) 75%
38. If a is a positive integer and if remainders of 4 and 6 are obtained when 89 and 125, respectively, are divided by a , then $a =$
- (A) 7
(B) 9
(C) 15
(D) 17
(E) 19
39. A pen- and - pencil set costs N12, the same as when the items are bought separately. If the pen costs N11 more than the pencil, what is the cost of the pencil?
- (A) N0.50
(B) N1.00
(C) N1.50
(D) N6.00
(E) N11.00
40. A salesman makes a commission of x percent on the first N2,000 worth of sales in any given month and y percent on all further sales during that month. If he makes N700 from N4,000 of sales in October and he makes N900 from N5,000 of sales in November, what is the value of x ?
- (A) 2%
(B) 5%
(C) 10%
(D) 15%
(E) 20%
41. If 20 liters of chemical X are added to 80 liters of a mixture that is 10% chemical X and 90% chemical Y, then what percentage of the resulting mixture is chemical X?
- (A) 15%
(B) 28%
(C) $33\frac{1}{3}\%$
(D) 40%
(E) 60%
42. A merchant makes a profit of N10 on a certain item. If the naira cost of the time is a whole number, then which of the following could NOT represent her profit as a percentage of her cost?
- (A) 10%
(B) 20%
(C) 25%
(D) 40%
(E) 80%
43. If x is an even number, which of the following must be odd?
- I. $3x + 1$
II. $(5x)^2 + 2$
III. $(X + 1)^2$
- (A) I only
(B) III only
(C) I and II only
(D) I and III only
(E) I, II and III
44. Sixteen cylindrical cans, each with a radius, of 1 inch, are placed inside a rectangular cardboard box . If the cans touch adjacent cans and/or the walls of the box which of the following could be the interior area of the bottom of the box, expressed in square inches?
- (A) 16
(B) 32
(C) 64
(D) 128
(E) 256

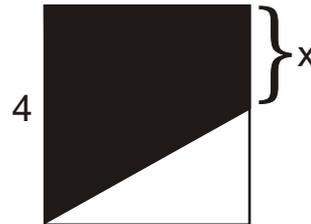
45. Mr. Femi Adebayo invested a total of N12,000 for a one-year period. Part of the money was invested at 5% simple interest, and the rest was invested at 12% simple interest. If he earned a total of N880 in interest for the year, how much of the money was invested at 12%?
- (A) N1,920
 (B) N4,000
 (C) N4,800
 (D) N7,200
 (E) N8,000



46. In the figure above, the circle O has a radius of 6. What is the area of the shaded portion of the figure.
- (A) $\frac{\sqrt{3}}{2}$
 (B) $\frac{5\sqrt{3}}{2}$
 (C) $12\sqrt{3}$
 (D) $18\sqrt{3}$
 (E) $30\sqrt{3}$
47. If during a one-year period, the dividend paid on a certain share of stock was equal to $8\frac{3}{8}\%$ of the par value of the stock, then the dividend paid was what fraction of the par value of the stock?
- (A) $\frac{32}{800}$
 (B) $\frac{67}{800}$
 (C) $\frac{32}{100}$
 (D) $\frac{67}{100}$
 (E) $\frac{72}{100}$
48. If a machine consumes $\frac{k}{5}$ kilowatts of power every t hours, how much power will three such machines consume in 10 hours?
- (A) $\frac{6t}{k}$
 (B) $\frac{t}{k}$
 (C) $30kt$
 (D) $\frac{k}{t}$
 (E) $\frac{6k}{t}$
49. Machine P can produce x beads in 10 hours, Machine Q can produce x beads in 6 hours, and Machine R can produce $2x$ beads in 15 hours. If the three machines work together but independently, without interruption, how much time, expressed in hours, will be needed for them to produce $5x$ beads?
- (A) $7\frac{2}{3}$
 (B) 8
 (C) 2
 (D) $12\frac{1}{2}$
 (E) $23\frac{1}{2}$
50. A motorist travels 15km to the liter of petrol and 600km to the litre of oil. He estimates that an annual distance of 6000km will cost him N204 in petrol and oil. In fact he used twice as much oil as he estimated and the cost was N216. What is the cost of a litre of petrol?
- (A) 48
 (B) 120
 (C) 96
 (D) 24
 (E) 60
51. A certain machine processes 8 quarts of milk every 6 seconds. How many gallons of milk can the machine process in 3 minutes?
- (A) 18
 (B) 20
 (C) 60
 (D) 75
 (E) 120

52. During a half-price sale, Ms. Phyl bought a toothbrush for the usual price a second toothbrush for one-half the usual price. If she paid N1.80 for the two toothbrushes, what was the usual price of a toothbrush?
- (A) N.50
(B) N.60
(C) N.90
(D) N1.20
(E) N2.40
53. For which of the following lengths of a side of a square would the perimeter be divisible by both 4 and 7?
- (A) 3
(B) 4
(C) 5
(D) 6
(E) 7
54. Of 24 children on a tennis coaching course, 14 are boys and 8 are left handed, including 5 of the boys. No child is ambidextrous. What is the probability that a child selected at random is a left-handed girl?
- (A) $7/24$
(B) $5/12$
(C) $1/8$
(D) $3/8$
(E) $7/12$
55. In a certain year, corporation X produced 40 percent of the total world production of a certain drug. If corporation X produced 18 kilograms of the drug, how many kilograms were produced by producers other than corporation X?
- (A) 22
(B) 27
(C) 36
(D) 40
(E) 45
56. Four cylindrical cans each with a radius of 2 inches are placed on their bases inside an open square pasteboard box. If the four sides of the box bulge slightly, which of the following could be the internal perimeter of the base of the box, expressed in inches?
- (A) 64
(B) 32
(C) 30
(D) 20
(E) 16
57. A certain liquid fertilizer contains 10 percent mineral X by volume. If a farmer wishes to treat a crop with $3/4$ of a liter of mineral X per acre, how many acres can he treat with 300 liters of the liquid fertilizer?
- (A) 40
(B) 24
(C) 18
(D) 16
(E) 12
58. Three athletes A, B and C are to ran a race. B and C have equal chances of winning but A is twice as likely to win as either. What is the probability of each athlete winning?
- (A) $2/3$
(B) $1/3$
(C) $3/4$
(D) $1/4$
(E) $3/5$
59. Two security lights, L_1 and L_2 , are located 100 feet apart. Each illuminates an area of radius 100 feet, and both are located 60 feet from a chain-link fence. What is the total length of fence, in feet, illuminated by the two lights?
- (A) 260
(B) 240
(C) 220
(D) 200
(E) 180
60. A racetrack bounded by two concentric circles, one with a diameter of 160 yards and the other with a diameter of 140 yards, is to be covered with asphalt. If the asphalt layer is to be 1 foot deep, how many cubic yards of asphalt will be needed?
- (A) 75 \neq
(B) 90 \neq
(C) 500 \neq
(D) 1500 \neq
(E) 2000 \neq
61. If m , n , o and p are real numbers, each of the following expressions equals $m(nop)$ EXCEPT.
- (A) $(op)(mn)$
(B) $ponm$
(C) $p(onm)$
(D) $(mp)(no)$
(E) $(mn)(mo)(mp)$

62. To go to office in the morning . I first walked to the bus stop at 8km/h and enter okada for the rest of the way at 40km/h. It normally takes me 21 min in all. One morning when I was late, I ran to the bus stop at 16km/h and took okada at 60km/h. I completed the journey in $11\frac{1}{2}$ min. How far is the bus stop from my office?
 (A) 6
 (B) 4
 (C) 3
 (D) 10
 (E) 9
63. A merchant sells a radio for N80, thereby making a profit of 25% of the cost. What is the ratio of cost to selling price?
 (A) 4/5
 (B) 3/4
 (C) 5/6
 (D) 2/3
 (E) 3/5
64. How many degrees are between the hands of a clock at 3 : 40?
 (A) 150°
 (B) 140°
 (C) 130°
 (D) 125°
 (E) 120°
65. If $mp + nq = 12mq$, and $mq > 0$, then $\frac{p+n}{q-m} = ?$
 (A) 12
 (B) $12mn$
 (C) $12m + 12q$
 (D) 0
 (E) $mp = nq$
66. A perfect number is one which is equal to the sum of all its positive factors that are less than the number itself. Which of the following is a perfect number?
 (A) 1
 (B) 4
 (C) 6
 (D) 8
 (E) 10
67. A class begins at 1:21 p.m and ends at 3:36 p.m the same afternoon. How many minutes long was the class?
 (A) 4587
 (B) 215
 (C) 150
 (D) 135
 (E) 75



68. In the square above with side 4, the ratio $\frac{\text{area of shaded region}}{\text{area of unshaded region}} =$
 (A) $\frac{2+x}{4}$
 (B) $\frac{4+x}{8}$
 (C) 2
 (D) $\frac{4+x}{4-x}$
 (E) $2x$
69. A carpenter needs four boards, each 2 feet 10 inches long. If wood is sold only by the foot, what is the minimum length, in feet, of wood the carpenter must buy?
 (A) 9
 (B) 10
 (C) 11
 (D) 12
 (E) 13
70. Ned is two years older than Mike, who is twice as old as Linda. If the ages of the three total 27 years, how old is Mike?
 (A) 5 years
 (B) 8 years
 (C) 9 years
 (D) 10 years
 (E) 12 years

ANSWER KEY

1.	C	11.	C	21.	A	31.	A	41.	B	51.	A	61.	E
2.	D	12.	A	22.	C	32.	D	42.	E	52.	D	62.	B
3.	D	13.	C	23.	D	33.	E	43.	D	53.	E	63.	A
4.	E	14.	D	24.	E	34.	B	44.	C	54.	C	64.	C
5.	A	15.	D	25.	C	35.	B	45.	B	55.	B	65.	A
6.	D	16.	A	26.	E	36.	C	46.	E	56.	C	66.	C
7.	B	17.	E	27.	B	37.	C	47.	B	57.	A	67.	D
8.	B	18.	C	28.	C	38.	D	48.	A	58.	D	68.	D
9.	E	19.	C	29.	D	39.	A	49.	D	59.	A	69.	D
10.	A	20.	A	30.	B	40.	D	50.	E	60.	C	70.	D

ANSWERS AND EXPLANATIONS

1. C Let the age of the wife = 50 yrs
 □the husband's age = $\frac{100+10}{100} \times 50$
 $= 55\text{yrs}$
 □difference in age = $(55 - 50)\text{ yrs} = 5\text{yrs}$
 $= \frac{5}{55} \times 100\%$
 $= 9.09\%$
2. D Let the cost price for A = N50
 the cost price for B = $\frac{120}{100} \times 50$
 $= \text{N}60$
 B sold to C at N50
 Loss = $\text{N}60 - \text{N}50 = \text{N}10$
 percentage loss for B = $\frac{10}{60} \times 100\%$
 $= 16\frac{2}{3}\%$
3. D Let the price before the rise = N50
 therefore 25% rise = $\frac{125}{100} \times 50$
 $= \text{N}62.5$
 A fall of 25% = $\frac{75}{100} \times \text{N}62.5$
 $= \text{N}46.875$
 Difference in price from initial price = $\text{N}50 - \text{N}46.875$
 $= \text{N}3.125$
 □percentage fall = $\frac{3.125}{50} \times 100\%$
 $= 6\frac{1}{4}\%$ fall
4. E Let the initial price = N50.00
 A gain of 35% = $\frac{135}{100} \times 50$
 $= \text{N}67.50$
 A discount of 10% = $\frac{90}{100} \times \text{N}67.50$
 $= \text{N}60.75$
 Gain = $\text{N}60.75 - \text{N}50.00$
 $= \text{N}10.75$
 Gain percent = $\frac{10.75}{50} \times 100$
 $= 21.5\%$
5. A Score = 20
 Sold = $\frac{90}{100} \times 20$
 $= 18$
 The man sold 12 for 60k and 6 for 30k
 □18 eggs was sold for = 90k
 Gain = $90\text{k} - 55\text{k}$
 $= 35\text{k}$
 Profit percent = $\frac{35}{55} \times 100\%$
 $= 63.6\%$
6. D Let initial distance traveled = A km
 Let initial price of petrol = B kobo per litre
 His initial bill was AB, and let M = number of Km traveled per litre of petrol.
 □New distance = $\frac{100-x}{100} \times A$
 New price = $\frac{100-y}{100} \times B$
 New annual bill = $\frac{(100-x)(100-y)}{100 \times 100} \times \frac{AB}{M}$
 $= 1 + \frac{y-x}{100} - \frac{xy}{10000}$
 $= (y-x - \frac{xy}{100})\%$
- For more on this attend IEC seminar*
7. B Let the total number of books = 50
 At a profit of 20% the selling price of a copy of book = 90k
 therefore the cost price = $\frac{100}{120} \times 90$
 $= 75\text{k}$
 But on 90% of the total books was sold for 90k each = $\frac{90}{100} \times 50$
 $= 45 \times 90\text{k}$
 $= \text{N}40.50$
 and the remaining 10% was sold for 60k each
 $= \frac{10}{100} \times 50$
 $= 5 \times 60$
 $= \text{N}3.00$
 Total sales = $\text{N}40.50 + \text{N}3.00$

$$\begin{aligned} \text{Profit} &= \text{N}43.50 \\ &= \text{N}43.50 - (75k \times 50) \\ &= \text{N}43.50 - \text{N}37.50 \\ &= \text{N}6.00 \end{aligned}$$

$$\begin{aligned} \text{Percentage profit} &= \frac{6}{37.5} \times 100 \\ &= 16\% \end{aligned}$$

8. B The selling price percentage at N5.35

$$\begin{aligned} &= 100\% + 7\% \\ &= 107\% \end{aligned}$$

$$\begin{aligned} \text{the selling price percentage for a profit} \\ \text{percent of 15\%} &= 100\% + 15\% \\ &= 115\% \end{aligned}$$

$$\begin{aligned} \text{the selling price at 15\%} &= \frac{115}{107} \times 5.35 \\ &= \text{N}5.75 \end{aligned}$$

9. E Let the cost price of the wholesaler = N50
the cost price of the retailer = selling price of the wholesaler

$$\begin{aligned} &= \frac{120}{100} \times 50 \\ &= \text{N}60 \end{aligned}$$

$$\begin{aligned} \text{the retailer's selling price} &= \frac{180}{100} \times 50 \\ &= \text{N}90 \end{aligned}$$

$$\begin{aligned} \square \text{ profit of the retailer} &= \text{N}90 - \text{N}60 \\ &= \text{N}30 \end{aligned}$$

$$\begin{aligned} \text{percentage profit} &= \frac{30}{60} \times 100 \\ &= 50\% \end{aligned}$$

10. A Let the price of each egg = N20

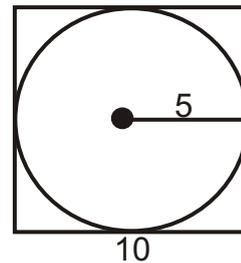
$$\begin{aligned} \text{therefore 12 eggs} &= \text{N}20 \times 12 \\ &= \text{N}240 \end{aligned}$$

$$\begin{aligned} \text{cost of 20 eggs} &= \text{N}20 \times 20 \\ &= \text{N}400 \end{aligned}$$

$$\begin{aligned} \text{profit} &= \text{N}400 - \text{N}240 \\ &= \text{N}160 \end{aligned}$$

$$\begin{aligned} \text{percentage profit} &= \frac{160}{240} \times 100 \\ &= 66.67\% \end{aligned}$$

11. C



Let the radius of the circle = 5cm
therefore the one side of the square = 10cm.

$$\begin{aligned} \text{Area of circle} &= 3.142 \times 5 \times 5 \\ &= 78.55\text{cm}^2 \end{aligned}$$

$$\begin{aligned} \text{Area of square} &= 10 \times 10 \\ &= 100\text{cm}^2 \end{aligned}$$

$$\begin{aligned} \square \frac{78.55}{100} \times 100\% \\ &= 78.55\% \end{aligned}$$

12. A Let the distance = 50 km

$$\text{Let the time} = 5 \text{ hrs}$$

$$\text{Speed} = \frac{50}{5}$$

$$= 10\text{km/hr}$$

$$\begin{aligned} 75\% \text{ of the scheduled time} &= \frac{75}{100} \times 5 \\ &= 3.75\text{hrs} \end{aligned}$$

$$\begin{aligned} \text{Difference in speed} &= 13.33 - 10 \\ &= 3.33 \end{aligned}$$

$$\begin{aligned} \text{Percentage increase} &= \frac{3.33}{10} \times \frac{100}{1} \\ &= 33\frac{1}{3}\% \end{aligned}$$

13. C Since there are four biros, and the biro used a day should differ from that of the previous day. In order words there is a differential choice of 2 units for each day. Therefore, take the biros as a binary code and convert it to decimal code.

$$\begin{aligned} 1111_2 &= 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 \\ &= 8 + 4 + 2 + 1 \\ &= 15 \end{aligned}$$

For more on this call: 0803-3438062 or come to our seminar.

14. D The time spent by Chidi = 3 hrs
 the rate of Chidi = $\frac{1}{3}$
 = 0.33

time spent by Peter = 4
 the rate of Peter = $\frac{1}{4}$
 = 0.25

the time spent by Peter's son = 8
 the rate of Peter's son = $\frac{1}{8}$
 = 0.125

sum of the rates = $0.33 + 0.25 + 0.125$
 = 0.708

Amount received by Peter's son
 = $\frac{0.125}{0.708} \times 8.5$
 = N1.50

15. D Let the age of C = s yrs
 \therefore B's ages = $\frac{3}{2}s$

\therefore A's age = $\frac{9}{4}s$

$S + 3/2s + 9/4s = 114$
 $\frac{4s + 6s + 9s}{4} = 114$
 $19s = 456$
 $S = 24$
 \therefore A's age = $24 \times 9/4$
 = 54 yrs

16. A
 $400 \times \frac{9}{12} = 300$

$300 \times \frac{8}{12} = 200$
 \therefore Ann will receive = $\frac{300}{500} \times 25$
 = N15

17. E
 $x:y = 3\frac{1}{2} : 2\frac{1}{3}$, $y:z = 1\frac{1}{4} : 2\frac{1}{7}$
 $\frac{x}{3\frac{1}{2}} : \frac{y}{2\frac{1}{3}} = \frac{y}{1\frac{1}{4}} : \frac{z}{2\frac{1}{7}}$
 $= 1\frac{1}{4}(3\frac{1}{2}) : 1\frac{1}{4}(2\frac{1}{3}) \quad 2\frac{1}{3}(1\frac{1}{4}) : (2\frac{1}{7})2\frac{1}{3}$

$\frac{35}{8} : \frac{35}{12} \quad \frac{35}{12} \quad \frac{15}{3}$

Since y is common on both sides, so we choose only one value of y.

$\therefore \frac{35}{8} : \frac{35}{12} : \frac{15}{3}$

Now multiply through by $\frac{1}{35}$
 Answer will be $\frac{1}{8} : \frac{1}{12} : \frac{1}{7}$

Now multiply through by 672 ($8 \times 12 \times 7$)
 Answer = 21 : 14 : 24

18. C
 Let the interest be = N100
 30% of the profit = N30
 \therefore the remaining N70 will be shared in the ratio in the capital invested.

\therefore for Silas = $\frac{3000}{4800} \times 70$
 = $43\frac{3}{4}\%$

19. C
 The selling price of the publisher
 = $\frac{115}{100} \times 5000$
 = 5,750

The selling price of the bookseller
 = $4000 \times 2.10 = 8,400$

Profit = $8,400 - 5,750 = 2650$
 $\therefore \frac{2650}{8,400} \times 100$
 = 31.5%

20. A
 $\frac{115}{100} \times 22,000$
 = N25,300

21. A The investigator drove the car for four days at N10 per day, which is N40; N40 subtracted from the total charge of N200 leaves N160, the portion of the total charge that was expended for the miles driven. This amount divided by the charge per mile ($160/.20$) gives the number of miles (800) driven by the investigator. The computation is:
 $4(10) + .20x = 200$

22. C

$$\begin{aligned} & \frac{1}{6} + \frac{1}{4} \\ &= \frac{2+3}{12} \\ &= 5/12 \\ \text{Average} &= \frac{5}{12} \times \frac{1}{2} \\ &= 5/24 \end{aligned}$$

23. D The cost of the switch after the government discount of 10% $18 - (18 \times 0.10)$, or N16.20. This amount, when subtracted from the total charge of N49.20 leaves N33, which represents the charge for labor. A charge of N33 at the rate of N22 per hour represents 1.5 hours, or 1 hour 30 minutes of work.

24. E

$$\begin{aligned} \text{Expected cost per tyre} &= 80/2 = 40 \\ \text{Actual cost} &= 34 \\ \text{Difference} &= 40 - 34 = 6 \\ \% \text{ saved} &= \frac{6}{40} \times 100\% \\ &= 15\% \end{aligned}$$

25. C

$$\begin{aligned} \text{Let total number of people} &= x \\ \text{Agency A} &= x/2 \\ \text{Agency B} &= x/3 \\ \text{Agency C} &= 3 \\ \therefore \frac{x}{2} + \frac{x}{3} + 3 &= x \end{aligned}$$

$$\begin{aligned} \frac{3x+2x+18}{6} &= x \\ 5x+18 &= 6x \\ x &= 18 \end{aligned}$$

26. E The correct answer is not given as one of the response choices. The answer can be obtained by first converting 12 minutes to 0.2 hour, and then setting up a simple proportion:

$$\begin{aligned} \frac{2.2}{4} &= \frac{x}{16} \\ \text{Solving this proportion, we obtain } 4x &= 35.2; \\ x &= 8.8. \text{ However, this is the number of} \end{aligned}$$

hours that it would take one filing clerk to do the job. If two clerks are filing the 16 drawers, the job would be completed in half that time, or in 4.4 hours, which is 4 hours and 24 minutes

27. (B)

$$\begin{aligned} \text{Let no of all patients} &= x \\ \text{Additional average} &= 50\% \text{ of } x \\ &= 0.5x \\ \text{Cost} &= N40x + N20(0.5x) \\ &= 40x + 10x = 60,000 \\ 50x &= 60,000 \\ x &= 1,200 \end{aligned}$$

28. (C)

Obtain the correct answer by setting up a simple proportion:

$$\frac{110\text{km}}{60\text{ min}} = \frac{33\text{km}}{x\text{ min}}$$

Solving this proportion, we obtain $x = 1980/110 = 18\text{mins}$.

29. (D)

No of Job(s)	No of typist(s)	Time (hrs)
1	2	24
1	1	48
2	1	96
2	x	8

Inverse variation

$$\begin{aligned} 8 &\dots\dots\dots x \\ 96 &\dots\dots\dots 1 \end{aligned}$$

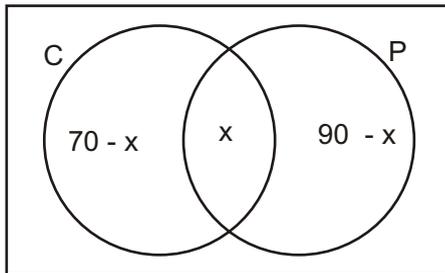
$$\begin{aligned} \therefore 8x &= 96 \\ x &= 12 \text{ typists} \end{aligned}$$

30. (D)

$$\begin{aligned} \text{Let gross pay} &= x \\ 82\% \text{ of } x &= 6.97 \text{ (discount pay)} \\ \therefore x &= 8.50 \\ \text{Hours of work} &= \frac{1200}{40} = 30 \\ \therefore N8.50 \times 30 &= N255 \end{aligned}$$

31. A

$$\begin{aligned} \frac{x+y+30}{3} &= 10 \\ x+y+30 &= 30 \\ x+y &= 0 \\ \text{Average of } x \text{ and } y &= \frac{x+y}{2} = 0 \end{aligned}$$



32. D x = No of seniors in both club
 $70 - x$ = No of seniors in chess club only
 $90 - x$ = No of senior in pep club only
 $\therefore 70 - x + x + 90 - x = 120$
 $x = 120 - 160$
 $x = 40$
 There are 40 students in both clubs.

33. E This problem has a certain trial and error aspect to it. We need to find a pair of factors of 72 such that one of them is a perfect square and the other is a perfect cube. 72 is 9×8 , and 9 is 3 squared and 8 is 2 cubed, so a is 3 and b is 2. Thus, $a + b$ is 5.

34. B This is an example of a problem whose exact nature is not fully known until the answer choices are examined. Here, a simplifying approach is to choose convenient values for a and b and then evaluate the fractions, picking the fraction nearest to 1 as the answer. Let us work with $a = 3$ and $b = 2$, since a must be greater than b . Then answer choice (A) becomes $3/2$, or $1\frac{1}{2}$. (B) becomes $5/4$ or $1\frac{1}{4}$. (C) becomes $4/3$, or $1\frac{1}{3}$. (D) becomes $4/2$, or 2. Finally, (E) becomes $2/1$, or 2. All of the answer choices are greater than one, and (B), which is the least of them, is therefore closest to 1.

35. C
- $$2000x + 2500y = 160$$
- $$2500x + 2000y = 155$$
- Solving by dividing through with 100
- $$20x + 25y = 1.6 \dots\dots\dots(1)$$
- $$25x + 20y = 1.55 \dots\dots\dots(2)$$
- Multiply equation (1) by 20 and equation (2) by -25
- $$400x + 500y = 32$$
- $$-625 + 20y = -38.75$$
- $$\hline -225x = -6.75$$

$$\therefore x = \frac{6.75}{225} = 0.03$$

$$20y = 1.55 - 25 \times 0.03 = 0.8$$

$$y = \frac{0.8}{20} = 0.04$$

Therefore, multiply x and y by 100
 $\therefore x = 3, y = 4$

36. C
 Volume of cylinder = $\pi r^2 h$
 Cylinder A = $\pi x (1/3r)^2 \times 36$
 $= 1/3 \pi r^2 h$
 Cylinder B = $\pi r^2 h$
 \therefore Ratio = $\frac{1/3 \pi r^2 h}{\pi r^2 h}$
 $= 1/3$
 $= 1:3$

37. C Let us call the jogger's original rate r_1 and her increased rate r_2 . If the original time is t , then the new time would be $3/4t$. Since the distance is the same in both cases, $D = r_1 t$

$$= r_2 \left(\frac{3}{4}t\right) \text{ or } r_2 = \frac{4}{3}r_1$$

The increase in speed would be $\frac{4}{3}r_1 - r_1 = \frac{1}{3}r_1$. Dividing this by the old total gives us the percentage increase:

$$\frac{\frac{1}{3}r_1}{r_1} = \frac{1}{3} = 33\frac{1}{3}\%$$

38. D if a remainder of 4 is obtained when 89 is divided by a , then a must divide $89 - 4 = 85$ evenly. Similarly, if a remainder of 6 is obtained when 125 is divided by a then a must divide $125 - 6 = 119$ evenly. 85 is 17×5 and 119 is 17×7 . The only integer that divides both numbers evenly is 17, so that is the correct answer.

39. A It is easy to misread this problem. It states that the pen costs N11 more than the pencil, not that the pen costs N11. Letting x = the cost of the pen and y = the cost of the pencil, we can write two equations: $x + y = 12$ and $x - y = 11$. Subtracting the second equation from the first we get $2y = 1$ and $y = .50$.

40. D The October commission can be expressed as $\left(\frac{x}{100}\right)(2000) + \left(\frac{y}{100}\right)(4000 - 2000)$ which must equal 700. This simplifies to $20x + 20y = 700$. The November commission can be written as $\left(\frac{x}{100}\right)(2000) + \left(\frac{x}{100}\right)(5000 - 2000) = 900$, which simplifies to $20x + 30y = 900$. Subtracting the first equation from the second, we get $10y = 200$ or $y = 20$. Subtracting for y in the first equation we get $20x + (2)(20) = 700$, $20x = 300$ or $x = 15$.

41. B You don't need any fancy formulae to attack this problem. If we start with 80 liters of a mixture that is 10% X and 90% Y, we have 8 liters of X, we end up with 28 liters of X and 72 liters of Y, for a total of 100 liters of the mixture. Since 28 out of the 100 liters of mixture are X, we have a mixture that is 28 or 28% X.

42. E
$$N10/\text{cost} \times 100 = x\%$$

This we can rewrite as:

$$N10(100)/x\% = \text{cost}$$

Or as:

$$N10/x = \text{cost}$$

When x now represents the decimal equivalent of a percentage. So to determine whether an answer choice is possible, you need only substitute the decimal equivalent in for x : for example, (A):

$$N10/.10 = N100$$

Which says that profit of N10 on top of a cost of N100 would be a 10% profit. Since the N100 is a whole naira amount, (A) is possible.

The correct choice is (E)

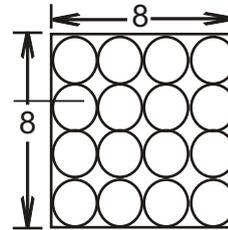
$$\frac{N10}{80} = N12.50$$

But N12.50 is not whole naira value.

43. D As for I, since x is even, $3x$ must also be even, and $3x + 1$ an odd number. As for II, since x is even $5x$ must be even: and since $3x$ is even, $5x$ times $5x$ is even, and an even number plus 2 is still even.

As for III, since x is even, $x + 1$ is odd that $x + 1$ times $x + 1$ is also an odd number.

44. C A picture should make clear the solution to the problem:



The box has inside dimension of 8 and 8, so the area is $8 \times 8 = 64$ square inches.

45. B This question can be solved using simultaneous equations. For example, let x be the amount of money invested at 5% and let y be the amount of money invested at 12%. Using those symbols, since the total amount invested was N12,000, we write:

$$x + y = N12,000$$

Next, we know that the interest earned on x (at the rate of 5% per year) plus the interest earned on y (at the rate of 12% per year) was a total of N880 in interest:

$$X(.05) + y(.12) = N880$$

So we have two equations:

$$x + y = 12,000$$

$$.05x + .12y = 880$$

We can solve for each variable by the following method. First, since $x + y = 12,000$, $x = 12,000 - y$. We substitute that value of x into the second equation:

$$.05(12,000 - y) + .12y = 880$$

$$600 - .05y + .12y = 880$$

$$0.7y = 280$$

$$y = 4,000$$

So the amount invested at 12% was N4,000.

46. E
Shaded Area = Area of Circle minus
Unshaded Area

First, the area of the entire circle is πr^2 or 36π . Next, the angle at the center of the circle belonging to the quadrilateral is 360° , so the missing angle must be 60° . And 60° is $1/6$ of the total number of degrees in a circle, so the unshaded area is $1/6$ the area of the circle, or $1/6$ of 36π , which is 6π . Substituting into our solution statement.
 $= 36 \pi - 6 \pi = 30 \pi$

47. B

$$8\frac{3}{8}\% = 8\frac{\frac{3}{8}}{100} = \frac{67}{100}$$

$$= \frac{67}{800}$$

48. E First, a single machine consumes $k/5$ kilowatts every t hours, which is a rate of $\frac{k}{5t}$. Or $\frac{k}{5t}$. Next, we have three such machines, and they will consume at three times the rate of one machine: $\frac{3k}{5t}$. Finally, a direct proportion will show us how much is consumed in 10 hours:

$$\frac{3k}{5t} = \frac{x}{10}$$

Cross-multiply: $30k = (x)5t$

$$\frac{30k}{5t} = x$$

Divided by $5t$: $\frac{6k}{t} = x$

49. D Rate (1) + Rate (2) + Rate (3) = Rate Combined

Amount: $\frac{x}{10} + \frac{x}{6} + \frac{2x}{15} = \frac{5x}{y}$

(Where y is the unknown time needed to answer the question).

Add: $\frac{3x + 5x + 4x}{30} = \frac{5x}{y}$

$$\frac{12x}{30} = \frac{5x}{y}$$

$$y(12x) = 150x$$

$$y = \frac{150x}{12x} = 12.5 \text{ hours}$$

50. A Let the cost of petrol be x kobo and the cost of a litre of oil y kobo. In travelling 6000km, he estimates to use 400 litres of petrol and 10 litres of oil.

The cost of these is $(400x + 10y)$ kobo

$$\therefore 400x + 10y = 20400$$

but he actually used twice as much oil
 $= 20$ litre

$$\therefore 400x + 20y = 21600$$

Solving both equation for x

$$400x + 10y = 20400$$

$$400x + 20y = 21600$$

$$x = 48$$

For more on this come to IEC seminar or lectures.

51. C Convert quartz to gallons and minutes to seconds. 8 quartz = 2 gallons

$$3 \text{ minutes} = 180 \text{ seconds}$$

Direct variation:

$$\frac{2 \text{ gallons}}{6 \text{ seconds}} = \frac{x \text{ gallons}}{180 \text{ seconds}}$$

$$x = \frac{2 \times 180}{6}$$

$$x = 60 \text{ gallons}$$

52. D Let usual price = x
 $\therefore 1/2$ of usual price = $x/2$

$$\therefore -x + x/2 = N1.80$$

$$\frac{3x}{2} = N1.80$$

$$3x = N3.60$$

$$x = N1.20$$

53. E The most efficient way of attacking this question is to test each choice. (A), (B), (c), and (D) have perimeters of 12, 16, 20, and 24, respectively, numbers that are not divisible by both 4 and 7. (E), however, has a perimeter of 28, divisible by both 4 and 7, and that is the correct choice.

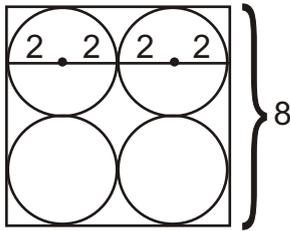
54. C Since there are 24 children, 14 of whom are boys, there must be 10 girls. Since 8 are left handed, including 5 boys, there must be 3 left handed girls.

$$\text{The probability} = \frac{3}{24} = \frac{1}{8}$$

55. B 40 percent of T = 18. So,
.4T = 18
t = 45

Go on to the next page

56. C A sketch of the bottom of the box may be helpful:



Since the radius of each can is 2, the diameter of each can is 4. If the cans fit exactly into the box, the box would have a side of 8 and a perimeter of 32. But we are told the box slightly bulged, so the inside perimeter must be slightly less than 32.

57. A We want to put $\frac{3}{4}$ of a liter on each acre. So we need to divide:

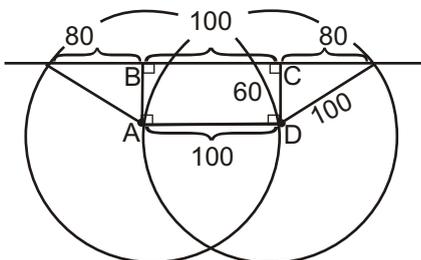
$$\begin{array}{r} 30 \text{ liters} \\ \underline{\quad 3} \\ 4 \text{ liter/acre} \end{array}$$

$$30 \text{ liters} \times \frac{4 \text{ acres}}{3 \text{ liters}} = 40 \text{ acres}$$

58. D Since one runner is certain to win (ignoring ties), the probabilities must total 1. Since B and C are equally likely to win, their probabilities must be the same, say x . Since A is twice as likely to win as either, his probability must be $2x$.

$$\begin{aligned} \therefore x + x + 2x &= 1 \\ x &= 1/4 \end{aligned}$$

59. A Here it is useful to sketch some additional lines:

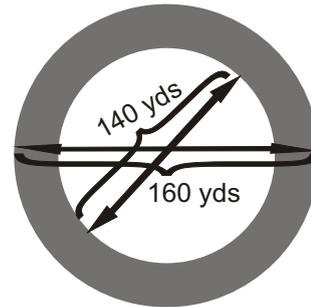


For convenience, we letter the points as shown. Now, ABCD is a rectangle. Since the two lights are 100 feet apart, BC is also 100. Then, we observe the sides are right triangles, the hypotenuses of which

are radii and equal to 100. Since AB and CD are both 60, the one remaining side for each triangle is:

$$\begin{aligned} X^2 + (60)^2 &= (100)^2 \\ x &= 80 \end{aligned}$$

You should have noticed the 3, 4, 5 relationship). So the total length is $80 + 100 + 80 = 260$.



60. C The larger circle has a diameter of 160 yards, thus a radius of 80 yards and an area of π times $(80)^2$, or 6400 π square yards. The smaller has a diameter of 140 yards, thus a radius of 70 yards and an area of π times $(70)^2$, or 4900 π square yards. Subtracting smaller area from the larger, we obtain $6400 \pi - 4900 \pi = 1500 \pi$ as the area of the track. Since the asphalt layer is to be 1 foot, or $\frac{1}{3}$ yard, deep, we must multiply 1500π by $\frac{1}{3}$, getting 500π cubic yards as the answer.

61. E multiplication is both associative and commutative. By associative, we mean that the grouping of the elements is not important for example, $(5 \times 6) \times 7 = 5 \times (6 \times 7)$. By commutative we mean that the order of the elements is unimportant - for example, $5 \times 6 = 6 \times 5$. So (A), (B), (C), and (D) are all alternative forms for $m(nop)$, but (E) is not: $(mn)(mo)(mp) = m^3nop$.

62. B Let x = distance he walked
 y = distance covered by okada

$$\frac{x}{8} + \frac{y}{40} = \frac{21}{60} \dots\dots\dots (i)$$

$$\frac{x}{16} + \frac{y}{60} = \frac{11.5}{60} \dots\dots\dots (ii)$$

Multiply equation (i) by 120 and equation (ii) by 240

$$15x + 3y = 42$$

$$15x + 4y = 46$$

Eliminate x and solve for y
 $Y = 4$

The office is 4km from the office

63. A Let x = the cost
 Then $x + \frac{1}{4}x = 80$

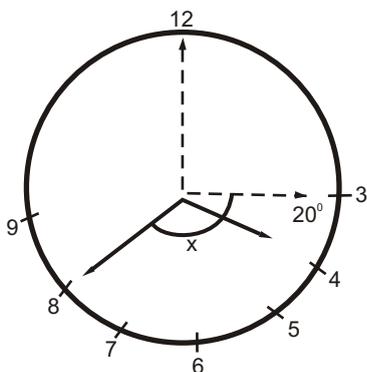
$$4x + x = 320$$

$$5x = 320$$

$$= \text{N}64 \text{ (cost)}$$

$$\frac{\text{Cost}}{\text{S.P}} = \frac{64}{80}$$

$$= \frac{4}{5}$$



64. C At 3:00, large hand is at 12 and small hand is at 3. During the next 40 minutes, large hand moves to 8 and small hand moves $\frac{40}{60} = \frac{2}{3}$ of the distance between 3 and 4. Since there is 30° between two numbers on a clock, $\angle x = 5(30^\circ) - 20^\circ = 150^\circ - 20^\circ = 130^\circ$.

65. A

$$\frac{p}{q} + \frac{n}{m} = x$$

$$\therefore \frac{mp + nq}{mq} = x$$

$$mp + nq = xmq$$

If $mp + nq = 12mq$
 $\therefore x = 12$

66. C Do not let the term "perfect number" throw you. Accept the definition of any such odd ball term and apply it to the problem. Since the factors of 6 less than 6 itself are 1, 2, and 3, 6 is the perfect number ($1+2+3 = 6$). 1 is not a perfect number since there are no factors of 1 less than itself. 4 is not a perfect number since the factors of 4 less than 4 are 1 and 2 and $1 + 2 \neq 4$. Nor is 8 a perfect number since the factors of a 8 are less than 8 itself are 1, 2, and 4, and those total 7, not 8. Finally, 10 is not a perfect number since the key factors here are 1, 2, and 5, which total 8, not 10.

67. D From 1:21 to 2:21 is 60 minutes. From 2:21 to 3:21 is 60 minutes. So far we have a total of 120 minutes. Then, from 3:21, to 3:36 is 15 minutes, for a total of 135 minutes.

68. D Area of shaded area is equal to
 Area of square - Area of unshaded triangle
 Area of square = $4 \times 4 = 16$
 Area of unshaded triangle = $\frac{1}{2} \times \frac{4}{1} \times 4 - x$

$$= 8.2x$$

\therefore Area of shaded area
 $= 16 - (8.2x)$
 $= 16 - 8 + 2x$
 $= 8 + 2x$

\therefore Ratio = $\frac{8 + 2x}{8 - 2x}$
 $= \frac{4 + x}{4 - x}$

69. D To find the total wood needed, you must multiply 2 feet 10 inches by 4. Two feet times 4 is 8 feet. Ten inches times 4 is 40 inches, which is between 3 feet (36 inches) and 4 feet (48 inches). There is no way to get 40 inches of wood out of 3 feet. You should round up, so that there is enough wood and the answer is thus 8 feet plus 4 feet = 12 feet.

70. D
Let Linda's age = x
∴- Mike = $2x$
and Ned = $2x + 2$
 $x + 2x + 2x + 2 = 27$
 $5x = 25$
 $x = 5$
Mike's age = $2 \times 5 = 10$ years



SHOP ARITHMETIC TEST I

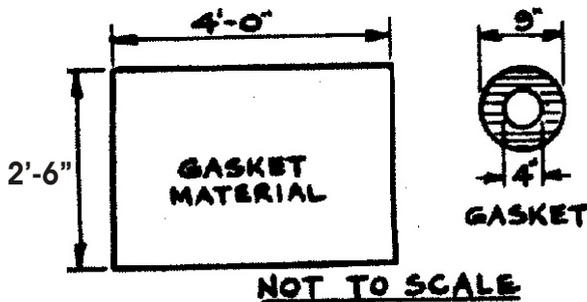
21 QUESTIONS
15 MINUTES

DIRECTIONS

For each question in this text, carefully read the stem and the four lettered choices that follow. Choose the answer that you consider correct or most nearly correct. Mark the answer sheet for the letter you have chosen: A, B, C, or D. Check your answers with the correct answers at the end of this chapter.

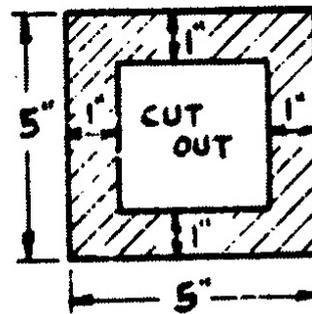
1. The maximum number of gaskets shown that can be cut from the gasket material as shown below is

- (A) 14
- (B) 15
- (C) 18
- (D) 20



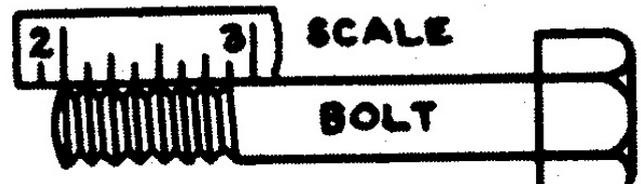
2. The gasket shown has an area of

- (A) 9 in.²
- (B) 15 in.²
- (C) 16 in.²
- (D) 20 in.²



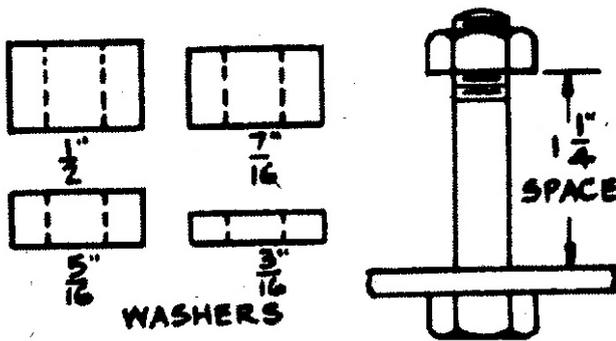
3. The number of threads per inch on the bolt is

- (A) 16
- (B) 10
- (C) 8
- (D) 7

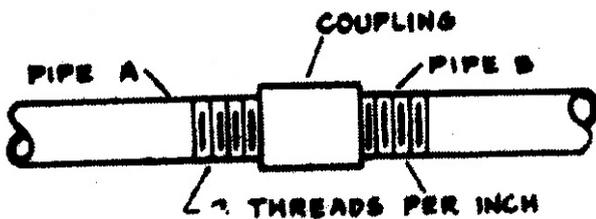


4. Using only the sizes of washers shown, the least number of washers needed to exactly fill the $1\frac{1}{4}$ " space is

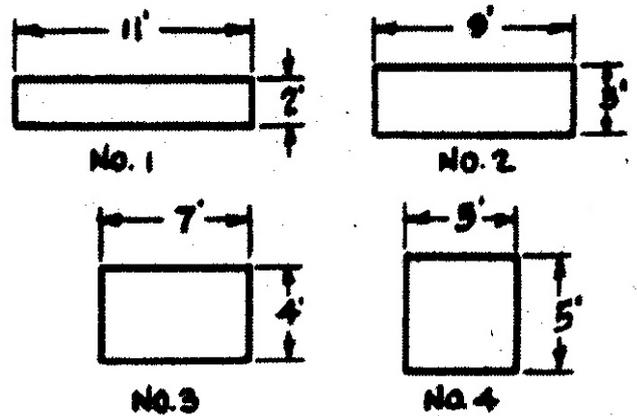
- (A) 6
- (B) 5
- (C) 4
- (D) 3



5. If both pipes A and B are free to move back and forth but are held so they cannot turn, and the coupling is turned 4 revolutions with wrench, the overall length of the pipes and coupling will
- (A) decrease $\frac{1}{2}$ "
 - (B) remain the same
 - (C) increase or decrease 1", depending upon the direction of turning
 - (D) increase $\frac{1}{2}$ "



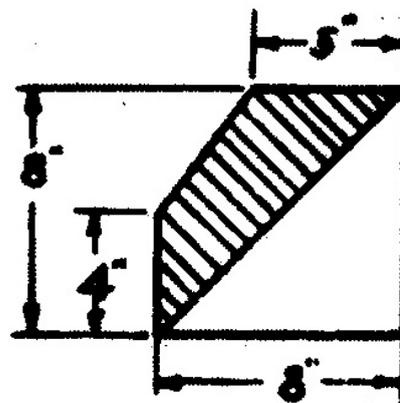
6. Shown are the bottoms of four bins that are used for storing materials. If the bins are all capable of holding the same amount of any particular material, then you would expect the bin with the shortest sides to be the one whose bottom is shown as
- (A) No. 1
 - (B) 2
 - (C) 3
 - (D) 4



7. The volume (in cubic inches) of the bar is
- (A) 24 in³
 - (B) 28 $\frac{1}{4}$ in³
 - (C) 48 in³
 - (D) 60 in³

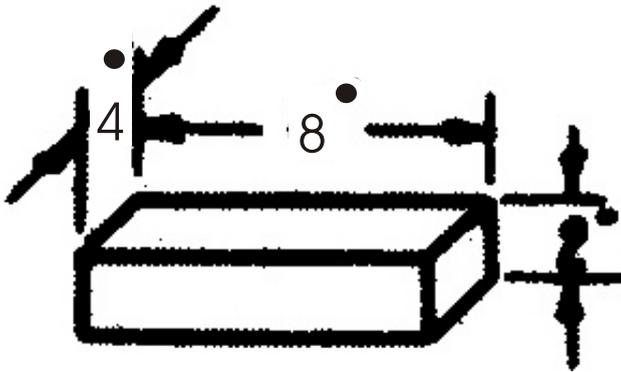


8. If the shaded portion is cut from the plate shown, the area of the remaining portion is
- (A) 26 in²
 - (B) 29 in²
 - (C) 32 in²
 - (D) 58 in²



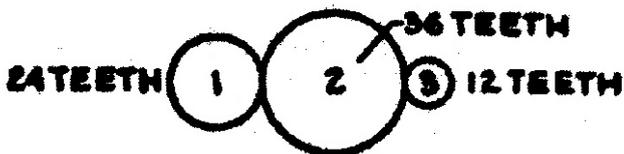
9. The approximate dimensions of a common brick are as shown. The volume of the brick is

- (A) 64 ft.³
- (B) 5 1/3 ft.³
- (C) 4/6 ft.³
- (D) 1/27 ft.³



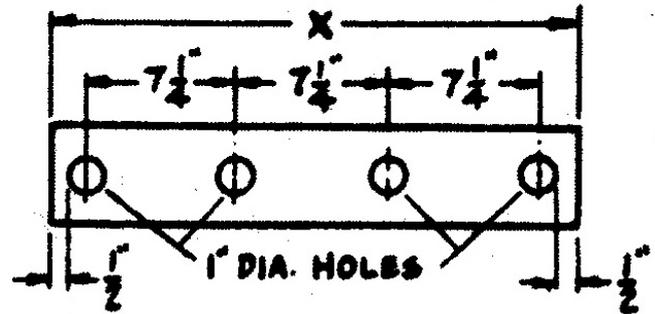
10. When the RPM of gear #1 is 120, the RPM of #3 is

- (A) 40
- (B) 60
- (C) 180
- (D) 240



11. The dimension "x" on the piece shown is

- (A) 20 3/4"
- (B) 22 3/4"
- (C) 23 3/4"
- (D) 24 1/4"

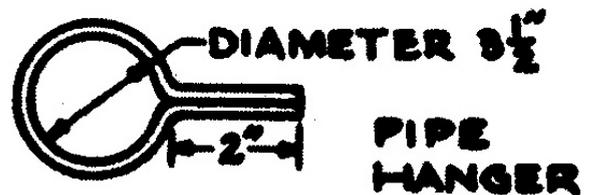


12. Five metal bars have lengths, measured in feet, of 4, 4, 3, 4, and 10. The average (arithmetic mean) length is

- (A) 6.7 feet
- (B) 5 feet
- (C) 4 feet
- (D) 3.8 feet

13. The minimum length of strap iron needed to make the hanger is most nearly

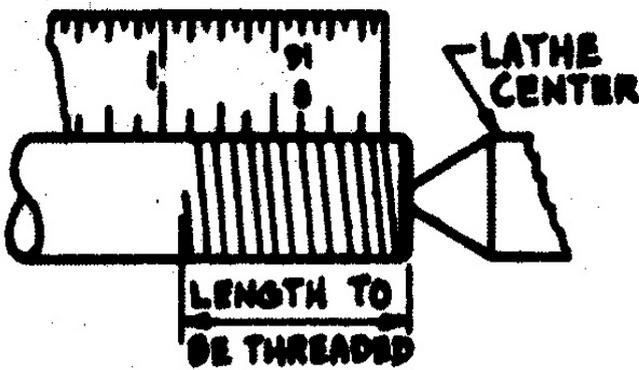
- (A) 26"
- (B) 15"
- (C) 13"
- (D) 9 1/2"



14. A very light cut (trace) is being measured as a check before cutting the thread on the lathe.

The number of threads per inch shown is

- (A) 12
- (B) 13
- (C) 14
- (D) 15



15. The minimum area of sheet metal strip required to make the duct (allowing 21/2% for joints) is

- (A) 24.6 ft.²
- (B) 41 ft.²
- (C) 42.5 ft.²
- (D) 100 ft.²

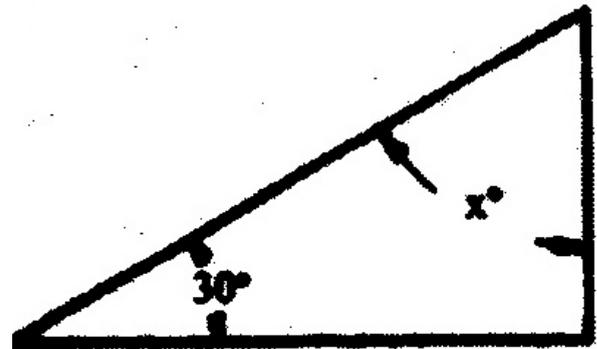


16. In a scale drawing where 1" = 1', 3/4" represents an actual length of

- (A) 3/4"
- (B) 3"
- (C) 8"
- (D) 9"

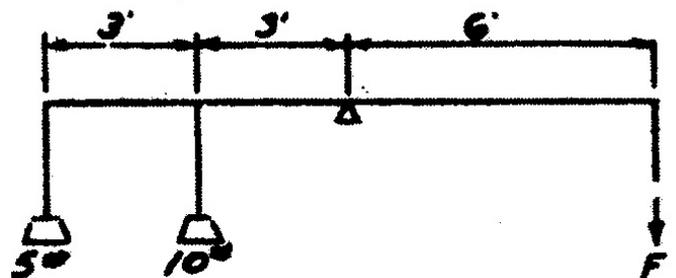
17. In the right-angled triangle shown, x is

- (A) 45°
- (B) 60°
- (C) 78°
- (D) 90°



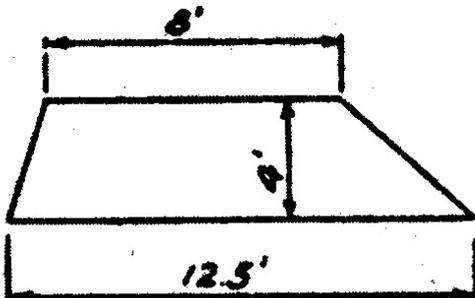
18. The force F needed to balance the lever is most nearly

- (A) 7.5 lbs.
- (B) 10 lbs.
- (D) 12.5 lbs.
- (D) 15 lbs.



19. A drawing uses a scale of 1 inch to represent 10 feet. If a square on the drawing measures 5 in on a side, what is the actual area?

- (A) 50 ft.²
- (B) 2500 ft.²
- (C) 2500 in.²
- (D) .25 ft.²

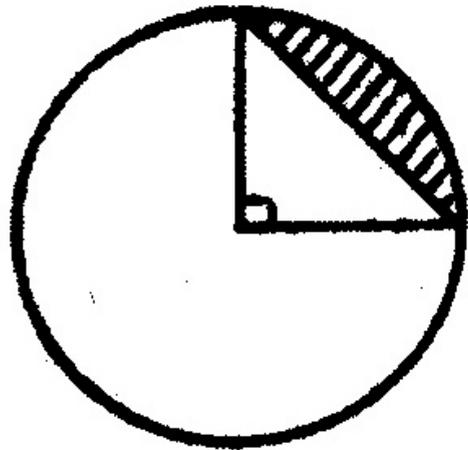


20. The top and bottom sides of the figure shown are parallel. The area is most nearly

- (A) 40.5 ft.²
- (B) 41.0 ft.²
- (C) 41.5 ft.²
- (D) 42.0 ft.²

21. In the circle shown, the radius is 10'. The area of the shaded portion is most nearly.

- (A) 27.5 ft.²
- (B) 28.0 ft.²
- (C) 28.5 ft.²
- (D) 29.0 ft.²



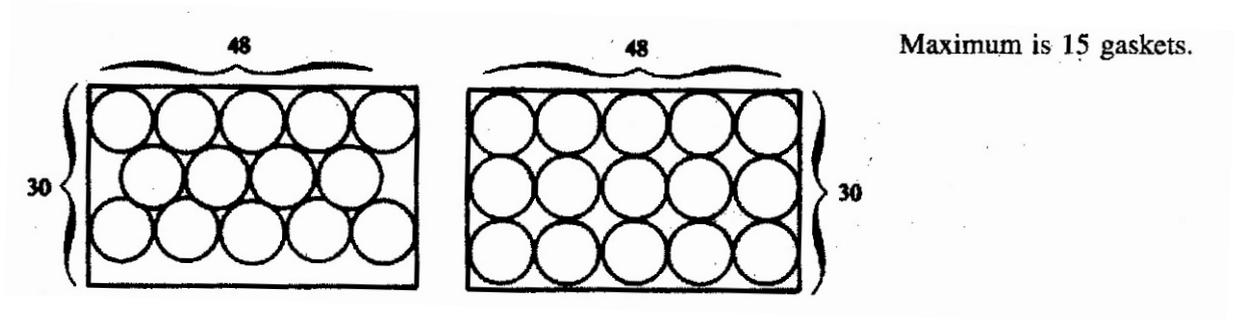
SHOP ARITHMETIC TEST 1

Correct Answers

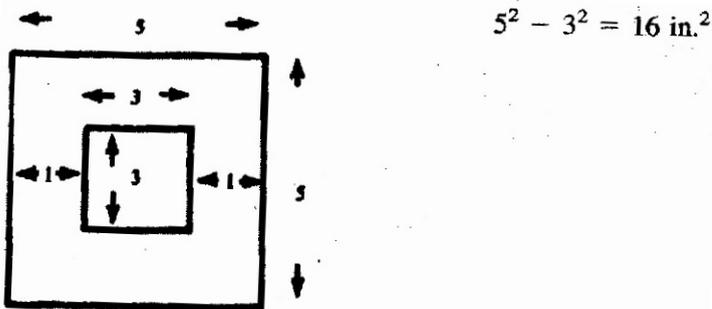
- | | | | | | | |
|------|------|------|-------|-------|-------|-------|
| 1. B | 4. D | 7. C | 10. D | 13. B | 16. D | 19. B |
| 2. C | 5. B | 8. C | 11. C | 14. B | 17. B | 20. B |
| 3. C | 6. C | 9. D | 12. B | 15. B | 18. B | 21. C |

EXPLANATORY ANSWERS

1. B



2. C



3. C

$$\frac{7}{8} = \frac{x}{8}$$

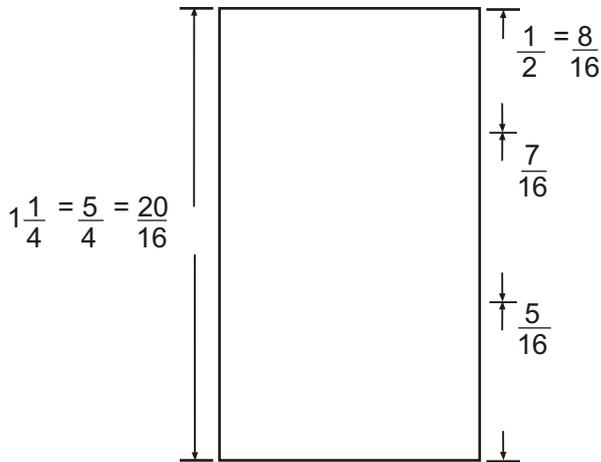
$$7 = \frac{7x}{8}$$

$$x = \frac{56}{7}$$

x = 8 threads

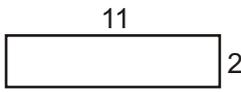
4. D

3. Washers

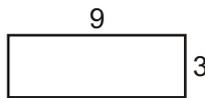


5. B The movement on one pipe is compensated for by the movement on the other pipe.

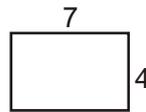
6. C Volumes are equal. The bin with the shortest sides has the greatest base area.



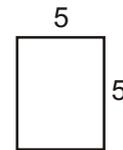
No. 1
A = bh = 22



No. 2
A = bh = 27



No. 3
A = bh = 28

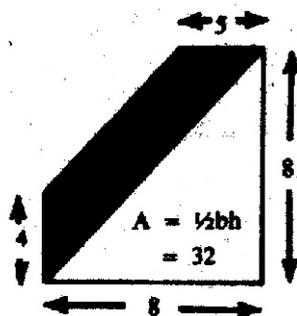


No. 4
A = s² = 25

7. C $V = \left(\frac{3}{2}\right)(2)(8) + \left(\frac{3}{4}\right)(2)(16)$

$v = 24 + 24$
 $v = 48 \text{ in}^3$

8. C



$A = 32 \text{ in}^2$

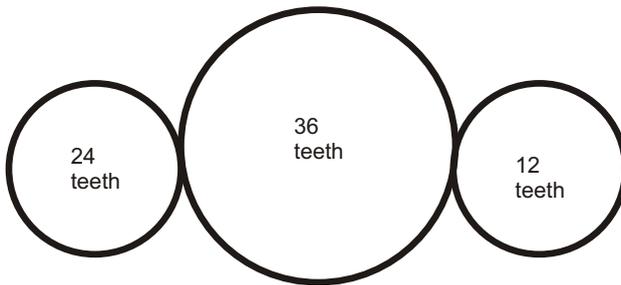
9. D $V = (4)(8)(2) \text{ in}^3$.

$V = 64 \text{ in}^3$.

$V = \frac{64}{(12)(12)(12)}$

$V = \frac{1}{27} \text{ ft}^3$.

10. D

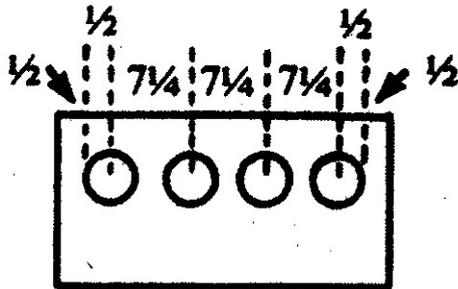


RPM varies inversely to the number of teeth.

$120(24) = (\text{RPM})(12)$

$\text{RPM} = 240$

11. C



$x = \frac{1}{2} + \frac{1}{2} + 7\frac{1}{4} + 7\frac{1}{4} + \frac{1}{2} + \frac{1}{2}$

$x = 2 + 21\frac{3}{4}$

$x = 23\frac{3}{4}''$

12. B Average = $\frac{\text{Sum of items}}{\text{Number of items}}$

Average = $\frac{4 + 4 + 3 + 4 + 10}{5}$

Average = $\frac{25}{5}$

Average = 5 feet

13. B



Diameter is $\frac{7}{2}$; radius is $\frac{7}{4}$

$2 + 2 + \text{Circumference}$

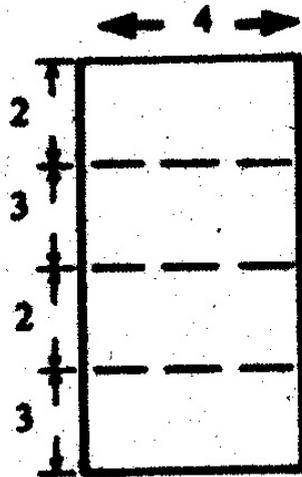
$$4 + 2\left(\frac{22}{7}\right)\left(\frac{7}{4}\right)$$

$$4 + 11 = 15$$

Length = 15"

14. B 13 threads

15. B



$$A = 8 + 12 + 8 + 12 = 40$$

$$A = 40 + 2\frac{1}{2}\% \text{ of } 40$$

$$A = 1.025(40)$$

$$A = 41 \text{ ft}^2.$$

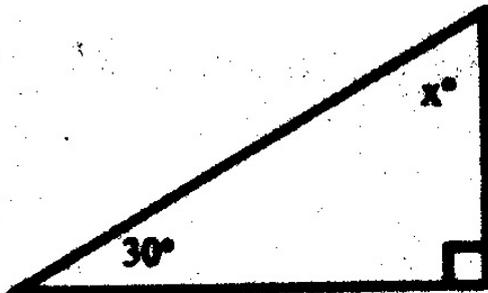
16. D

$$\frac{1 \text{ inch}}{1 \text{ ft.}} = \frac{3/4 \text{ inch}}{x}$$

$$x = 3/4 \text{ ft}$$

$$x = 9"$$

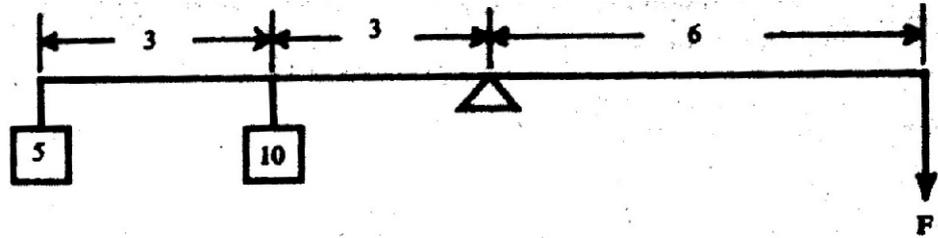
17. B



$$x + 30 + 90 = 180^\circ$$

$$x = 60^\circ$$

18. B



Clockwise moments = counter-clockwise moments

$$\begin{aligned} (f) (d) &= (f) (d) \\ 6F &= 3(10) + 6(6) \\ 6F &= 60 \\ F &= 10 \text{ lbs} \end{aligned}$$

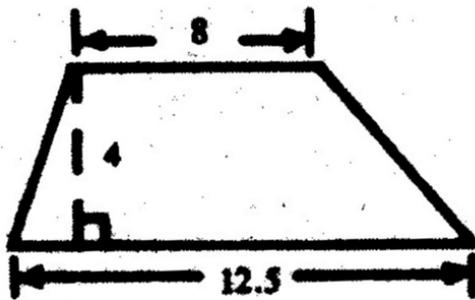
19. B

1 inch : 10 feet
 $(1 \text{ inch})^2 : (10 \text{ feet})^2$ $1 \text{ in}^2 = 100\text{ft}^2$
 A square 5 in. X 5 in. has 25 in^2

$$\frac{1 \text{ in}^2}{100 \text{ ft}^2} = \frac{25 \text{ in}^2}{x}$$

$$x = 2500 \text{ ft}^2$$

20. B



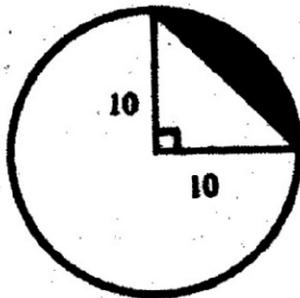
$$A = h \left(\frac{b_1 + b_2}{2} \right)$$

$$A = 4 \left(\frac{8 + 12.5}{2} \right)$$

$$A = 4 \left(\frac{20.5}{2} \right)$$

$$A = 41$$

21. C



Shaded area = $1/4$ circle area minus area of right triangle.

$$= 1/4 (\pi r^2) = 1/2 bh$$

$$= \frac{1}{4} \left(\frac{22}{7} \right) (10)^2 - 1/2(10)(10)$$

$$= 78.57 - 50 = 28.5$$

Shaded area 28.5 ft^2 .

PART TWO

VERBAL APTITUDE TESTS

**Relevant For All Company Aptitude Tests.
Study this section very carefully.**



IEC MONTHLY SEMINAR

CRITICAL READING TEST

50 QUESTIONS

20 MINUTES

DIRECTIONS

Each of the following reading comprehension questions are based on the content of the following passage. Read the passage and then determine the best answer choice for each question. Base your choice on what this passage states directly or implies, not on any information you may have gained elsewhere.

My precautions against disturbing the wolves were superfluous. It had required me a week to get their measure, but they must have taken mine at our first meeting; and while there was nothing dis-

(5) dainful in their evident assessment of me, they managed to ignore my presence, and indeed my very existence, with a thoroughness which was somehow disconcerting.

Quite by accident I had pitched tent within

(10) ten yards of one of the major paths used by the wolves when they were going to, or coming from, their hunting paths to the westward; and only a few hours after I had taken up my residence one of wolves came back from a trip and discov-

(15) ered me and my tent

He was at the end of a hard night's work and was clearly tired and anxious to go home to bed. He came over a small rise fifty yards from me with his head down, his eyes half-closed, and a prec-

(20) cupied air about him. Far from being the preternaturally alert and suspicious beast of fiction, this wolf was so self-engrossed that he came straight on to within fifteen yards of me, and might have gone right past the tent without seeing it at all,

(25) had I not banged an elbow against the teakettle, making a resounding clank. The wolf's head came up and his eyes opened wide, but he did not stop or falter in his pace. One brief, sidelong glance was all he vouchsafed to me as he continued on his

(30) way.

By the time this happened, I had learned a great deal about my wolfish neighbors, and one of the facts which had emerged was that they were not nomadic roamers, as is almost universally

(35) believed, but were settled beasts and the possessors of a large permanent estate with very definite boundaries. The territory owned by my wolf family comprised more than a hundred square miles, bounded on one side by a river but otherwise not delimited by geographical features. Nevertheless there were boundaries, clearly indicated in wolfish fashion.

Once a week, more or less, the clan made the rounds of the family lands and freshened up the

(40) boundary markers - a sort of lupine* beating of the bounds. This careful attention to property rights was perhaps made necessary by the presence of two other wolf families whose lands abutted on ours, although I never discovered any

(50) evidence of bickering or disagreements between the owners of the various adjoining estates, I suspect, therefore, that it was more of a ritual activity. In any event, once I had become aware of this strong feeling of property among the wolves, I

(55) decided to use this knowledge to make them at least recognize my existence. One evening, after they had gone off for their regular nightly hunt, I staked out a property claim of my own, embracing perhaps three acres, with the tent at the middle,

(60) and including a hundred yard long section of the wolves' path. This took most of the night and required frequent returns to the tent to consume copious quantities of tea; but before dawn brought the hunters home, the task was done and

(65) I retired, somewhat exhausted, to observe the results.

I had not long to wait. At 0814 hours, according to my wolf log, the leading male of the clan appeared over the ridge behind me, padding

(70) homeward with his usual air of preoccupation. As usual, he did not deign to look at the tent; but when he reached the point where my property line intersected the trail, he stopped as abruptly as if he had run into an invisible wall. His attitude of

(75) fatigue vanished and was replaced by one of bewilderment. Cautiously he extended his nose and sniffed at one of my marked bushes. After a minute of complete indecision he backed away a few yards and sat down. And then, finally, he

(80) looked directly at the tent and me. It was a long, considering sort of look.

Having achieved my object - that of forcing at least one of the wolves to take cognizance of my existence - I now began to wonder if, in my igno-

(85) rance, I had transgressed some unknown wolf law of major importance and would have to pay for my temerity. I found myself regretting the absence of a weapon as the look I was getting became longer, more thoughtful, and still more intent. In

(90) an effort to break the impasse I loudly cleared my throat and turned my back on the wolf to indicate as clearly as possible that I found his continued scrutiny impolite, if not actually offensive.

He appeared to take the hint. Briskly, and with

(95) an air of decision, he turned his attention away from me and began a systematic tour of the area, sniffing each boundary marker once or twice, and carefully placing his mark on the outside or each clump of grass or stone. In fifteen minutes he

(100) rejoined the path at the point where it left my property and trotted off towards his home, leaving me with a good deal to occupy my thoughts.

Go on to the next page

1. According to the author, why were his precautions against disturbing the wolves “superfluous” (line 2)?
 - (A) It was several weeks before he encountered his first wolf.
 - (B) Other wild animals posed a greater threat to his safety.
 - (C) The wolves noticed him but were not interested in harming him.
 - (D) He was not bothered by the wolves until he started interfering with them.
 - (E) The wolves were unable to detect him because of their poor eyesight.
2. The author mentions the wolves’ “assessment” of him (line 5) in order to
 - (A) Account for their strange behavior towards him.
 - (B) Convey his initial fear of being attacked
 - (C) Emphasize his ignorance on first encountering them.
 - (D) Indicate the need for precautions against disturbing them.
 - (E) Suggest his courage in an unfamiliar situation.
3. In the third paragraph, the author is primarily surprised to find that the wolf
 - (A) is traveling alone
 - (B) lacks the energy to respond
 - (C) is hunting at night
 - (D) is not more on its guard
 - (E) does not attack him
4. In line 17, the word “anxious” most nearly means
 - (A) Distressed
 - (B) Afraid
 - (C) Eager
 - (D) Uneasy
 - (E) Worried
5. In line 35, the word “settled” most nearly means
 - (A) Decided
 - (B) Resolute
 - (C) Stable
 - (D) Inflexible
 - (E) Confident
6. Lines 31 - 37 provide
 - (A) A contradiction of popular myth
 - (B) An explanation of a paradox
 - (C) A rebuttal of established facts
 - (D) An exception to general rule
 - (E) A summary of conclusions
7. The author suggests that boundary marking was a “ritual activity” (line 52) because
 - (A) The wolves marked their boundaries at regular intervals
 - (B) No disputes over territory ever seemed to occur
 - (C) The boundaries were marked by geographical features
 - (D) The boundaries were marked at the same time each week
 - (E) The whole family of wolves participated in the activity
8. Which of the following discoveries would most weaken the author’s thesis concerning the wolves’ “strong feeling of property” (line 54)?
 - (A) Disputes over boundaries are a frequent occurrence.
 - (B) Wolf territories are typically around one hundred square miles in area.
 - (C) Wolf families often wander from place to place to find food.
 - (D) Territorial conflicts between wolves and human beings are rare.
 - (E) Wolves are generally alert when encountering other animals.
9. The author most likely mentions an “invisible wall” (line 74) in order to emphasize
 - (A) His delight in attracting the wolf’s attention
 - (B) The wolf’s annoyance at encountering a challenge
 - (C) The high speed at which the wolf was traveling
 - (D) The sudden manner in which the wolf stopped.
 - (E) The wolf’s exhaustion after a night of hunting

10. The wolf's first reaction on encountering the author's property making is one of
- (A) Combativeness
 - (B) Confusion
 - (C) Anxiety
 - (D) Wariness
 - (E) Dread
11. In line 87, "temerity" means
- (A) Discourtesy
 - (B) Rashness
 - (C) Courage
 - (D) Anger
 - (E) Discretion
12. The author turns his back on the wolf (line 91-92) primarily in order to
- (A) Demonstrate his power over the wolf
 - (B) Bring about some change in the situation
 - (C) Compel the wolf to recognize his existence
 - (D) Look for a suitable weapon
 - (E) Avoid the wolf's hypnotic gaze

While many of us express disdain at the declining condition of artistic awareness, let alone appreciation, in this country, we cannot honestly express surprise. This general decline in tastes has

(5) not escaped the commentary and analysis of cultural critics who have warned us that we may be turning into a nation of Philistines. These same critics have pointed to a pair of causes for this cultural decline. Perhaps, they note, the decline is

(10) due to the crumbling state of our educational system, or to the media's focus on pop culture and the general decline of taste this breeds.

Nevertheless, this type of scholarly discussion about the roots of the decline, while relevant to

(15) sociological and cultural historical analysis, does nothing to solve the problem. Understanding the causes does not change the sad fact that the same country that gave the world film noir, jazz, and abstract expressionism now mostly concerns itself

(20) with teen movies and boy bands. We must use our understanding and analysis of the causes to address the problem of artistic decline in America.

Before we can begin a discussion of artistic decline, we must first define the word "art", an

(25) endeavor that has proven problematic, especially after the introduction of modern art forms during the twentieth century. Indeed, some may argue that the entire debate about artistic decline in this country is flawed due to our exclusion of modern

(30) forms of art such as pop music. Many claim that such discussion can be seen as snobby, even culturally imperious. Without entering the debate on the validity of the post-modern conception of art as an idea, the question of "what is art" must

(35) be addressed. But it should be addressed expeditiously. Far too much time has been spent arguing over whether a teen movie is more or less art than *Citizen Kane* is, or whether the music of a boy band is more or less art than are the works of

(40) *Sondheim*. To be fair, society should not adopt an exclusionary definition or attitude. Indeed, history has proven that today's pop music can be tomorrow's great art in retrospect. Thus, we should accept all artistic endeavors as art. Individuals and

(45) critics should judge the quality of such endeavors. But this does not change the fact that today, people are unaware of and uneducated about the classics, or even about recent movements in art apart from cinema, television, and pop music.

(50) Imagine a United States of America in which artistic education, and thus appreciation, flourishes, a place where parents read books on art and listen to classical music and opera, as well as pop music. Children observe these adult activities and

(55) mimic them. Parents read to their children and educate them.

These parents also give their children art books, classical recordings, and plays as gifts. These parents underwrite, with their tax dollars, public art, public broadcasting, and

(60) community art groups. In school, students receive an education in art history, classical music and opera. This curriculum can also include pop culture such as the music videos, teen movies, and pop music students enjoy in their free time. In

(65) fact, a better education in art will better equip them to judge the artistic merit of these newer, more trendy art forms, or at least place these art forms in historical context and analyze them as an outgrowth of societal and sociological trends - an

(70) important aspect of artistic knowledge that has been lost by the general public. When these children grow up, some may produce their own art, which would likely be higher in quality than the pop music and movies produced today. Imagine a

(75) land of such developed artistic production and taste! *How can we achieve such a society?*

Having noted that the proliferation of low quality art in pop culture can be addressed effectively by education, there remains one fundamental

(80) cause for the decline in artistic taste: the crumbling state of our educational system. Unfortunately, with tightening

(85) budgets due to increased levels of government debt, often the first programs cut are those that provide art and music classes. Often these cuts are viewed as easy ones by the public since they do not compromise the fundamentals supposedly

(90) required for an adequate education: reading, writing, history, science, and math. However, what the public often misses is that art, music, and culture are inextricably tied to literary and historical developments that themselves stem from changes

(95) in society and culture. A holistic approach to the arts would both redefine their role in education (thereby subsuming the argument of those who want to focus on fundamentals) and improve the state of artistic education by teaching students in

(100) an inter-textual and multi-disciplinary manner. The first step in improving artistic awareness and taste in this country will be not only to reinstate and improve art, music, and other cultural classes but also to restructure the curriculum to provide a

(105) more holistic education in which art, music, and culture become a part of the fundamental education in history, literature, and society. This system would require more funding and most likely higher taxes. However, such an investment would

(110) pay dividends by ensuring a more educated populace, one which is better equipped to analyze its surroundings in an analytically balanced manner and one which appreciates all forms of human artistic endeavor.

13. According to the author, which endeavor has proven problematic?
- (A) Improving the education system
(B) Making art seem relevant
(C) Defining the word “art”
(D) Deciding what students should learn in school
(E) Deciding whether or not to teach art
14. In the second paragraph of the passage (line 23-49), the author suggests that too much time has been spent
- (A) debating the artistic merits of so-called “classics”
(B) Debating the artistic merits of modern works
(C) Debating whether or not art education can be improved
(D) debating whether or not a historical perspective should be used in art education
(E) comparing the artistic merits of different works traditionally considered classics
15. The author mentions “film noir, jazz and abstract expressionism” (line 18-19) chiefly in order to
- (A) appeal to the reader’s sense of nostalgia
(B) introduce a historical parallel
(C) examine the history of art
(D) remind the reader how tastes change over time
(E) suggest that current artistic works are inferior to older ones
16. In line 32, “imperious” most nearly means
- (A) imperative
(B) arbitrary
(C) regal
(D) urgent
(E) arrogant
17. According to the author, which important aspect of artistic knowledge has been lost by the general public?
- (A) the ability to place art works in a historical context
(B) the ability to define the word “art”
(C) the ability to produce art that rivals the classics
(D) the ability to judge the merits of current art works
(E) the ability to value all forms of art
18. In lines 50-58 (“Imagine...gift”), the hypothetical United States described is noteworthy because
- (A) people have allowed new interested to develop
(B) parents share their interest in and enjoyment of art
(C) children learn about art in school
(D) children and parents share many activities
(E) artistic knowledge is viewed as a valuable skill
19. Line 60 - 64 (“In school...time”) present a model of education where students learn to
- (A) value artistic diversity over tradition
(B) respect the views of all artistic
(C) reflect critically on the nature of artistic education
(D) appreciate classic art works over contemporary ones
(E) encounter art through a wide-ranging exploration
20. The author includes the third paragraph (lines 50 - 76) primarily in order to
- (A) propose a vision of a utopian society
(B) propose a vision of an artistically educated society
(C) argue that pop culture leaves no lasting impact on society
(D) observe that classic literature has great appeal for even reluctant students
(E) indicate that contemporary and classical works are interchangeable

21. In lines 91-107 ("However...society"), the education illustrated is best described as
- (A) elitist
 - (B) philanthropic
 - (C) eclectic
 - (D) comprehensive
 - (E) rudimentary
22. In line 107 - 114, the author describes an education system that would be
- (A) more expensive than the current system
 - (B) more celebrated than the current system
 - (C) more controversial than the current system
 - (D) more interesting than the current system
 - (E) more likely to inspire than the current system
23. The name purpose of the passage is to
- (A) shift the focus of a debate from causes to effect
 - (B) outline a debate and support one side
 - (C) present a problem and suggest a solution
 - (D) revive a discredited idea that might be able to solve a current problem
 - (E) promote certain kinds of art
24. In the hypothetical United States the author discusses, why does the author imply that children will grow up to produce art that may be higher in quality than the pop music and movies produced today?
- (A) they would not want to disappoint their parent
 - (B) society would not accept low quality art
 - (C) their education would provide them with more artistic knowledge
 - (D) they would have more free time to experiment with their art
 - (E) critics would judge the merits of the art more harshly
25. The author's attitude toward pop music is that
- (A) he admires it
 - (B) he has no feelings about it
 - (C) he is not a fan
 - (D) he wants to see more pop-influenced education
 - (E) he believes it is more important than classical music

The relationship between humans and animals dates back to the misty morning of history. The caves of southern France and northern Spain are full of wonderful depictions of animals. Early

- (5) African petroglyphs depict recognizable mammals and so does most American Indian art. But long before art, we have evidence of the closeness of humans and animals. The bones of dogs lie next to those of humans in the excavated villages of
 - (10) northern Israel and elsewhere. This unity of death is terribly appropriate. It marks a relationship that is the most ancient of all, one that dates back at least to the Mesolithic Era. With the dog, the hunter acquired a companion and ally very early
 - (15) on, before agriculture, and long before the horses and the cat. The companion animals were followed by food animals, and then by those that provided enhanced speed and range, and those that worked for us.
 - (20) How did it all come about? A dog of some kind was almost inevitable. Consider its essence : a social carnivore, hunting larger animals across the broad plains it shared with our ancestors. Because of its pack structure it is susceptible to domina-
 - (25) tion by, and attachment to, a pack leader - the top dog. Its young are born into the world dependent, rearable, without too much skill, and best of all, they form bonds with the rearers. Dogs have a set of appeasement behaviors that elicit affective reac-
 - (30) tions from even the most hardened and unsophisticated humans. Puppies share with human babies the power to transform cynics into cooing softies. Furthermore, the animal has a sense of smell and hearing several times more acute than our own.
 - (35) great advantages to a hunting companion and intrusion detector. The dog's defense behavior makes it an instinctive guard animal.
- No wonder the dog was first and remains so close to us. In general, however, something else
- (40) was probably important in narrowing the list-the candidates had to be camp followers or cohabitants when humankind ceased to be continually nomadic, when we put down roots and established semi-permanent habitations, but clusters, and
 - (45) finally villages, we created on instant, rich food supply for guilds of opportunistic feeders. Even today, many birds and mammals

parasitize our wastes and feed from our stores. They do so because their wild behaviors provide the mecha-

- (50) nisms for opportunistic exploitation. A striking example occurred in Britain during the 1940s and '50s. In those days, milk was delivered to the homeowners' doorstep in glass bottles with aluminum foil caps. Rich cream topped the milk, the
- (55) paradise before homogenization. A chickadee known as the blue tit learned to puncture the cap and drink the cream. The behavior soon spread among the tits, and soon milk bottles were being raided in the early morning throughout Britain. if
- (60) the birds had been so specialized that they only fed in deep forest, it never would have happened. But these were forest-edge opportunists, pioneers rather than conservatives. It is from animals of this ilk that we find our allies and our foes.
- (65) Returning to the question of how it all came about, my instincts tell me that we first domesticated those individual animals that were orphaned by our hunting ancestors. In my years in the tropics, I have seen many wild animals raised by sim-
- (70) ple people in their houses. The animals were there, without thought of utility or gain, mainly because the hunter in the family had brought the orphaned baby back for his wife and children. In Panama it was often a beautiful small, spotted cat
- (75) that bounced friskily out of a peasant's kitchen to play at my feet. The steps from the home-raised wolfing to the domestic dog probably took countless generations. I bet it started with affection and curiosity. Only later did it become useful
- (80) When we consider that there are more than 55 million domestic cats and 50 million dogs in this country, and that they support an industry larger than the total economy of medieval Europe, we must recognize the strength of the ancient bond.
- (85) Without the "aid" of goats, sheep, pigs, cattle, and horses we would never have reached our present population densities. Our parasitization of some species and symbiosis with others made civilization possible. The civilization, in turn, is increas-
- (90) ingly causing the extinction of many animals and plant species-an ironic paradox indeed.

26. The author most likely describes the archeological discoveries mentioned in lines 8-10 as “terribly appropriate” because
- (A) dogs were always buried next to their owners in the Mesolithic Era
 - (B) few animals were of religious significance in prehistoric cultures
 - (C) they illustrate the role of dogs on a typical hunting expedition
 - (D) our relationship with dogs goes back farther than with any other animals
 - (E) they indicate the terrible speed of natural disasters
27. According to the first paragraph, the first animals that humans had a close relationship with were those that
- (A) acted as companions
 - (B) provided a source of food
 - (C) helped develop agriculture
 - (D) enabled humans to travel farther
 - (E) raided our food supply
28. According to the author, why was some kind of dog “inevitable” (line 21) as a companion animal for humans?
- (A) It survived by maintaining its independence
 - (B) It was stronger than other large animals
 - (C) It shared its prey with our ancestors
 - (D) It was friendly to other carnivores
 - (E) It was suited for human domination
29. In line 21, “essence” means
- (A) history
 - (B) nature
 - (C) scent
 - (D) success
 - (E) aggression
30. Judging from lines 29-39, “affective reactions” most probably means
- (A) callous decisions
 - (B) rational judgements
 - (C) emotional responses
 - (D) juvenile behavior
 - (E) cynical comments
31. The author most likely compares puppies with human babies in lines 31-32 in order to
- (A) criticize an uncaring attitude toward animals
 - (B) point out ways in which animals dominate humans
 - (C) support the idea that dogs form bonds with their owners
 - (D) dispel some misconceptions about the innocence of puppies
 - (E) show how rewarding the ownership of a dog can be
32. In line 40, “the list” most likely refers to the
- (A) types of birds that scavenge human food supplies
 - (B) number of animals that developed relationships with humans
 - (C) group of species that are able to communicate with dogs
 - (D) variety of attributes that make dogs good hunters
 - (E) range of animals depicted in cave paintings
33. The author most likely discusses the case of the British blue tit (line 5-59) in order to
- (A) highlight a waste of valuable food supplies
 - (B) indicate the quality of milk before homogenization
 - (C) explain how unpredictable animal behavior can be
 - (D) point out the disadvantages of living in rural areas
 - (E) provide one example of an opportunistic feeder
34. In line 63-64, “animals of this ilk” refers to animals that are
- (A) good companions
 - (B) forest inhabitants
 - (C) adaptable feeders
 - (D) efficient hunters
 - (E) persistent pests

35. The author most likely describes his experience in the tropics (lines 68-76) in order to
- (A) portray the simple life led by a hunter's family
 - (B) show how useful animals can be in isolated place
 - (C) underline the effort involved in training a wild animal
 - (D) illustrate how the first domesticated animals were created
 - (E) indicated the curious nature of the domestic cat
36. In line 85, the use of "aid" in quotation marks emphasizes the point that
- (A) the animals' help was involuntary
 - (B) population levels are dangerously high
 - (C) the contribution of animals is rarely recognized
 - (D) many animals benefitted from the relationship
 - (E) livestock animals are not as loyal as dogs.
37. Which of the following best describes the "ironic paradox" mentioned in line 91?
- (A) More money is now spent on domestic animals
 - (B) Pet ownership will become impractical if population density continues to increase.
 - (C) The pet are industry in the U.S. Today is larger than the total economy of medieval Europe
 - (D) Many parasitical species have a beneficial effect on the human population
 - (E) Human civilization is currently making extinct many of the other life forms that enabled it to grow
38. The phrase "to a lesser extent" in line 13, indicates that before the invention of writing, the wisdom of earlier generations was
- (A) rejected by recent generations when portrayed in pictures, carvings, or statues
 - (B) passed down orally, or not at all
 - (C) transmitted more frequently by spoken word than by other means
 - (D) based on illusory memories that turned Fact into fiction
 - (E) more strongly grounded in science than in the arts

There is one fact about the origin of life which is reasonably certain. Whenever and wherever it happened, it started a very long time ago, so long ago that it is extremely difficult to form any realistic

(5) idea of such vast stretches of time. The shortness of human life necessarily limits the span of direct personal recollection.

Human culture has given us the illusion that our memories go further back than that. Before

(10) writing was invented, the experience of earlier generations, embodied in stories, myths, and moral precepts to guide behavior, was passed down verbally or, to a lesser extent, in pictures, carvings, and statues. Writing has made more pre-

(15) cise and more extensive the transmission of such information and, in recent times, photography has sharpened our images of the immediate past. Even so, we have difficulty in contemplating steadily the march of history, from the beginnings of civiliza-

(20) tion to the present day, in such a way that we can truly experience the slow passage of time. Our minds are not built to deal comfortably with periods as long as hundreds or thousands of years.

Yet when we come to consider the origin of life,

(25) the time scales we must deal with make the whole span of human history seem but the blink of an eyelid. There is no simple way to adjust one's thinking to such vast stretches of time. The immensity of time passed is beyond our ready

(30) comprehension. One can only construct an impression of it from indirect and incomplete descriptions, just as a blind man laboriously builds up, by touch and sound, a picture of his immediate surroundings.

(35) The customary way to provide a convenient framework for one's thoughts is to compare the age of the universe with the length of a single earthly day. Perhaps a better comparison, along the same lines, would be to equate the age of our

(40) earth with a single week. On such a scale the age of the universe, since the Big Bang, would be about two or three weeks. The oldest macroscopic fossils (those from the start of the Cambrian*

Period would have been alive just one day ago.

(45) Modern man would have appeared in the last 10 seconds and agriculture in the last one or two. Odysseus** would have lived only half a second before the present time.

Even this comparison hardly makes the larger

(50) time scale comprehensible to us. Another alternative is to draw a linear map of time, with the different events marked on it. The problem here is to make the line long enough to show our own experience on a reasonable scale, and yet short enough

(55) for convenient reproduction and examination. But perhaps the most vivid method is to compare time to the line of print themselves. Let us make a 200-page book equal in length to the time from the start of the Cambrian to the present; that is,

(60) about 600million years. Then each fill page will represent roughly three million years, each line about ninety thousand years, and each letter or small space about fifteen hundred years. The original of the earth would be about seven books ago (65) and the origin of the universe (which has been dated only approximately) ten or so books before that. Almost the whole of recorded human history would be covered by the last two or three letters of the books.

(70) if you now turn back the pages of the book, slowly reading one letter at a time - remember, each letter is fifteen hundred years - then this may convey to you something of the immense stretches of time we shall have to consider. On this scale the

(75) span of your own life would be less than the width of a comma.

39. The author most likely describes the impact of writing (lines 14-17) in order to
- (A) illustrate the limitation of the human memory
 - (B) provide an example of how cultures transmit information
 - (C) indicate how primitive preliterate cultures
 - (D) refute an opinion about the origin of human civilization
 - (E) explain the difference between historical facts and myth
40. The word “ready” in line 29 most nearly means
- (A) set
 - (B) agreeable
 - (C) immediate
 - (D) apt
 - (E) willing
41. The analogy of the “blind man” (line 32) is presented primarily to show that
- (A) humans are unable to comprehend long periods of time
 - (B) myths and legends fail to give an accurate
 - (C) human history is only a fraction of the time since life began
 - (D) humans refuse to learn the lessons of the past
 - (E) long periods of time can only be understood indirectly
42. In lines 40 - 44, the author mentions the Big Bang and the Cambrian Period in order to demonstrate which point?
- (A) The age of the Earth is best understood using the time scale of a week.
 - (B) Agriculture was a relatively late development in human history.
 - (C) No fossil record exists before the Cambrian Period.
 - (D) Convenient time scales do not adequately represent the age of the Earth
 - (E) The customary framework for thinking about the age of the universe should be discarded permanently.
43. According to lines 52- 56, one difficulty of using a linear representation of time is that
- (A) linear representation of time do not meet accepted scientific standards of accuracy
 - (B) prehistoric eras overlap each other, making linear representation deceptive.
 - (C) the more accurate the scale, the more difficult the map is to copy and study.
 - (D) there are too many events to represent on a single line
 - (E) our knowledge of pre-Cambrian time is insufficient to construct an accurate linear map
44. The author of this passage discusses several kinds of time scales primarily in order to illustrate the
- (A) difficulty of assigning precise dates to past events.
 - (B) variety of choices faced by scientists investigating the origin of life
 - (C) evolution of efforts to comprehend the passage of history
 - (D) immensity of time since life began on earth
 - (E) development of the technology of communication

Blood, a connective tissue, is a sticky fluid that has multiple functions. It transports oxygen, nutrients, and other solution to cells; carries away metabolic waste and secretion; and help stabilize internal pH. Plasma, red blood cells, white blood cells and plates are its components.

- (5) Plasma, which is mostly water, functions as a transport medium for blood cells and platelet. It also serves as a
- (10) solvent for ion and molecules, including hundreds of different kinds of plasma proteins. Some of the plasma protein transport lipids and fat-soluble vitamins through the body. Other have roles in blood clotting or in defense against pathogens.
- (15) Collectively, the concentration of plasma protein affects the blood's fluid volume, for it influences the movement of water between blood and interstitial fluid.
- Erythrocytes, or red blood cells, are biconcave disks, like
- (20) doughnuts with a squashed-in center instead of a hole. They transport the oxygen used in aerobic respiration and carry away some carbon dioxide waste. When oxygen diffuses into blood, it binds with hemoglobin, the iron-containing pigment that gives red blood cells their color.
- (25) Mature red blood cells no longer have their nucleus, nor do they require it. They have enough hemoglobin, enzymes and other protein to function for about 120 days. At any time,

phagocytes are engulfing the oldest red blood cells or the ones already dead, but ongoing replacement keep the cell count fairly stable.

- Leukocytes, or white blood cells, arise from stem cells in bone marrow. They function in daily housekeeping and defense.
- (35) Many patrol tissues, where they target or engulf damage or dead cells and anything chemically recognized as foreign to the body. Many others are massed together in the lymph nodes and spleen. There they divide to produce armies of cell the
- (40) battle specific viruses, bacteria, and other invaders.
- White blood cells differ in size, nuclear shape, and staining traits. There are five categories: neutrophils, eosinophil, basophil, monocytes, and lymphocytes. The neutrophils and
- (45) monocytes are search-and-destroy cells. The monocytes follow chemical trails to inflame tissues where they develop into macrophage that can engulf invaders and debris. Two classes of lymphocytes, B cells and T cells, make highly specific defense
- (50) responses.
- Some stem cells in bone marrow gives rise to giant cells called megakaryocyte. These shed fragment of cytoplasm enclosed
- (55) in a bit of plasma membrane. The membrane-bound fragment are plates, which initiate blood clotting. Each plate only lasts five to nine days, but hundreds of thousand are always circulating in blood.

45. The passage is primarily concerned with
- (A) blood function
(B) plasma and platelets
(C) blood components
(D) blood
(E) the circulatory system
46. According to the passage, plasma is
- (A) a biconcave disk
(B) composed of ions and molecules
(C) interstitial fluid
(D) mostly water
(E) hemoglobin
47. In line 17, "interstitial" most nearly means
- (A) situated within an organ
(B) within the blood
(C) small space
(D) erythrocytes
(E) a lattice
48. According to the passage, what gives blood its red color?
- (A) hemoglobin
(B) oxygen
(C) iron
(D) the nucleus
(E) hemoglobin, enzymes, and other proteins
49. The author's use of the words "defense" and "patrol" (line 34) and "armies" and "battle" (line 39) implies that
- (A) white blood cells serve as protection against invaders
(B) white blood cells differ in size, shape, and traits
(C) white blood cells are violent
(D) B and T cells are highly specific
(E) phagocytes attack old red blood cells
50. In line 46, "inflamed" most nearly means
- (A) on fire
(B) under attack
(C) engulfed
(D) irritated
(E) healthy

ANSWERS

1. C	11. B	21. D	31. C	41. E	51. B
2. A	12. B	22. A	32. B	42. A	52. A
3. D	13. C	23. C	33. E	43. C	53. D
4. C	14. B	24. C	34. C	44. D	54. E
5. C	15. E	25. C	35. D	45. C	55. E
6. A	16. E	26. D	36. A	46. D	56. A
7. B	17. A	27. A	37. E	47. A	57. D
8. C	18. B	28. E	38. C	48. C	58. B
9. D	19. E	29. B	39. C	49. A	59. E
10. B	20. B	30. C	40. C	50. B	60. D

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ANSWERS AND EXPLANATORY

1. C In the first paragraph, the author explains how the wolves were aware of his presence but ignored him. That's why the author's precautions were superfluous. (C) basically Paraphrases that idea: the author's precautions were unnecessary because the wolves weren't interested in him. (A) doesn't work because the wolves weren't interested in him long it was before he encountered the wolves. (B) is out because the author never mentions any wild animals other than wolves. Contrary to (D), even after the author interfered with the wolves' boundaries, They never bothered him. (E) is out because it's never suggested that the wolves have poor eyesight.
2. A The author's basic point in paragraph 1 is that he was surprise at the way the wolves behaved toward him: they sized him up quickly right at the beginning and, from then on, ignored him. He found this behavior disconcerting, or *strange*, as (A) puts it. (B) sounds exaggerated - the author never really suggest that he was fearful of attack. With (C), the author says that he took longer to assess the not to emphasize his own ignorance. (D) doesn't work because the wolves left the author alone - precautions weren't necessary. (E), like (B), isn't suggested - that the author thinks he has a lot of courage.
3. D In paragraph 3, the author describes how the wolf was so preoccupied that he came within 15 yards of his tent with-out seeing it. It wasn't until the author made noise that the wolf suddenly became aware of its surroundings. (D) paraphrases this idea: that the wolf was not on its guard - it was self-absorbed. The author expresses no surprise about the wolf traveling alone (A) or hunting at night (C). As for (B), the point is not that the wolf lacks energy - it does respond when the author startles it. (E) is out because the author doesn't really mention any fear of attack.
4. C The first sentence of paragraph 3 describes the wolf as anxious to go home to bed. The idea is that he was eager to get home (C). Distressed (A), afraid (B), uneasy (D), and worried (E) are other definitions of anxious, but they don't fit the idea in the sentence.
5. C In paragraph 4, the author explains that one of the things he learned is that, contrary to popular belief, the wolves were settled beasts rather than nomadic hunters. The idea, in other words, is that the wolves were stable - they had established homes. Decided (A) and resolute (B) are other meanings of settled, but they don't work in the sentence. Neither inflexible (D) nor confident (E) fits when plugged in.
6. A The idea at the beginning of paragraph 4 is that the wolves, contrary to what people generally think, are not nomadic. (A) catches the idea: the author is countering a popular myth or belief about the behavior or ambiguity: the idea is that the wolves are NOT nomadic. (C) is tricky too, but the passage never says that the idea that wolves are nomadic is an established fact. As for (D), there's no indication that what the author observed - that the wolves live in established territories - is an exception to a general rule. (E) doesn't work because there's really no summary of any conclusions in the quoted lines. (A) is the best choice.
7. B In the middle of paragraph 5, the author describes how the wolf family regularly made the rounds of their lands and freshened up the boundary markers. He guessed that this was done because there were other wolves living in adjacent areas, although he never saw any sign of trouble between the neighboring wolf families. Then you get the quoted idea: since he never witnessed any disputes, he figured that it was all basically a ritual activity. (B) catches the idea. The idea that the activity was a ritual isn't related to the fact that it was repeated (A), that the boundaries were marked by geographic features (C), that they were marked at the same time each week (D)- that's never suggested - or that the whole family participated (E). The wrong choices miss the point.
8. C One of the author's discoveries is that the wolves live in territories with clearly marked boundaries. So, contrary to what most people think, they aren't nomadic - they don't travel endlessly from place to place looking for food and sleeping in new areas. The idea in (C), if it were true, would contradict or weaken that idea. The idea in (A) would strengthen the thesis - if there were disputes over boundaries, that would suggest that the wolves are protective of their territory. The idea in (B) - the particular size of the wolves' territory-is irrelevant- it doesn't work: the author finds that the wolves are territorial even though they actually don't have conflicts with their neighbors. The idea in (E) is irrelevant: the passage never discusses whether of not wolves are alert when encountering other animals encountered the spot where the author had left his own markings. So the idea about the invisible wall is that the wolf was stopped suddenly (D), as if it had suddenly banged up against it. The idea of an invisible wall has nothing to do with delight in getting the wolf's attention (A), annoyance on the part of the wolf (B), high speed (C) - the wolf was padding, not running - or exhaustion after a night of hunting (E).

9. D The phrase *invisible wall* occurs in paragraph 7, and the point is that the wolf, who was plodding home as preoccupied as usual, was suddenly stopped in its track when it encountered the spot where the author had left his own marking. So the idea about the invisible wall is that the wolf was stopped suddenly (D), as if it had suddenly banged up against it. The idea of an invisible wall has nothing to do with delight in getting the wolf's attention (A), annoyance on the part of the wolf (B), high speed (C)-wolf was *padding*, not running -or exhaustion after night of hunting (E).
10. B In the way same sentence in paragraph 7, the author says that the wolf, upon finding the author's marks, immediately became bewildered. (B) restates that. The passage says nothing about combativeness (A), anxiety (C), wariness (D), or dread (E).
11. B Temerity is a tough vocabulary word - it means impetuousness or rashness (B). But you really didn't have to know that definition to pick the right answer. All you have to do with Vocabulary-in-Context questions is plug in each of the answer choices, and eliminate the ones that don't fit the sentence's meaning. If you do that here, none of the other choices works. (With (A), it's not that the author's being discourteous. That sounds strange. Rather, he's being too bold-only (B) makes sense. Remember, if you're stumped with any hard question, work backward by eliminating any wrong choices you can - and then guess.
12. B At the end of paragraph 8, the author states that he turned his back on the wolf in an effort to break the impasse. In other words, he did it to bring about a change in the situation (B). Nothing suggests that he did it to show his power over the wolf (A); make the wolf recognize his existence (C) - the wolf already did; look for a weapon (D); or avoid the wolf's hypnotic gaze (E).
13. C Your notes should list something like "A discussion of defining art" as the purpose of paragraph 2; it not, skim from the words endeavor and problematic: Either way, you should find the first sentences of paragraph 2 mentioning: "Before we can begin a discussion of artistic decline, we must first define the word 'art', and endeavor that has proven problematic." (A), (B), (C), and (D) are all distortions; the author discusses improving the education system (A) in later paragraphs, but the author discusses how education can make art more relevant (B) by linking it to historical and sociological developments, but the author never characterizes this as a "problematic endeavor." Likewise, in later paragraphs, the author discusses what students should learn in school (D), but the author never characterizes this a problematic endeavor," Finally, also in later paragraphs, the author discusses whether or not to teach art (E), but the author never characterizes this as a "problematic endeavor." (C) is exactly as the passage states and is correct.
14. B Since you are given the part of the passage from which you must draw the inference, skim paragraph 2 to find evidence of what the author characterizes as "too much time spent." In lines 36-40 the author says that, "far too much time has been spent arguing over whether a teen movie is more or less than Citizen Kane, or whether a boy band is more or less art than Sondheim." Now examine the answer choices by comparing them to this information and eliminating those that do not necessarily have to be true based on it. (A) is opposite; whereas the author discusses comparisons of "classics," the author does so in order to highlight the comparison of such classics to modern works, thereby judging the modern works' artistic merits. (C) and (D) are misused details; the author mentions them in later paragraphs. (E) is a distortion; the author never discusses comparisons of works traditionally considered classics to each other; the author discusses their comparison to newer works. (B) is the correct answer; the author states, "Far too much time has been spent arguing over whether a teen movie is more or less art than Citizen Kane is, or whether the music of a boy band is more or less art than the works of Sondheim are." Thus, the author implies that too much time has spent comparing modern works to more established works in order to judge the modern works' artistic merits.
15. E Your task is to determine why the author included this detail in the passage. Your notes should tell you that the author uses most of paragraph 1 to bemoan or lament the decline of artistic appreciation and awareness in America. Since the author thinks that it is "sad" that America concerns itself with "teen movies and boy bands" then the author must think that film noir, jazz, and abstract expressionism are better. Thus, he must be mentioning them in order to draw a comparison and suggest their superiority. Look for that in the answer choices. (A) is a distortion; whereas the author does seem to be appealing to a sense of a lost golden age, the author uses that as part of the comparison to newer art to suggest their inferiority. (B) is opposite; far from making a historical parallel, this author suggests that newer works are inferior. (C) is out of scope, the author never examines the history of art. (D) is a misused detail; the author uses different details in a later paragraph to remind readers of this. (E) is just as we predicted.
16. E The sentence in question states: "Many claim that our discussion can be seen as snobby, even culturally imperious." Since the author states that many people might think the discussion is "snobby" and then goes on to say "even culturally imperious" the author must be using imperious as a higher degree of the same meaning as snobby. (A), imperative, is not a higher degree of snobbery. (B) is opposite; when something is arbitrary, it is not carefully chosen which means that it cannot relay

the meaning of snobbery. (C), regal, simply means elegant in a royal way. While this may be associated with snobbery, it does not convey the same meaning. (D), urgent, is a dictionary meaning of imperious but it makes no sense in the context of the original sentence. (E) is the answer; arrogant can be used as a higher degree of snobbery. When placed into the original sentence, it replace imperious perfectly.

17. A Both paragraphs 3 and 4 discuss aspects of artistic education. Skim for any language that might stand out of the text. In this case, the words “lost by the general public” should help you find the relevant detail in paragraph 3: “...a better education in art will better equip them to judge the artistic merit of these newer, more trendy art forms, or at least place these art forms in historical context and analyze them as an outgrowth of societal and sociological trends an important aspect of artistic knowledge that has been lost by the general public.” Now find the answer choice that matches an ability to place art works in a “historical context and analyze them as an outgrowth of societal and sociological trends.” (B) is a misused detail; the definition of “art” is discussed earlier in the passage as a problematic endeavor for society, not an important aspect of artistic knowledge that has been lost. (C) is out of scope; the author never discusses the general public’s ability to produce art that rivals the classics. (D) is a distortion; whereas the author does suggest ways the general public can better judge art works, the author never states that the general public has lost the ability to judge the merits of current art works. (E) is also a misused detail; the author discusses the value of all forms of art during the discussion of the definition of art. (A) is correct; this match the first part of the author’s detail.
18. B Reread the lines in question in order to find evidence of what distinguishes the author’s hypothetical United States. Parents read to their children and educate them. These parents also give their children art books, classical recordings, and plays as gifts.” Now evaluate each answer choice, choosing the one that must be true based on the author’s statements. (A) is out of scope; the author’s statements deal with a new interest in art, not new interest in general. (C) is a misused detail; the author never mentions school in the piece of the paragraph mentioned by the question. (D) is out of scope; the author’s statements discuss sharing enthusiasm for art, not other activities. (E) is a distortion; in the referenced lines, the author never alludes to the value of artistic skill. (B) is correct; the lines in question describe a country in which parents share their interest in and enjoyment of art with their children, so it must be true that this what the author finds distinguishing about this hypothetical country.
19. E Since you are given specific line numbers, your first step should be to reread the relevant lines, which state that “in school, students receive in education in art history, classical music, and opera. This curriculum can also include pop-culture such as the music videos, teen movies, and pop music students enjoy in their free time.” Now use this information to evaluate the answer choices, choosing the one that must describe such an educational model. (A), (B), (C), and (D) are all distortions; whereas the author’s statements describe an education that examines a diverse body of art forms, the author never mentions which, if any, are valued (A) over other or whether or not the students would learn to respect (B) the views of all artist. In fact, a critical examination might lead students to disrespect the views of certain art or artists. The author’s statements describe an education that reflects upon art forms, but the author never describes an education that reflects on the nature of art education (C). likewise, the author describes an education that examines both classical and contemporary art (D), but the author never describes whether one would be valued over the other. (E) is correct; the author describes an education that explores both classical and contemporary art, including pop-culture; such a model is wide-ranging in its exploration
20. B Your notes might indicate that in paragraph 3, the author advances a vision of an artistically education society. If your notes do not indicate this, then simply revisit the paragraph by skimming it, and then evaluate what the author does in this paragraph. The author provides an example of a more artistically educated America. Thus, the author must have included the paragraph in order to propose or provide a vision of a more artistically educated society. (A) is a distortion; the author merely provides a vision of a more artistically educated society, not a utopian one. (C) and (D) are out of scope; in the third paragraph, the author never examines whether pop culture leaves a lasting impact on society (C), and the author never deals with classic literature and younger students (D), (E) is also a distortion; whereas the author proposes studying both, the author never states that contemporary and classical works are interchangeable. (B) is the best answer.
21. D Use the line numbers to locate and reread the situation described by the author. The author states that since “art music, and culture are inextricably tied to literary and historical developments which themselves stem from changes in society and culture” the educational system should focus on a more “holistic” approach that teaches “students in an intertextual and multi-disciplinary manner.” Find the answer choice that must be characteristics of this education. (A) and (B) are distortions; the author describes an artistic education, not an elitist one (A) or a charitable one (B). (C) is the opposite; eclectic means mixed together from various elements. This might seem true, but eclectic implies a mismatching of items. The author argues that literature, art, and history are not mismatched at all. (E) is also opposite; rudimentary means basic; the education described by the author goes beyond the basics and fundamentals by contextualizing art within other

developments in society, thus creating an overarching education. (D) is correct; the author describes an education that takes an overarching view. Comprehensive characterizes this.

22. A In lines 107 - 114, the author states that “this system would require more funding, and most likely higher taxes.” Find the answer choice that must be true based on this information. (B), (C), (D), and (E) are all distortions; clearly, the author believes that the new system would be better, but the author’s statements don’t provide evidence that the new system would be more celebrated (B), more controversial (C), more interesting (D), or more likely to inspire (E) than the current system. (A) is correct; because the new system would require more funding and probably higher taxes, it must be true that the new system would be more expensive.
23. C As you should have noted while reading the passage, the topic is the decline of artist knowledge and appreciation in America. The author outlines causes for this decline and proposes a solution. Look for an answer choice that says something similar to this. (A) is a distortion; in the first paragraph, the author does shift the focus of the debate from analyzing causes to proposing a solution, but the author does not attempt to shift the focus of the debate from causes to effect. (B), (C), and (D) are all out of scope; the author never supports, nor does he revive a discredited idea (D), or promote certain types of art (E). The author promotes art education in general. (C) is the best answer.
24. C Paragraph 3 contains the discussion of the author’s hypothetical United States. Skim the passage for any regarding the production of higher quality art. The paragraph states that “when these children grow up, some may produce their own art, perhaps art that is higher in quality than the pop music and movies production today”. In a preceding line, the paragraph states that “a better education in art will better equip them to judge the artist meant of these newer, more trendy art form, or at least place these art forms in history context and analyze them as an outgrowth of societal and sociological trends...”. Now compare; each answer choice to this information. (A) is a distortion of better art. (B) is too extreme; the author presents a more artistically educated society, but the author never goes far as to claim that this society would not accept lower quality art. (D) and (E) are also distortions; the author never mentions free time (D) or discusses how strictly critics would judge art in this hypothetical society (E). (C) is correct, the author presents children with better artist educations, and then states that they would grow up to produce better art. Thus, their production of better art must stem from their artistic education.
25. C In the first paragraph of the passage, the author states that the culture decline in society has many causes, including “the media’s focus on pop culture and the general decline of taste this breeds.” (Line 11 - 12). It is clear from this statement and the continuing tone of the passage that the author does not think much of popular music, making (C) the best choice. (A) and (B) are out of scope; there is not evidence in the passage to support either statement, and quite the contrary, there is plenty of evidence against both (A) and (B). (D) and (E) are misused details. The author discusses education, but he believes society would benefit from a more artistic and classically geared music education and this would eliminate the possibility of his feeling that pop music was more important than classical music.
26. D The *archeological discoveries* mentioned in the question stem are human and dog bones lying next to each other in ancient burial sites. The reason the author feels it’s *terribly appropriate* that these bones are found together comes a few lines later, when he says *it marks a relationship that is the most ancient of all*. (D) paraphrases that idea. You can see from this how important it is to read a few lines before and after the line reference in the stem. The author says nothing about burial habits in the Mesolithic Era (A), or the religious significance of animals in prehistoric cultures (B). He says about natural disasters (E) either. He does mention hunting (C), but the bone finds are not appropriate because they *illustrate the role of dogs in hunting expeditions*. (D) is the only possibility.
27. A The end of paragraph 1 provides the answer. The author says that dogs were the first domesticated animal because they serve as *a companion and an ally* (A). Only *after* domesticating animals as companions did humans *domesticate food animals* (B) and then *those that provide enhanced speed and range* (D) and then those that helped us farm (C). The key thing is to see that all these other types of domesticated animals came after animals were domesticated as companions.
28. E The line reference takes you to the beginning of paragraph 2. The author says that having a dog as a companion animal was almost *inevitable*, and then lists several reasons why. One of these is that the dog is *susceptible to domination by, and attachment to a pack leader—the top dogs*. The implication is that humans formed bonds with dogs because they could dominate them (E). None of the other choices gives a characteristic that makes sense in answer to the question.
29. B As with all Vocabulary-in-Context questions, you should go back to the sentence to see how the word is used. The author asks us to consider the essence of the dog in order to understand why it became a companion. He then lists several of the dog’s characteristics that made it easy to domesticate. In other words, we’re looking at the dog’s Nature (B). The only other choice that might seem to make sense in this context is (A) history— but what follows the line is considered its essence is not a history; rather, it’s a list of characteristics that make up the dog’s nature,

30. C This is definitely a question you need to return to the passage to answer. Back in the second paragraph, the author lists the characteristics that made dogs *inevitable* companion for humans. In addition to being born dependent and forming bonds with their rearers, dogs have a *set of appeasement behavior* that elicits *affective reactions* from even the most *hardened* humans. The author goes on to talk about puppies transforming *cynics into cooing softies*. Even if you weren't sure what *appeasement behavior* were, you can see the gist of the author's point here; humans form bond with dogs largely because dogs are cute and loveable. So would it make sense if *affective reaction* were *callous* (A), *rational* (B), or *cynical* (E)? No. (D) goes too far. The author isn't saying human become childish around dogs, but that dogs arouse human emotions. (C) is the best answer.
31. C The easiest way to way understand the point of a comparison is to understand the context. What's the author saying in these lines? He's trying to show why it was inevitable that dogs became human companions. One reason is that dogs bond with their owners (C). That's the only reasons he compares puppies with babies-to show how emotional people get about dogs. The author's point has nothing to do with *criticizing an uncaring attitude* (A), so that can't be the point of his comparing puppies and babies. The same is true for the rest of the choices, so (C) is correct.
32. B Again, go back to the passage. Notice that the start of paragraph 3 actually refers back to the end of the first paragraph. Paragraph 1 ended with the author listing the dogs as the domesticated animal, followed by food animals, work animals, etc. Paragraph 2 talk about *why* the dog came first. So when paragraph 3 being with *no wonder the dog was first*, it's referring to the dog's status as the first domesticated animal. Similarly, *the list* refers to other domesticated animals, or *the number of animals that developed relationship with humans* (B). The author hasn't yet mentioned *birds that scavenge human food supplies*, and when he does, he only mentions one, not many *types* (A). The passage never mentions species that are able to communicate with dogs (C), or the variety of attribute that make dogs good hunters (D). Finally, if you chose (E), you were losing track of the author's main points. Read over the first three paragraph to see what's going on, and give a closer reading next time.
33. E this question might seem more complicated than it really is. If you were confused by the digression by the author made to talk about the blue tit, taking a look at the choices first probably would've saved you time. (A), (B), and (D) are fairly easy to eliminate-they have nothing to do with any of the author's main points. Good -now that you've eliminated three choices you can always guess. But first let's go back to the passage. In line 46 the author mentions *opportunistic feeders*. He goes on, *saying even today, many birds...fed from our stores*. So (E) must be right; the blue tit is an example of an opportunistic feeder. The question doesn't go any more into depth than that, so you're done.
34. C This is a clear reference question. Go back to the lines you're given to see what kind of animals are being referred to. You have to read above a little to find the answer. The author has just finished describing the blue tit as an example of an opportunistic feeder. He reinforces the idea that the tit is an opportunist feeder. He reinforces the idea that the tit is an animals that feed when and where it can by saying, *if all birds had been so specialized that they only fed in deep forest, it never would have happen*. In other words, they are not so specialized - they'll eat wherever they find a food source (C). The author isn't talking here about companion animals (A). Forest inhabitants (B) is too broad. (D) is out because the birds are not hunting, they're feeding. And the point about the birds is not to give an example of *persistent pests* (E).
35. D Go back to the passage to see in what context the author discusses his experience in the tropic. At the beginning of paragraph 4, the author says that he thinks that the first domesticated animals were orphaned as a result of hunting. He then tells how, in the tropics he saw many instance of wild animals, raised in homes of hunters. So his experience illustrated his theory about how *the first domesticated animals were created* (D). None of the other choices related to the author's argument here (or anywhere in the passage).
36. A This one's a little tricky-if you though so, you should've jumped ahead and come back later if you had time. Remember, reading question don't go from easy to hard so the next one could be easier. Check out the line aid is in to see what's going on. The author says that without domesticated animals-goats, sheep, pigs, cattle, and horses- we never would've achieved civilization. These animals helped or *aided* us they didn't have much choices in the matter. We dominated them, and then used them for food or labor. That's why *aid* is in quote, and (A) is correct. The passage never says *population levels are dangerously high*(B). (C) is a better possibility-but it's not a point the author makes; you're inferring too much if you chose (C). It's not clear that animals benefit at all from domestication (D). (E) is really far-out, not supported by the passage.
37. E The *ironic paradox* is found in the last four lines of the passage. The authors says living with other species-using them for food and labor-is what made our civilization possible. It is ironic then, that our civilization is presently wiping out many plant and animals species (E). Nowhere does the author says anything about the care industry in the final paragraph, but not to say its size is *ironic*. His [points. It's by being parasites on other species that humans benefit, not the other way around.

38. C Before writing, we're told, the wisdom of generation was passed down in two ways-verbally, and to a lesser extent, in pictures, carvings, and statues. This means that the wisdom of the past was transmitted less frequently by nonverbal means and thus (C) *more frequently by the spoken word than by other means*. Choices (A) and (B) *distort* this idea. Nowhere are we told that wisdom was rejected, and since spoken words and pictures were both used, it was obviously not an all or nothing proposition. (E) doesn't make much sense. How could there be an emphasis on science before writing existed? (D), finally, makes no sense at all -the author never says that all ancient wisdom was fiction
39. B This is a Little Picture question asking about the purpose of a detail. The question asks why the author discusses the impact of writing. Looking at the lines around the line reference given, we're told that writing has made the transmission of information about the past a lot more precise and extensive. Pictures and photography are also mentioned as a way in which the experience of the past has been passed down. So choice (B)'s correct here -writing is mentioned as an example of how culture record knowledge about the past. (A) is a distortion-the author is showing us something about the past, not why we remember hardly anything. He never implies any criticism of preliterate cultures, so choice (C) is out too. Choices (D) and (E) are wrong because the author never mentions them in the context referred to or in the whole passage.
40. C Another Vocabulary-in-Context question. The word *ready* can mean several things-choices (A), (C), (D), and (E) are all possible meaning. In the context however, it most nearly means *immediate*, choice (C). In the sentence before the cited line, the author *says there is no simple way* to understand vast stretches of time. In the sentence following the cited line, the author compares the way we understand vast stretches of time. In the sentence following the cited line, the author compares the way we understand time to the way a blind man *laboriously* constructs a picture of his surroundings. This implies that our understand of time is a difficult and time-consuming task, not something we can do *readily or immediately*.
41. E Another question asking about the purpose behind part of the author is argument. Give the context a quick scan. Once again, the author's talking about how difficult it is to understand vast stretches of time. We're told that it's like a blind man building up a sensory picture of his surroundings. This is an *indirect* process, so choice (E) is right. Choice (C) is dealt with later in paragraph 4, so you can eliminate it right away. (A) is too sweeping. The author never says that human beings are *completely unable to comprehend time*. (B) and (D) have nothing to do with the passage.
42. A Inference skill are required here. What is the author's underlying point in mentioning the Big Bang and the Cambrian Period? The author introduces this discussion in the cited passage by saying that a week provides a better yard stick for the age of the Earth than a day. The Big Band and the Cambrian Period are used as example to support this point. So (A) is right-it's the point about time scale that the author's trying to demonstrate. Choices (D) and (E) both distort the point in different way. The author is not suggesting that the time scale of a day should be totally abandoned-just that the week is a better scale. The development of (B) *agriculture* is another supporting example like the Big Band and the Cambrian Period, but it's not the author central point here. Finally, fossils have nothing to do with the question at hand, so (C) is easily eliminated.
43. C A more straightforward comprehension question this time. When we go back to the lines referred to, we're told about the problem with linear maps: when you produce one that's big enough to show us on it, the map becomes too big to study and reproduce conveniently. (C) gets the right paraphrase here. Notice especially the match up in synonyms for *convenient reproduction and examination*. (A), (B), and (E) aren't supported here-there's nothing about *overlapping periods, scientific standards*, or ignorance about *pre-Cambrian times* in the passage. (D) doesn't address the problem. The question is about getting our human experience on the map.
44. D What's the overall point the author is trying to prove? The big picture is that life started on Earth so long ago that it is difficult for us to comprehend. Everything that follows is meant to illustrate this point, including the time scales. Don't let the material confuse you. The point is (D)-the *immensity of time since the origin of life*. (C) is trickily to rejected because it's an aspect of the large argument, but it's not the whole point. The other wrong choice mention issues that the author hardly touches on. In paragraph 4-6, the author's not concerned with getting dates right (A), the question of how life actually began (B), or the (E) development of communication.
45. C Carefully read the opening paragraph and notice that the topic becomes more detailed as the paragraph progresses. The topic mentioned are blood, blood attributes, blood function, and blood components. (A) is a misused detail; although the *function* of blood is discussed, the overall passage focuses on the component of blood and the attributes of those components. (C), although similar, is a better answer. *Plasma and platelet* (B) are discussed, but they are not the main concern of the entire passage. (D) and (E) are both out of scope. The passage is concerned with *blood* (D) but focuses on a more detailed topic, and although blood is a component of the circulatory system (E), this is never mentioned in the passage. (C) is the best.

46. D The detail of plasma being *mostly water* (D) is set apart by commas, which should alert the reader that the author recognizes this attribute as important and want it to be noted. (A) is a misused detail; red blood cell, not plasma, are biconcave disks. (B) is a distortion; plasma serves as a solvent for ions and molecules, but the passage does not state that it is composed with the movement of water between blood and interstitial fluid (C) but is not itself *interstitial fluid*. Likewise, the passage does not say that plasma is hemoglobin (E), which is mention in the next paragraph pertaining to red blood cells. (D) is the only answer supported in the passage.
47. A Notice that interstitial fluid is separated from blood and plasma in this sentence. Where would other fluid be located in the body? (B) is opposite of what you are looking for; plasma affects the water between blood and interstitial fluid, thus signifying that blood is not the same this fluid, (C), and (E) are misused detail; (C) relies on the assumptions of the reader and not the context of the passage. Interstices are indeed small spaces, but interstitial in this context is descriptive of the fluid. (E) relies on the assumption of the reader. Although a lattice is often used as a metaphor for interstitial space, this metaphor is not mentioned in the passage at hand. (D) is too extreme. Erythrocytes are red blood cells, which are not related to the topic of plasma in this sentence. (A) is the best answer choice.
48. C Notice that many element are responsible for eventually coloring blood red. Oxygen must bind with hemoglobin, and the iron (C) in hemoglobin is mentioned as giving "red blood cell their color", making choice (A) a distortion of what is stated in the passage. (B) is also a distortion; *oxygen* binds with hemoglobin and plays a part in coloring red blood cells, but the passage provides more details than that. (D) is too extreme; mature red blood cell s no longer have their nucleus, and the nucleus does not color them. *Hemoglobin, enzymes, and other protein* (E) help in red blood cell function, but this fact is not detailed to discern what color the red blood cells.
49. A Writers used metaphor to better illustrate their argument their augment. Consider what patrols and armies do, and picture what that role would be within the blood system and body. (B) is a misused detail; these are attributes of white blood cells, but the author's metaphors do not apply to them. (C) is too extreme because although white blood cells may be considered violent by the invader's standpoint, the passage implies that they must be provoked before acting. Indeed, *B and T cells are highly specific* (D), combative cells, but this is too detailed an answer given the broad range of the question. Like (C), (E) is also extreme; phagocytes engulf old red blood cells, and these metaphors do not pertain to red blood cells but rather white blood cells. (A) is the best choice.
50. B The sentence states that macrophage "engulf invaders and debris" at the site of "inflamed tissues." Describes the state of being attacked, or choice (B). (A) is out of scope; although on the assumptions of the reader and not the context of the sentence. (C) and (D) are distortions; macrophage engulf the invaders, which are responsible for inflaming the tissue, and *irritated* (D) is often synonymous with *inflamed*. However, the reader should extricated the meaning of inflamed from the context of the sentence, which point outs that inflammation is the result of invaders and debris. (E) is too extreme; an inflamed tissue is clearly not healthy but is one in need of rescue.

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20 MINUTES

DIRECTIONS

Each passage is accompanied by four statements relating to the information or arguments it contains. Assume that what is stated is true; even if it contradicts what you know or believe to be the case in reality. Decide on this assumption whether the statement is:

TRUE: If the statement follows logically from the information or opinions contained in the passage.
Click on A

FALSE: If the statement is obviously false from the information or opinions contained in the passage.
Click on B

If you **CANNOT SAY** whether the statement is true or false without further information.
Click on C

Advertising and selling books via internet sites is becoming more popular with traders. It costs less to publicise a book on the internet than by traditional methods, and as books are stored in warehouse prior to being despatched to customers, overheads are lower than those of shops.

True, the price war on the internet is likely to put pressure on royalties, with publishers demanding that they be calculated not on the cover prices of books but on the prices actually received for them. However, these discounts will be greatest on best-sellers, rather than other books.

1. Entrepreneurs tend not to compete with large organisations. A B C
2. Large businesses do not want to accommodate an employee's individual employment needs. A B C
3. Small firms run by entrepreneurs provide no benefits for the community. A B C
4. More new jobs are provided by entrepreneurs than large organisations. A B C
5. The consumer demand for books sold on the internet is increasing. A B C
6. The cost of placing an advertisement for a book on the internet is less than other methods of marketing. A B C

7. Internet bookstores offer their biggest discounts on less popular books. A B C
8. Writers will definitely lose money because of the nature of internet book-selling. A B C
9. Some accidents at work are the result of misfortune. A B C
10. Organisations have no power to make workplaces safer. A B C
11. Under the proposed system of fines, organisations taking safety seriously would have nothing to fear. A B C
12. A system of fines is the best way to reduce accidents in the workplace. A B C

Applications are now being accepted for the following courses: Beginners and intermediate Japanese, beginners Polish, intermediate to advanced Russian, an introduction to Chinese culture and a Musical Theatre Performance Workshop. The Language Department, with the exception of the Musical Theatre Performance Workshop, which is being run by the Drama Society, is running all of the above courses. Application forms can be obtained from the Faculty of Arts Administration Office. Please note: the closing date for receipt of applications is March 10th. All fees are outlined in the application form and 10% deposits are due in advance of the commencement of each course.

13. There are no courses available for those who wish to study Russian. A B C
14. The Faculty of Arts administration office only holds information on courses run by the Language Department and the Drama Society. A B C
15. Full fees are due in advance of the course start date. A B C
16. Applications will be accepted for all courses until March 10th. A B C

Many organisations find it beneficial to employ students during the summer. Permanent staff often wish to take their own holidays over this period. Furthermore, it is not uncommon for companies to experience peak workloads in the summer and so require extra staff. Summer employment also attracts students who may return as well qualified recruits to an organisation when they have completed their education. Ensuring that the students learn as much as possible about the organisation encourages their interest in working on a permanent basis. Organisations pay students on a fixed rate without the usual entitlement to paid holidays or sick leave.

17. It is possible that permanent staff who are on holiday can have their work carried out by students. A B C
18. Students in summer employment are given the same paid holiday benefit as Permanent staff. A B C
19. Students are subject to the organisations' standard disciplinary and grievance procedure. A B C
20. Some companies have more work to do in summer when students are available for vacation work. A B C

Guidelines regarding the payment of suppliers are stored in the Finance Unit. Those wishing to purchase from suppliers must adhere to the following rules. Firstly, a request for a quote must be issued to at least three suppliers which will detail the unit cost, delivery time and total cost of the purchase. Only budget holders are permitted to decide upon what quote should be accepted. Once the quote has been accepted, a purchase order is issued by the Finance Unit to the relevant supplier. The invoice should be sent directly to the Finance Unit upon receipt by the budget holder where it is compared to the Purchase Order for accuracy.

21. There are certain rules, which must be adhered to by those wishing to purchase from suppliers. A B C
22. Whoever requests the quote has the responsibility of deciding which quote will be accepted. A B C
23. The budget holder is generally the office manager. A B C
24. Suppliers should send invoices directly to the Finance Unit. A B C

The computer system is limited in the number of reports it can generate. The workflow Report was designed to allow the manager to print or view the workflow activity of the department. Department managers must have “senior access” rights in order to generate this report. The System Administrator and four other staff only are permitted to give users access rights to the computer system. “Viewing Access” rights are one of the three sets of rights available to users. Reports have to be designed by computer programmers who have “report writing” access right. All reports with the exception of the Security Breach Report are compatible with the department’s word processing computer package. The Security Breach Report can be generated to show the security password of the user that breached the system. All staff are advised to keep their password secret and not to disclose it to any third party. The System Usage report and the Security Breach report can only be generated by the System Administrator.

25. Only the System Administrator and the staff of the System Administrator are permitted to give users access rights to the computer system. A B C
26. All department managers have their own security password. A B C
27. The department word processing packages can be used to generates all the department reports. A B C
28. Reports can be designed within the system by Computer programmers with “Report Writing” rights. A B C

“The project was ambitious in its size, complexity, triparty nature, and in its pioneering of the Private Finance Initiative. This difficulty was unavoidable and contributed to the project’s failure. However, a more prudent estimation of the unknown difficulties and timescales would have enabled the department to better assess the merits of the project.

In December 1997 Xsoft indicated they needed more time, which should have been inevitable. If the Department knew from the start how long the project would take, it is questionable whether they would have considered inception; especially considering the implications of delay on their business case for the project.”

29. If more care had been put into estimating the difficulties, it is less likely the project would have failed. A B C
30. XSoft withheld information from the Department as to how long the project would take. A B C
31. The Department’s profits were dependent upon how long the project took. A B C

“Ever since the gun’s invention it has been changing the world in many different ways. Many of these changes have been brought about by man’s desire to protect themselves, and the challenge of inventing bigger and more accurate weapons.

Each time there has been a major innovation in the development of the gun, there has been profound effect on the world. The gun helped in the exploration of the world, it has also helped in the development of society as we know it.”

32. The gun was invented because the human race needs to protect themselves.

A B C

33. Guns are the reason our society is the way it is today.

A B C

34. Financial incentives had no part to play in the development of the gun.

A B C

“Being social responsible is acting ethically and showing integrity. It directly affects our quality of the through such issues as human rights, working conditions, the environment, and corruption. It has traditionally been the sole responsibility of governments to police unethical behaviour. However, the public have realized the influence of corporations and over the last ten years, brought about global voluntary corporate social responsibility initiatives that dictate the actions of corporations.”

35. The ethical actions of corporations are changing.

A B C

36. Corporations can influence the public's quality of life.

A B C

37. Ten years ago, it was up to each corporation to decide whether they acted morally or not.

A B C

38. Children who eat healthily will perform better in exams.

“The number of accidents, which occur during the course of the working day, will never be reduced to zero, regardless of the attempts of regulating bodies. This is because all activity inevitably involves some degree of risk and luck. However, it is possible to reduce the number of occupational accidents, and one way of doing this would be to impose punitive fines on organisations within which occupational accidents occur. Whilst this will result in cases of injustice to some organisations, the overall effect for the employee, in terms of securing a safer workplace, will surely be beneficial. .”

39. Nowadays, more children are obese than in previous years. A B C
40. School meals would improve if schools had more money. A B C
41. It is more expensive for German customers to use a roaming service than it is for UK customers. A B C
42. Pay-as-you-go roaming rates are generally lower than they are for pre-pay. A B C

“Applications are now being accepted for the following courses; Beginners and intermediate Japanese, beginners Polish, intermediate to advanced Russian, an introduction to Chinese culture and a Musical Theatre Performance Workshop. The Language Department, with the exception of the Musical Theatre Performance Workshop, which is being run by the Drama Society, is running all of the above courses. Application forms can be obtained from the Faculty of Arts Administration Office. Please note: the closing date for receipt of applications is March 10th. All fees are outlined in the application form and 10% deposits are due in advance of the commencement of each course”.

43. Sometimes customers are charged for calls which they do not make themselves. A B C
44. Mid-sized firms may have to change their prices according to larger-sized firms. A B C
45. The larger the company, the larger the grant awarded becomes. A B C
46. Mid-sized firms are better able to adapt to market changes. A B C

“ Many organisations find it beneficial to employ students during the summer. Permanent staff often wish to take their own holidays over this period. Furthermore, it is not uncommon for companies to experience peak workloads in the summer and so require extra staff. Summer employment also attracts students who may return as well qualified recruits to an organisation when they have completed their education. Ensuring that the students learn as much as possible about the organisation encourages their interest in working on a permanent basis. Organisations pay students on a fixed rate without the usual entitlement to paid holidays or sick leaves.”

47. Adults sometimes looks to children to see what is fashionable. A B C
48. Young customers do not noticeably contribute to Timberland's profits. A B C
49. Adults wear the same shoes as children because they eant to look younger. A B C
50. Rupert Murdoch is the woner of BSKyB. A B C

“Guidelines regarding the payment of suppliers are stored in the Finance Unit. Those wishing to purchase from suppliers must adhere to the following rules. Firstly, a request for a quote must be issued to at least three suppliers, which will detail the unit cost, delivery time and total cost of the purchase. Only budget holders are permitted to decide upon what quote should be accepted. Once the quote has been accepted, a purchase order is issued by the Finance Unit to the relevant supplier. The invoice should be sent directly to the Finance Unit upon receipt by the budget holder where it is compared to the Purchase Order for accuracy”.

51. Viewers were able to tailor the programmes they eatched before digital TV existed. A B C
52. Television broadcaster are upgrading their equipment because they will make more money from digital TV. A B C
53. Companies brands are more valuable than the company itself. A B C
54. Many people distrust corporations. A B C

“The computer system is limited in the number of reports it can generate. The Workflow Report was designed to allow the manager to print or view the workflow activity of the department. Department managers must have “senior access” rights in order to generate this report. The System Administrator and four other staff only are permitted to give users access rights to the computer system. “Viewing Access” rights are one of three sets of rights available to users. Reports have to be designed by computer programmers who have “report writing” access rights. All reports with the exception of the Security Breach Report are compatible with the department’s word processing computer package. The Security Breach Report can be generated to show the security password of the user that breached the system. All staff are advised to keep their password secret and not to disclose it to any third party. The System Usage report and the Security Breach report can only be generated by the System Administrator.

55. People buy Dove soap because they like the idea of peace. A B C
56. Financial accounts provide information about what is going to happen in the future. A B C
57. Companies only create financial accounts for legal reasons. A B C
58. Reports can be designed within the system by Computer programmers with “Report Writing” rights. A B C

VERBAL REASONING TEST 2

58 QUESTIONS

20 MINUTES

DIRECTIONS

Each passage is accompanied by four statements relating to the information or arguments it contains. Assume that what is stated is true; even if it contradicts what you know or believe to be the case in reality. Decide on this assumption whether the statement is:

A

DEFINITELY TRUE

B

DEFINITELY UNTRUE

C

INSUFFICIENT INFORMATION

Parts can only be drawn on the basis of properly completed dockets, which are issued by the Engineering Department for jobs which are currently in progress, any request for materials or spares will be prioritized in accordance with the urgency of the order, as determined by the Chief Engineer's office.

Only in the case of emergency call-out where spares or materials are needed immediately will these made available without such explicit authorization.

1. The procedure for identity for parts has become more rigorous.

A

The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage

B

The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.

C

I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.

2. The issue of spaces for emergency repairs has no priority over parts for planned project work.

A

The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage

B

The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.

C

I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.

Go on to the next page

3. The issue of parts is normally subject to an assessment of urgency
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.
4. Material cannot be issued from the store without the express approval of the chief engineer.
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.

Asbestos is the name given to a group of six different fibrous minerals that occur naturally in the environment. One of these, namely Chrysotile, belong to the serpentine family of minerals while all of the others belong to the amphibole family. All forms of asbestos are hazardous and can cause cancer, but amphibole forms of asbestos are considered to be more hazardous. Chrysotile, also known as white asbestos is the predominant commercial form of asbestos.

5. All forms of asbestos are equally harmful
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.

6. More individuals, who in the past have worked with materials containing asbestos, have developed cancer than those who have not been exposed to the substance.
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
- B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
- C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.
7. Asbestos comes in the form of hazardous manmade fibers that we used predominantly in building materials.
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
- B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
- C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.

A few safe as Houses alarms have been re-designed in an attempt to reduce the large number of complaints where alarms have sounded by accident. One of the new types of alarm is less sensitive than its predecessors. Studies have shown that these new alarm are rarely activated for no apparent reason. 'Safe as Houses' still sells a number of the original sensitive alarm systems, because the increase in threshold for motion detection means that the new style alarms may fail to register break-in where limited force is being used.

8. All the company's alarm systems are now less sensitive.
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
- B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
- C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.

9. The new alarm system should reduce the number of accidental sounding by at least a half.
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
- B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
- C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.

Sages stores enjoys an international reputation for quality and style. Nowhere is this more important than in the dress and appearance of its staff. The company sets minimum standards of appearance, which are demanded of all shop floor staff, although some department have specific additional requirements.

Hair must be clean tidy and well at all the times.

With very few expectations such as “Designer Corner” which operate a different staff dress code reflecting their particular style, business dress must be worn. Women should wear tailored suits with a white or cream louse. Men should wear dark gray trousers together with a white shirt and navy blazer.

10. Women in “Designer Corner are allowed to wear jewellery
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage.
- B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
- C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.
11. Business dress must be worn by staff in all departments.
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage.
- B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
- C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.

The early chaos of the home computing in the USA, where it develop, probably had a more detrimental effect in Europe than it had in the states. All the innovators in the field were companies, which were too small to cope with or understand foreign sales. As a result all US companies sold exclusively, through European distributors, some of which were only interested in making maximum profit in a minimum amount of time. Home computing in Europe got off to a slow start because greedy distributors worked through incompetent suppliers, none of which had any real interest in the long-term future of the technology.

12. Incompetent suppliers were one of the reasons for slow development of home computing in Europe.

A The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage.

B The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.

C I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.

13. None of the American innovators in the field were able to deal adequately with foreign sales.

A The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage

B The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.

C I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.

Staff training can have a number of objectives, it can be educational, aiming to develop the knowledge, skills and abilities of the trainees; it can be a vehicle to promote company policy or values; or finally, it can raise levels of staff satisfaction by ensuring employees are able to improve their exiting skills. Lively debate usually accompanies the allocation of expenditures to the annual training budget. Critics argue that cost associated with such programme could be scaled down, and those causes which are unproductive could be axed.

14. Knowledge-based training is the most effect form for staff
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.
15. Training sharpens an organization's competitive edge
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.
16. The majority of cycle casualties last year involved people less than 20 years of age.
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.
17. Fewer adult were involved in cycle casualties this year
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.

Hargraves, one of the Country leading specialist electrical engineering companies announced the rejection of a take-overbid made by the larger, more generalized MLT Group, The Board of Directors Majority of shareholders and the announcement kept the prince to id had been made. The Chairman was known to be very relieved by the decision, as he could see no advantage for the shareholders, the company or its employers in take-over.

18. Some shareholders were against accepting the proposed take-over
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.
19. The employees of Hargraves were against that take-over
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.

Although people are buying less sugar to add to their food, the percentage of sugar eaten in manufactured food is increasingly sharply. In that form it is often referred to on the label as fructose, sucrose or dextrose. Although there is concern at the growing compulsion to eat over sugared food, there is no proven link between sugar and coronary heart disease, and sugar does not by itself make people fat.

20. Over-consumption of sugar sometimes result in heart disease

A The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage

B The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.

C I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.

21. The average individual consumption of sugar in all its various forms is increasing.

A The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage

B The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.

C I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.

Total quality does not refer only to the excellence of the delivered product. That is only prime consequence of raising standard through out the organization, whether in service or manufacture, to the highest attainable level using combination of quality systems, technology, design, training functional integration and cultural change. It is a demanding long-term process, which requires the highest commitment from all levels. Business transformation is an endless task and this kind of programme is precisely the kind to which many managers are averse. It scores low on short-term pay-offs and high on current expenditures, while the benefits such as gain in the market share, higher productivity and more satisfied customers, can only be won by unremitting professionalism.

22. Managers averse to programme take total quality because they are demanding long-term processes and Require huge commitment from all levels of the business.
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.
23. Higher levels of productivity are not only achieved through total quality programmes, but also by the placing of unrealistic demands of professionalism
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.
24. Cultural change is just one of a combination of factors that will allow an organization to raise standards.
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.

25. Mangers tend to be suspicious of total quality programmes because of high level of expenditure and limited return.

- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
- B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
- C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.

A state of equilibrium between a species population and its natural resources does not imply that species number will remain unchanged. Disease and changes in climate and physical environment particularly in response to the expansion or contraction of the polar ice caps-generates fluctuations in population numbers and lead a species to advance or retreat geographically.

26. Over time, the population of a species continues to grow.

- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage.
- B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
- C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.

By the middle of the next decade a sharp fall in the availability of graduates has been predicted, which is in contrast to the present upward trend towards a peak in three years' time competition for graduates, which is already intense, is likely to increase over the next decade, as demand exceeds supply. Employers need to be increasingly proactive in their planning to cope with the anticipated shortage.

27. There will be an increase in the number of graduates available for employment next year.
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage.
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.
28. Despite declining numbers of graduates in the next decade supply will still exceed demand.
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.
29. By the middle of the next decade, graduates should have improved prospect of gaining employment compared with current graduates.
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.
30. Current and future trends in graduate employment are the subject of much research.
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.

Transcendental meditation is widely credited with being the first turn of Eastern meditation to practice on a mass scale in the west. For thousands of years, religions the world over extolled the benefits of mediation and quiet contemplation, and the value of sitting quietly, using various techniques to cultivate stillness recognized. More recently, thousand of research studies, most of them published in well-respected scientific journals, attest to a wide range of measurable improvements in human function or as a result of meditative practice.

31. The benefits of meditation have only been recognized in the last few hundred years.
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.
32. Whilst the benefit of meditation is undoubtedly great, it is not possible to quantify the positive outcomes.
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.

Managers are finding it extremely difficult to recruit individuals with the most indispensable of all office skills, the ability to touch-type. Computers may have replaced typewriters but bashing at a key board with two fingers will never be a substitute for the skills of a trained professional who is able to type up to 100 words per minute. Despite the decline in this skill, computer are being used more and more commonly and therefore strong typing skill are not just essential for the secretary, but are also vital, for example, when coping with replying to the ever-present barrage of emails.

33. Office workers who can touch type are more equipped to deal with replying to e-mails
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.
34. If typing skills were improved, computer users could save hours every week.
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.

The World Bank Estimates that by 2030 the proportion of the worlds', will 1 billion people. On average, these people will spend over 25 hears in retirement, and some taking early retirement may spend half their live or more as retired citizen.

Today, as societies seek to adapt to the profound historic shift in life expectancy, one obvious impact is the increasing strain put not national budgets by pension costs.

35. In the future, people can expect to spend 25years or more in retirement.
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.

36. Independent tribunals would replace national courts for arbitrating would-be salespeople's complaints.
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.
37. The European Court acts as an appeal court for dissatisfied salespeople.
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.
38. The EU would be able to intervene without going through the courts, if it found that contract were not being fully advertised.
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.
39. Contracts advertised for long periods break open procurement rules.
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.

Response is indicated on machine-storable form by filling the appropriate circles. In order for an optical mark reader to read the completed forms a definition file (FDF) defines a form. A form is a set of sheets that comprise a distinct and a set data. FDFs are split into two main sections. The first section describes the width, length and thickness of the sheets that make up the form. The second section describes to the system where on the sheet the circles have been printed to take the respondents responses. It also describes how these circles are combined to form a number of options for one particular response.

40. Questionnaires can be viewed a particular type of form.
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.
41. The optional mark reader can detect which circles on a form have been filled in without reference to a Form Definition File.
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.

Increase competition and choice between stores, as well as hectic lifestyle which limits the free consumers once had to stop and browse, doesn't make customers loyalty less valuable or easier to require commodity for retailer. There is a need for retailers to understand the reasons why consumers remain loyal to a certain store, and how to create that loyalty so they ensure success in a retail environment where only the fittest survive.

42. The increase difficulty in obtaining customer loyalty is caused particular by the reduced amount of spare time consumers have.
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.
43. Success is the indisputable result of understanding the reasons, why customers remain loyal.
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.

Recent Research has started to examine how the customers and traditions evident in everyday society can be applied to improved organizations. For example, many people traditionally make resolutions in the New Year to change their behavior by changing old habits and establishing new ones. The resolutions people make tend to involve losing weight or exercising more, but they invariably involve some form of change for the better. Perhaps the New Year is the time for managers everywhere to consider the strength and well being of their organizations, and the changes required to improve and increase success.

44. New Years' resolutions do not represent improvements.
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.
45. Many people make resolutions to counteract the bad habits they established over the pervious year.
- A** The statement is **DEFINITELY TRUE**, or would be a reasonable conclusion to draw from the passage
 - B** The statement is **DEFINITELY UNTRUE**, or would not be a reasonable conclusion to draw.
 - C** I have **INSUFFICIENT INFORMATION** to answer either of the above with any certainty.

VERBAL ANALOGY TEST 1

50 QUESTIONS
20 MINUTES

DIRECTIONS

In the following questions, you are to determine the relationship between the first pair of capitalized words and then decide which of the answers choices share similar relationship with the third capitalized word.

1. REMUNERATIVE : PROFITABLE ::
FRAUDULENT :
(A) lying
(B) slander
(C) fallacious
(D) plausible
(E) reward
2. AX : WOODSMAN :: AWL :
(A) cut
(B) hew
(C) plumber
(D) pierce
(E) cobbler
3. SURGEON: SCALPEL :: BUTCHER :
(A) mallet
(B) cleaver
(C) chisel
(D) wrench
(E) medicine
4. CAT : FELINE :: HORSE :
(A) equine
(B) tiger
(C) quadruped
(D) carnivore
(E) vulpine
5. ADVERSITY : HAPPINESS ::
VEHEMENCE :
(A) misfortune
(B) gaiety
(C) troublesome
(D) petulance
(E) serenity
6. NECKLACE : ADORNMENT ::
MEDIAL:
(A) jewel
(B) mental
(C) bravery
(D) bronze
(E) decoration
7. GUN : HOLSTER :: SWORD:
(A) pistol
(B) scabbard
(C) warrior
(D) slay
(E) plunder
8. ARCHEOLOGIST : ANTIQUITY ::
ICHTHYOLOGIST:
(A) theology
(B) ruins
(C) horticulture
(D) marine life
(E) mystic

9. SHOE : LEATHER :: HIGHWAY:
(A) passage
(B) road
(C) asphalt
(D) trail
(E) journey
10. SERFDOM : FEUDALISM ::
ENTREPRENEUR :
(A) laissez faire
(B) captain
(C) radical
(D) agriculture
(E) capitalism
11. FIN : FISH :: PROPELLER :
(A) automobile
(B) airplane
(C) grain elevator
(D) water
(E) canoe
12. PULP : PAPER : HEMP :
(A) rope
(B) basket
(C) yarn
(D) cotton
(E) wood
13. SKIN : MAN :: HIDE
(A) scales
(B) fur
(C) animal
(D) hair
(E) fish
14. RAIN : DROP :: NOW :
(A) ice
(B) cold
(C) zero
(D) flake
(E) sleet
15. WING : BIRD :: HOOF :
(A) dog
(B) foot
(C) horse
(D) girl
(E) horseshoe
16. CONSTELLATION : STAR ::
ARCHIPELAGO:
(A) continent
(B) peninsula
(C) country
(D) island
(E) river
17. ACCOUNTANCY :
BOOKKEEPING :: COURT REPORT :
(A) law
(B) judgement
(C) stenography
(D) lawyer
(E) judge
18. ABSENCE : PRESENCE :: STABLE :
(A) steady
(B) secure
(C) safe
(D) changeable
(E) influential
19. RUBBER : FLEXIBILITY :: PIPE :
(A) iron
(B) copper
(C) pliability
(D) elasticity
(E) rigidity
20. SAFETY VALVE : BOILER :: FUSE :
(A) motor
(B) house
(C) wire
(D) city
(E) factory
21. SCHOLARLY : UNSCHOLARLY ::
LEARNED :
(A) ignorant
(B) wise
(C) skilled
(D) scholarly
(E) literary

22. IMMIGRANT : ARRIVAL :: EMIGRATION:
(A) leaving
(B) alienation
(C) native
(D) welcoming
(E) emigrant
23. GOVERNOR : STATE :: GENERAL :
(A) lieutenant
(B) navy
(C) army
(D) captain
(E) admiral
24. LETTER CARRIER : MAIL ::
MESSENGER :
(A) value
(B) dispatches
(C) easy
(D) complicated
(E) fast
25. CLOTH : COAT :: GINGHAM :
(A) doll
(B) cover
(C) washable
(D) dress
(E) dressmaker
26. BOAT : DOCK :: AIRPLANE:
(A) wing
(B) strut
(C) engine
(D) wind
(E) hangar
27. OAT : BUSHEL :: DIAMOND:
(A) gram
(B) hardness
(C) usefulness
(D) carat
(E) ornament
28. MEDICINE : EXAMINATION :: LAW :
(A) jurist
(B) court
(C) interrogation
(D) contract
(E) suit
29. PARENT : COMMAND :: CHILD :
(A) obey
(B) will
(C) women
(D) love
(E) achieve
30. CAPTAIN : VESSEL :: DIRECTOR :
(A) touring party
(B) board
(C) travel
(D) orchestra
(E) musician
31. FATHER : DAUGHTER :: UNCLE :
(A) son
(B) daughter
(C) son-in-law
(D) niece
(E) aunt
32. PISTOL : TRIGGER :: MOTOR :
(A) wire
(B) dynamo
(C) amperes
(D) barrel
(E) switch
33. CUBE : PYRAMID :: SQUARE :
(A) box
(B) solid
(C) pentagon
(D) triangle
(E) cylinder
34. PROFIT : SELLING :: FAME :
(A) buying
(B) cheating
(C) bravery
(D) praying
(E) loving

35. BINDING : BOOK :: WELDING :
(A) box
(B) tank
(C) chair
(D) wire
(E) pencil
36. GYMNASIUM : HEALTH :: SCHOOL :
(A) sick
(B) study
(C) books
(D) knowledge
(E) library
37. RIGHT : WRONG :: SUCCEED :
(A) aid
(B) profit
(C) fail
(D) error
(E) gain
38. INDIAN : AMERICA :: ABORIGINE :
(A) Hindustan
(B) Mexico
(C) soil
(D) magic
(E) Australia
39. WEALTH : MERCENARY :: GOLD :
(A) lucre
(B) miner
(C) fame
(D) eleemosynary
(E) South Africa
40. BOTTLE : BRITTLE :: TIRE :
(A) elastic
(B) scarce
(C) rubber
(D) spheroid
(E) automobile
41. SOPRANO : HIGH :: BASS :
(A) violin
(B) good
(C) low
(D) fish
(E) soft
42. OLFACTORY : NOSE :: TACTILE :
(A) tacit
(B) bloody
(C) finger
(D) handkerchief
(E) stomach
43. STREET : HORIZONTAL :: BUILDING :
(A) tall
(B) brick
(C) board
(D) vertical
(E) large
44. ALLEGIANCE : LOYALTY :: TREASON
(A) obedience
(B) rebellion
(C) murder
(D) felony
(E) homage
45. CANVAS : PAINT :: MOLD :
(A) clay
(B) cloth
(C) statues
(D) art
(E) aesthetic
46. FISH : FIN :: BIRD ::
(A) wing
(B) five
(C) feet
(D) beak
(E) feather
47. CONQUEST : ASCENDANCY ::
DEFEAT :
(A) omission
(B) frustration
(C) censure
(D) subjugation
(E) mastery



48. SOLUTION : MYSTERY ::
COMPLETION :
- (A) puzzle
 - (B) books
 - (C) college
 - (D) school
 - (E) detective

49. ALUMNUS : ALUMNA :: PRINCE :
- (A) castle
 - (B) king
 - (C) knight
 - (D) country
 - (E) princess

50. OCCULT : OVERT :: SECRET :
- (A) abstract
 - (B) outward
 - (C) science
 - (D) tarry
 - (E) concealed

ANSWERS

- | | | | | |
|-------|-------|-------|-------|-------|
| 1. C | 11. B | 21. A | 31. D | 41. C |
| 2. E | 12. A | 22. D | 32. E | 42. C |
| 3. B | 13. C | 23. C | 33. D | 43. D |
| 4. A | 14. D | 24. B | 34. C | 44. B |
| 5. E | 15. C | 25. D | 35. B | 45. A |
| 6. E | 16. D | 26. E | 36. D | 46. A |
| 7. B | 17. C | 27. D | 37. C | 47. D |
| 8. D | 18. D | 28. C | 38. E | 48. A |
| 9. C | 19. E | 29. A | 39. A | 49. E |
| 10. E | 20. A | 30. B | 40. A | 50. B |

VERBAL ANALOGY TEST 2

40 QUESTIONS

15 MINUTES

DIRECTIONS

In each of the following questions, you are given a related pair of words or phrases in capital letters. Each capitalized pair is followed by five pairs of words or phrases. Choose the pair which best expresses a relationship similar to that expressed by the original pair.

1. HEAR is to *INAUDIBLE* as
 - A. touch is to intangible
 - B. mumble is to praiseworthy
 - C. spend is to wealthy
 - D. prepare is to ready
 - E. enjoy is to illegal
2. GARGOYLE is to *GROTESQUE* as
 - A. magician is to elegant
 - B. boulevard is to serene
 - C. government is to amicable
 - D. miser is to affectionate
 - E. philanthropist is to benevolent
3. EXTINGUISHED is to *RELIT* as
 - A. completed is to discourage
 - B. announced is to publicized
 - C. collapsed is to rebuilt
 - D. Evicted is to purchased
 - E. imagined is to denied
4. VACUUM is to *AIR* as
 - A. invitation is to host
 - B. vacancy is to occupant
 - C. love is to passion
 - D. literacy is to writing
 - E. bait is to trap
5. BLAME is to *SCAPEGOAT* as
 - A. explain is to answer
 - B. convict is to punishment
 - C. lionize is to hero
 - D. appreciate is to art
 - E. relate is to secret
6. LIBEL is to *DEFAMATORY* as
 - A. praise is to laudatory
 - B. option is to selective
 - C. value is to sparse
 - D. insult is to apologetic
 - E. struggle is to victorious
7. ANNEX is to *BUILDING* as
 - A. bedroom is to apartment
 - B. fountain is to park
 - C. epilogue is to novel
 - D. dining air is to train
 - E. memory is to computer
8. BOOK is to *TOME* as
 - A. page is to binding
 - B. plot is to character
 - C. omission is to diligence
 - D. library is to borrower
 - E. story is to saga
9. GREGARIOUSNESS is to *SOCIABILITY* as
 - A. courageousness is to fearfulness
 - B. reliability is to esteem
 - C. forgetfulness is to memorability
 - D. affability is to friendliness
 - E. gullibility is to believability
10. HARBINGER is to *BEGINNING* as
 - A. ordain is to decree
 - B. herald is to advent
 - C. amend is to correction
 - D. emancipate is to freedom
 - E. commiserate is to news

Go on to the next page 

11. FOREST is to TREES as
A. fleet is to ships
B. lumber is to wood
C. rose is to thorns
D. shelf is to books
E. camera is to film
12. RAMPART is to FORTRESS as
A. bicycle is to wheel
B. river is to lake
C. cage is to animal
D. ladder is to roof
E. fence is to house
13. SCYTHE is to REAPING as
A. screws is to turning
B. crops is to planting
C. lights is to reading
D. shears is to cutting
E. saws is to gluing
14. MOISTEN is to DRENCH as
A. Pump is to replenish
B. chill is to freeze
C. deny is to pretend
D. dance is to rejoice
E. announce is to suppress
15. MAVERICK is to STRAY as
A. hermit is to recluse
B. expert is to ignorance
C. trickster is to payment
D. miser is to money
E. rumor is to truth
16. EXEMPLARY is to REPROACH as
A. erroneous is to correction
B. accomplished is to praise
C. fulfilling is to control
D. planned is to implementation
E. unimpeachable is to criticism
17. MENDICANT is to BEGGING as
A. competitor is to joining
B. legislator is to funding
C. Miser is to donating
D. prevaricator is to lying
E. mechanic is to selling
18. RAIN is to DELUGE as
A. pond is to ocean
B. desert is to camel
C. ore is to iron
D. street is to road
E. wheat is to crop
19. LUBRICANT is to FRICTION as
A. balm is to pain
B. eraser is to correction
C. solvent is to paint
D. reagent is to chemical
E. merchant is to business
20. CHAPTER is to NOVEL as
A. piano is to orchestra
B. diamond is to gem
C. scene is to drama
D. poetry is to prose
E. fraction is to portion
21. IMPLY is to AVER as
A. reject is to announce
B. hint is to proclaim
C. encourage is to absolve
D. remind is to contradict
E. embolden is to accept
22. DETENTION is to RELEASE as
A. viciousness is to attack
B. calamity is to repair
C. qualification is to employ
D. induction is to discharge
E. therapy is to confuse
23. PONDEROUS is to WEIGHT as
A. eternal is to temporality
B. convincing is to decision
C. gargantuan is to size
D. ancient is to value
E. prototypical is to affection
24. FEBRILE is to ILLNESS as
A. tenacious is to astonishment
B. juvenile is to maturity
C. classic is to cultivation
D. eccentric is to discrimination
E. delusional is to insanity

25. INCOMMUNICADO is to CONTACT as
A. sequestered is to company
B. pretentious is to affectation
C. submissive is to compromise
D. perpetual is to adventure
E. severed is to replacement
26. EQUIVOCATION is to MEANING as
A. feint is to intention
B. secrecy is to stealth
C. geniality is to amiability
D. travesty is to insight
E. refinement is to innovation
27. WEB is to ENTANGLE as
A. spider is to spin
B. trap is to ensnare
C. treason is to betray
D. ransom is to kidnap
E. grid is to delineate
28. LETHARGY is to ENERGY as
A. appetite is to hunger
B. redemption is to sacrament
C. sorrow is to pity
D. merit is to remuneration
E. apathy is to interest
29. THWART is to ACHIEVE as
A. retain is to submit
B. couch is to conceal
C. silence is to speak
D. pretend is to inherit
E. permeate is to infiltrate
30. APOCRYPHAL is to GENUINE as
A. spurious is to authentic
B. labored is to relieved
C. fragmented is to riddled
D. enigmatic is to rambunctious
E. Credulous is to flagrant
31. BALEFUL is to EVIL as
A. fulsome is to refinement
B. disjointed is to compatibility
C. mandatory is to requirement
D. literacy is to obstreperousness
E. dogmatic is to hostility
32. WATERFALL is to CASCADE as
A. snow is to freeze
B. missile is to launch
C. tree is to exfoliate
D. wave is to undulate
E. monarch is to reign
33. INFLATE is to MAGNITUDE as
A. measure is to weight
B. extend is to duration
C. magnify is to coin
D. limit is to speed
E. legislate is to crime
34. MOCK is to DERISION as
A. despise is to contempt
B. reject is to account
C. repair is to corruption
D. inspire is to muse
E. observe is to refinement
35. SINGER is to CHORUS as
A. architect is to blueprint
B. teacher is to student
C. author is to publisher
D. driver is to highway
E. actor is to cast
36. INCISION is to SCALPEL as
A. hospital is to patient
B. playground is to swing
C. kitchen is to knife
D. electricity is to wire
E. cut is to saw
37. ALTIMETER is to HEIGHT as
A. speedometer is to velocity
B. observatory is to constellation
C. racetrack is to furlong
D. vessel is to knots
E. metronome is to tempo
38. UNGAINLY is to ELEGANCE as
A. stately is to majesty
B. suitable is to propriety
C. vacuous is to temerity
D. feckless is to sobriety
E. perfunctory is to attention



39. CONSERVATOR is to WASTE as
A. sentinel is to vigilance
B. monarchy is to subject
C. demagogue is to benevolence
D. chaperon is to transgression
E. minister is to profanity

40. POLEMICIST is to CONTROVERSY as
A. dilettante is to virtuosity
B. visionary is to dream
C. pundit is to sophistry
D. zealot is to benevolence
E. bigot is to equanimity

ANSWERS

- | | | | |
|-------|-------|-------|-------|
| 1. A | 11. A | 21. B | 31. C |
| 2. E | 12. E | 22. D | 32. D |
| 3. C | 13. D | 23. C | 33. B |
| 4. B | 14. B | 24. E | 34. A |
| 5. C | 15. A | 25. A | 35. E |
| 6. A | 16. E | 26. A | 36. E |
| 7. C | 17. D | 27. B | 37. A |
| 8. E | 18. A | 28. E | 38. E |
| 9. D | 19. A | 29. C | 39. D |
| 10. B | 20. C | 30. A | 40. B |

ANSWERS AND EXPLANATIONS

1. (A) The defining characteristic of something that is **INAUDIBLE** is that it cannot be **HEARD**, and the defining characteristic of something that is **intangible** is that it cannot be touched. Additionally, you can eliminate (B), (C) and (E) as non-answers.
2. (E) **GROTESQUENESS** is a defining characteristics of a **GARGOYLE**, and **benevolence** is a defining characteristic of a **philanthropist**.
3. (C) **RELIGHTING** follows **EXTINGUISHING**, and **rebuilding** collapse. This is an analogy based on sequence. You can eliminate (A), (D), and (E) as non-answer. (B) is a possible analogy, but it does not fit the sequence pattern.
4. (B) Lack of **AIR** is a defining characteristic of a **VACUUM**, and lack of an occupant's is a defining characteristic of a **vacancy**. The other choices are possible analogies, but they do no fit the pattern for lack.
5. (C) **BLAME** is a defining characteristic of a **SCAPEGOAT**, and **lionize** is a defining characteristic of a **hero**. You can eliminate (A), (D), and (E) as non-answers. Further, (B) does not fit the defining characteristic pattern.
6. (A) **DEFAMATORY** is defining characteristic of what it is to **LIBEL**, and **laudatory** is a defining characteristic of what it is to **praise**. In any case, the remaining choices are so weak as to be non-answers.
7. (C) This analogy does not fit any of our standard patterns. An **ANNEX** is not really a part of a **BUILDING**, but something added to an already existing building. Similarly, an **epilogue** is a section or comment added to a play or a novel. Perhaps it best fits as a sequence. An **ANNEX** comes after the original **BUILDING**, and an **epilogue** comes after the original novel. You can eliminate (A), for a **bedroom** is part of, not added to, an **apartment**. And for the same reason you can eliminate (D) and (E). Finally, (B) qualifies as a non-answer. A **fountain** is not necessarily found in a **park** does not necessarily contain a **fountain**.
8. (E) A **TOME** is a large **BOOK**, and a **saga** is a lengthy story. The analogy is one of degree, but to see this you have to be attentive to the precise meaning of **TOME**. This is what makes the analogy difficult. A **TOME** is not merely a **BOOK**; it is a large **BOOK**. (C) can be eliminated as a non-answer, and the others must be incorrect since they do not fit the pattern for degree.
9. (D) **SOCIABILITY** is a defining characteristic of **GREGARIOUSNESS**, and **friendless** is a defining characteristic of **affability**.
10. (B) To **HARBINGER** is to announce the **BEGINNING** of something, and to **herald** is to announce the advent of something. This is a difficult analogy because of the **HARBINGER**, and it is made more difficult because **HARBINGER** is used as a verb. (It is usually used as noun: "The robin is a harbinger of spring.") But even if you do no know the meaning of the key word in this analogy, you should be able to eliminate (E) as a non-answer.
11. (A) A **TREE** is a part of the **FOREST**, and a **ship** is part of the **fleet**. Once we change the word order, the fairly common "is part of" pattern becomes evident. You might, however, need to refine your sentences to eliminate some of the other choices. You might try: a **FOREST** is a group of **TREES**, and a **fleet** is a group of **ships**.
12. (E) This is a fairly odd analogy. It doesn't fit any of the patterns. It is based on a physical similarly. A **RAMPART** is an embankment encircling a **FORTRESS**, and a **fence** encircles a **house**. Occasionally, we have analogies based on physical similarities, e.g., **FRAME** is to **PICTURE** as, **envelope** is to **letter**. (The **FRAME** surrounds the **PICTURE**, and the **envelope** surrounds the **letter**). You could have eliminated both (B) and (D) as non-answers.

13. (D) SCYTHE is a tool for REAPING, and shears are a tool for cutting. (A), (C), and (E) are non-answers, and (B) does not fit the tool pattern.
14. (B) To DRENCH is to do more than just MOISTEN, and to freeze is to do more than just chill. This analogy is based upon a relationship of degree. You can eliminate (A), (C), and (D) as non-answers; and (E), though a possible analogy, does not fit the pattern we are looking for.
15. (A) A defining characteristic of a MAVERICK is that it is a STRAY, and defining characteristic of a hermit is that he is a recluse. You can easily eliminate (C) as a non-answer. And (B) and (E) fail because they are based upon the “is a lack of” pattern. What about (D)? It is the love of money, or greed, that is the defining characteristic of a miser. Had (D) read miser is to greed, it would have been better. Since we can improve (D), we know it is not the best choice as it originally stands.
16. (E) This relationship might be expressed as “That which is EXEMPLARY is beyond REPROACH.” So, too, that which is unimpeachable is not subject to criticism.
17. (D) Here the relationship is one of defining characteristic. The MENDICANT is a BEGGAR and the prevaricator is a liar.
18. (A) This relationship is simply one of degree: A DELUGE is a big RAIN and an ocean is a big pond.
19. (A) The relationship here is that of agent to effect. The effect of a LUBRICANT is to reduce FRICTION, and the effect of a balm is to reduce pain. Notice also that there is an “echo” here. Friction is something that “afflicts” a machine as pain afflicts a body. And a lubricant is something like a “medicine” or balm that solves the problem.
20. (C) This is clearly a part-to-whole analogy. A CHAPTER is a part of a NOVEL and a scene is part of a drama. Don't be deceived by the mention of other literary terms such as poetry and prose or by other words such as fraction and portion, which mean “part.”
21. (B) This analogy is one of degree. To imply is to indicate indirectly; to AVER is to affirm with confidence. To hint is to suggest; to proclaim is to announce officially.
22. (D) This is an analogy based on sequence of events. After DETENTION one be RELEASED, and after induction one may be discharged.
23. (C) This analogy is based on a defining characteristic. By definition, something that is PONDEROUS have a lot of WEIGHT, and something gargantuan is large or sizable.
24. (E) This analogy is based on the “sign of” relationship. To be FEBRILE is a sign of ILLNESS and to be delusional a sign of insanity.
25. (A) This analogy is based on the “lack of” relationship. Lack of CONTACT is a defining characteristic of INCOMMUNICADO, and lack of company is a defining characteristic of sequestered.
26. (A) This is analogy doesn't belong to any specific category, but you might create diagnostic sentences such as “EQUIVOCATION is ambiguous speech that hides MEANING” and “Feint is a deceptive act or sham that serve to hide intention.” Do not be misled by secrecy and stealth, which are related to the key words and to each other.
27. (B) A WEB may be used to ENTANGLE and a trap is used to ensnare. Do not be distracted by (A) because spider and spin seem related to WEB.
28. (E) This analogy is based on a “lack of” relationship. LETHARGY is a lack of ENERGY, and apathy is a lack of interest.

29. (C) This analogy is a twist on the defining characteristic analogy. It is characteristic of THWART that one does not ACHIEVE and of silence that one does not speak.
30. (A) This is a type of “lack of” analogy. Something that is APOCRYPHAL is not GENUINE, and what is spurious is not authentic.
31. (C) This is a defining characteristic analogy. That which is BALEFUL is an EVIL, and that which is mandatory is a requirement. Note that EVIL in the original pair is a noun and not an adjective.
32. (D) This analogy is a type of defining characteristic. By its nature, a WATERFALL CASCADES and a wave undulates. You might be attracted to answer choice (A). But you can eliminate it by trying to improve it. (A) would be more nearly correct if it were snow: fall.
33. (B) Although this does not fit into any category, the relationship is clear. To INFLATE something means “to increase its MAGNITUDE,” and to extend something means “to increase its duration.”
34. (A) This analogy is a “defining characteristic.” To MOCK is to show DERISION or scorn. Similarly, to despise is to show contempt or disdain.
35. (E) This is a part to whole analogy. A SINGER is part of a CHORUS, and an actor is part of a cast.
36. (E) This analogy falls into the “tool” category. An INCISION is made with a SCALPEL, or a scalpel is the tool used to make an incision. A cut is made with a saw, or a saw is the tool used to cut.
37. (A) This analogy is fairly straightforward. An ALTIMETER measures HEIGHT, and a speedometer measures velocity.
38. (E) This analogy fits into the “lack of” category. That which is UNGAINLY lacks ELEGANCE, and that which is perfunctory lacks attention.
39. (D) This is a variation on the “defining characteristic” analogy. A CONSERVATOR is one who prevents WASTE and a chaperon is one who prevents transgression.
40. (B) This is another “defining characteristics” analogy. A POLEMICIST is involved in CONTROVERSY and a visionary in dreams.

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SENTENCES COMPLETION TEST

30 QUESTIONS

15 MINUTES

DIRECTIONS

Each sentence below has one or two blanks, each blank indicating that something has been omitted. Beneath the sentence are five lettered words or sets of words. Choose a set of word for each pair of blanks that best fits the meaning of the sentence as a whole.

- Philosophers tell us that one's lifetime is ___ when considered from the viewpoint of ___ making humans appear much less important than they think in the grand scheme of things.
A. laudatory..prestidigitation
B. jaded..youth
C. ephemeral..eternity
D. superfluous..transience
E. gauche..theology
- The primitive emotions of love and hate, even though extreme opposites, are found in varying degrees even in the most ___ and ___ person, according to sociologists.
A. brakish..mature
B. sylvan..intellectual
C. celestial..civilized
D. beneficent..stable
E. defunct..healthy
- When surveying the rule of the elderly king, we could only conclude that as he neared his ___ he became a(n) ___ ruler, which was obvious by his inattention to some matters.
A. pinnacle..blatant
B. dotage..effete
C. prime..voluble
D. euphony..dissident
E. prerogative ..covert
- Surveying the college course guide, we could conclude that ___ is a phase of the study of _____.
A. nihilism..gynecology
B. hypertension..etymology
C. recidivism..criminology
D. altruism..paleontology
E. hallucination..chivarly
- A refugee may be force to ___ allegiance to his former country and ___ all of his former friends in order to work in a new country.
A. fabricate..garble
B. fetch..extradite
C. fluctuate..expurgate
D. abjure..forsake
E. lacerate..occlude
- Some experts think that the origin of schizophrenia is ___; others believe it is _____.
A. contiguous..environmental
B. congenital..environmental
C. congenital..deleterious
D. contagious..pathological
E. exogenous..celestial
- Even though we had heard that Professor Smith of the English Department taught an easy class, we knew that ___ and ___ are usually studied by those who enjoy the language.
A. liturgy..pantheism
B. philology..etymology
C. prosody..ubiquity
D. tautology..simony
E. raillery ..verity
- When I am ____, I am also ____, I explained to my friends who wondered at my long face.
A. scintillating..verbose
B. quiescent..succinct
C. lugubrious..lachrymose

Go on to the next page 

- D. reviled..providential
E. Providential..rubicund
9. One of the things we learned in health class is that when eating, it is important to _____ thoroughly in order for proper _____ to occur.
A. rankle..temerity
B. mitigate..digestion
C. transmute..veneration
D. query..progeny
E. masticate..digestion
10. Compelled by professor to attend a lecture by an aging former teacher, I found the lecture was full of _____, and, as I had suspected and dreaded, it became most _____.
A. cliches..bromidic
B. gabble..blatant
C. foibles..bombastic
D. histrionics..insidious
E. metaphors..laconic
11. After introducing two of my friends, I learned that the introduction was a disaster because her _____ immediately led her to suspect his _____ in discussing his life experiences.
A. philology..valiant
B. rancor..secular
C. vigilance..petulance
D. perspicacity..fraudulence
E. vagary..indolent
12. My friends were absolutely amazed when attending a religious convocation where the _____ outbursts of the congregation were ignored by the _____.
A. heretical..indigent
B. heinous..indolent
C. profane..ecclesiastic
D. ebullient..commissary
E. flagrant..exodus
13. After ruining her dress, I would have preferred her most biting _____ to the _____ looks she directed my way.
A. euphemisms..consummate
B. anodynes..feckless
C. diatribes..reproachful
D. effigies..refulgent
E. histrionics..penitent
14. During the fearful storm, the people in its path _____ God for divine _____.
A. importuned..intervention
B. imputed..favours
C. expiated..revelation
D. deprecated..power
E. immortalized..gifts
15. After studying psychology for a quarter, I can see that my friend is a _____ because he is always _____ favors from others.
A. sycophant..curring
B. benediction..eliciting
C. brigand..flouting
D. facade..brandishing
E. tryst..avowing
16. Many of my peers have turned to religion, realizing that the _____ in the church was a sign of _____ rather than money-hungry leaders.
A. tithe..redress
B. windfall..sacrilege
C. skeptic..predilection
D. wraith..piety
E. schism..sedition
17. After the burglarizing of my home, I overheard the detective remark to the police officer that apparently the thief had moved in a _____, _____ manner.
A. sensuous..tangible
B. furtive..surreptitious
C. phlegmatic..probing
D. moribund..menial
E. ostentatious..patrician
18. During our commencement, the student body president delivered the _____, which had a _____ effect on the audience.
A. martinet..pernicious
B. patrimony..depraved
C. salutatory..bracing
D. elixir..blatant
E. cudgel..brusque

19. Returning home for vacation, I learned that my mother's new medicine had made her extremely _____ and _____.
- A. articulate..copious
 - B. Doltish..overt
 - C. autocratic..congruent
 - D. torpid..phlegmatic
 - E. ludicrous..remiss
20. When I was interviewed for a journalist's position, I was told that often the editor was very _____; he made numerous _____.
- A. sedentary..rifts
 - B. fastidious..emendations
 - C. saline..parables
 - D. maudlin..orifices
 - E. onerous..idylls
21. My erratic brother gives us all kinds of problems; his occasional _____, _____ are frightening to the family members.
- A. spurious..tacks
 - B. transitory..oblations
 - C. turgid..zephyrs
 - D. sporadic..fulminations
 - E. perfidious..nosegays
22. When listening to nursery rhymes, my daughter likes the part in which the _____ witch uses a ting doll as a _____.
- A. ductile..missal
 - B. eviscerated..derelict
 - C. exacting..crux
 - D. malevolent..fetish
 - E. doughty..doxology
23. When my Criminal Justice class observed a courtroom proceeding, we watched while one accused was examined; the _____ heard the testimony and _____ the man to jail.
- A. iconoclast..condoled
 - B. bourgeois..denuded
 - C. doggerel..eulogized
 - D. consort..imbibed
 - E. arbiter..remanded
24. My friend's uncle is a member of Alcoholics Anonymous; his _____ led to an _____ liver disease.
- A. dipsomania..ineluctable
 - B. avarice..auspicious
 - C. volition..unctuous
 - D. sojourn..audacious
 - E. tableau..incipient
25. Can you believe that I won the photo contest with the _____ of the two pictures that was most _____, even though I only tried to hang them where there were nails!
- A. sophistry..hallow
 - B. juxtaposition..esthetic
 - C. trappings..emaciated
 - D. pseudonym..facile
 - E. corollary..extraneous
26. In Biology class, we learned about animal families, so that I was able to understand that members of the _____ family are _____ and why my farmer uncle grows grass.
- A. bovine..herbivorous
 - B. anthropoid..adamant
 - C. conduit..corpulent
 - D. congenital..incarnadine
 - E. heretic..chivalrous
27. When my sister get her first job, here novice _____ led to a ridiculous _____.
- A. collusion..consanguinity
 - B. synthesis..cordovan
 - C. colophon..temerity
 - D. ineptitude..imbroglio
 - E. chauvinism..quirk
28. In Meteorology, we learned that the _____ around the noon is a(n) sign.
- A. parody..audacious
 - B. oblation..heretic
 - C. hiatus..onerous
 - D. corona..auspicious
 - E. dregs..organic

29. During the time of Teddy Roosevelt, soldiers in battles might see the _____troop appear over the _____
- A. equestrian..butte
 - B. albino..heyday
 - C. exorbitant..pendant
 - D. diabolic..ventricle
 - E. incendiary..rhesus
30. After a year of hard work in the metropolitan rush, as a relief from _____ pressures, many plan to _____ on their vacation.
- A. Inveterate..pique
 - B. urban..rusticate
 - C. pent..prate
 - D. neolithic..venerate
 - E. Laconic..slake

ANSWERS

- | | | |
|-------|-------|-------|
| 1. C | 11. D | 21. D |
| 2. D | 12. C | 22. D |
| 3. B | 13. C | 23. E |
| 4. C | 14. A | 24. A |
| 5. D | 15. A | 25. B |
| 6. B | 16. A | 26. A |
| 7. B | 17. B | 27. D |
| 8. C | 18. C | 28. D |
| 9. E | 19. D | 29. A |
| 10. A | 20. B | 30. B |

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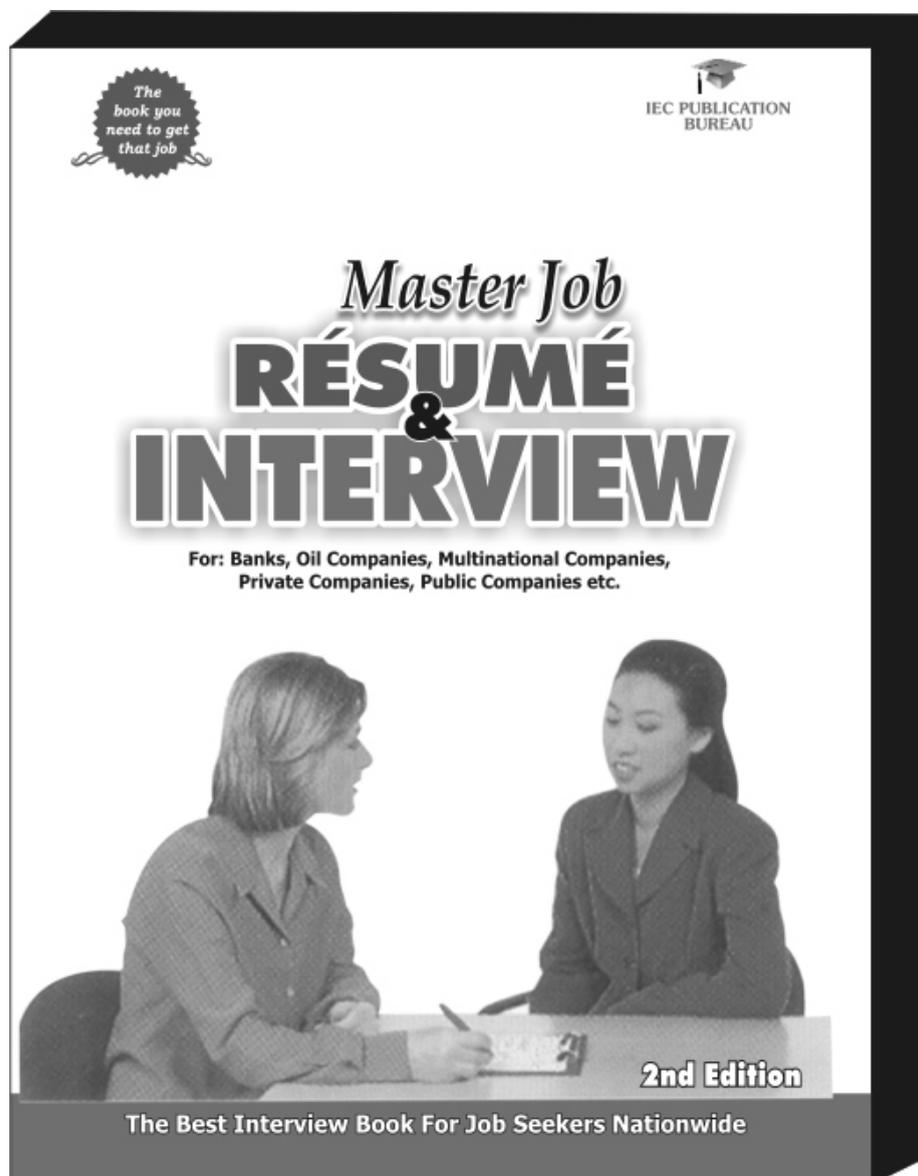
ANSWERS AND EXPLANATIONS

1. The correct answer is (C). the key words are less important. A good word would be “unimportant.” That eliminates choices (A), (D), and (E). the trigger for the second blank is grand scheme of things. A good word choice would be “lifetime.” That eliminates choice (B).
2. The correct answer is (D). The clue in the sentence is emotions...are found. The trigger words are even in the most. A good word for a person who would have both qualities would be “good.” That eliminates choice (A), (B), and (E). Since celestial means “heavenly,” it cannot apply to a person. This eliminates choice (C).
3. The correct answer is (B). The key word here is elderly. A good word would be “senile.” This eliminates choice (A) and (E). The trigger for the second blank is inattention. A good word would be “tired.” That eliminates choices (C) and (D).
4. The correct answer is (C). It is the only choice that correctly describes a phase of an academic subject.
5. The correct answer is (D). The key word is refugee. A good word for what a refugee must do is “surrender.” That eliminates choices (A), (C), and (E). A good word for another act for a refugee would be “forgo.” That eliminates choice (B).
6. The correct answer is (B). The key words are some experts think. A good word for what some would believe is “genetic.” That would eliminate choice (A) and (E). The trigger for the second blank is others believe. A good word for the opposite of what is in the first blank would be “acquired.” That eliminates choice (C) and (D).
7. The correct answer is (B). The key word is English. A good word for a characteristic of an English teacher is “scholar.” That eliminates choices (A), (D), and (E). The trigger for the second blank is language. That eliminates choice (C).
8. The correct answer is (C). The key words are long face. A good word would be “sad.” That eliminates choices (A), (D), and (E). Another good words is “tearful.” That eliminates choice (B).
9. The correct answer is (E). The key word is eating. A good word is “chew.” That would eliminate choices (A), (B), and (D). A good word for the result of chewing is “utilize.” That eliminates choice (C).
10. The correct answer is (A). The key word for the second blank is dreaded. A good choice would be “boring.” That eliminates choices (B), (D), and (E). The trigger word for the first blank is aging. A good choice would be “overused phrases.” That eliminates choice (C).
11. The correct answer is (D). The key is suspect. A good word would be “distrust.” That eliminates choices (A) and (E). The trigger for the second blank is discussing his life experiences. A good word would be “honesty.” That eliminates choices (B) and (C).
12. The correct answer is (C). The key words for the second blank are church leader. A good word would be “priest.” That eliminates choices (A), (B), and (E). The trigger for the first blank is outbursts. A good word would be “irreligious.” That eliminates choice (D).
13. The correct answer is (C). The key words are would have preferred. A good word is “cursing.” That eliminates choices (A), (B), and (D). The trigger for the second blank is looks. A good word is “blaming.” That eliminates choice (E).
14. The correct answer is (A). The key words are fearful storm. A good word would be “prayed.” That eliminates choice (C), (D), and (E). The trigger for the second blank is divine. A good word would be “assistance.” That eliminates choice (B).

15. The correct answer is (A). The key words for the second blank are favors from others. A good word would be “begging.” That eliminates choice (C), (D), and (E). For the first blank, key words are studying psychology, which would lead one to observe behavior. A good word would be “flatterer.” That eliminates choice (B).
16. The correct answer is (A). The key word is money-hungry. A good word would be “begging.” That eliminates choice (C), (D), and (E). The trigger words for the second blank are turned to. A good word would be “good.” That eliminates choice (B).
17. The correct answer is (B). The key is burglarizing. Two synonyms are needed, as indicated by the comma between the blanks. A good word would be “sneaky.” That eliminates choices (A), (C), and (E). Another good word for such behavior would be “careful.” That eliminates choice (D).
18. The correct answer is (C). The key word is commencement. A good word for a speech delivered on such an occasion is “address.” That eliminates choice (A), (B), and (E). The trigger for the second blank is effect. A good word would be “energizing.” That eliminates choice (D).
19. The correct answer is (D). The key here is that we need synonyms, as indicated by the pairing divided by “and.” A good word for the result of medication is “drowsy.” This eliminates choice (A), (C), and (E). Another good word is “sleepy.” This eliminates choice (B).
20. The correct answer is (B). The key word here is editor. A good word for the work of an editor is “exacting.” That eliminates choices (A), (C), and (D). The trigger for the second blank is numerous. A good word would be “corrections.” This eliminates choice (E).
21. The correct answer is (D). The key words are erratic and problems. We need an adjective and a noun, as indicated by the lack of a comma between the two words. A good word choice would be “infrequent.” That eliminates choices (A) and (E). The trigger for the second blank is frightening. A good word would be “displays.” That eliminates choices (B) and (C).
22. The correct answer is (D). The key words are nursery rhymes. A good word for a witch in such a work would be “evil.” That eliminates choice (A), (C), and (E). The trigger for the second blank is doll. A good word would be an “effigy.” That eliminates choice (B).
23. The correct answer is (E). The key word is courtroom. A good word for one who hears in a courtroom is “judge.” That eliminates choice (B), (C), and (D). The trigger words for the second blank are to jail. Good word choices would be “sent back.” That eliminates choice (A).
24. The correct answer is (A). The clue here is Alcoholics Anonymous. A good word would be “alcoholism.” That eliminates choices (B), (D), and (E). The trigger for the second blank is liver disease. A good word would be “cirrhosis.” That eliminates choice (C).
25. The correct answer is (B). The clue here is hang them. A good word would be “arrangement.” That eliminates choices (A), (D), and (E). The trigger for the second blank requires a result. A good word would be “interesting.” That eliminates choice (C).
26. The correct answer is (A). The key word for the second blank is grass. That eliminates choice (B), (C), and (E). The clue for the first blank is animal. A good word would be “cow.” That eliminates choice (D).
27. The correct answer is (D). The key words are first job and novice. A characteristic of a beginner would be “lack of training.” That eliminates choices (B), (C), and (E). The trigger for the second blank is ridiculous. A good word would be “confusion.” That eliminates choice (A).
28. The correct answer is (D). The key words are around the moon. A good word would be “circle.” That eliminates choices (A), (B), and (E). The trigger for the second blank is sign. A good word would be “beautiful.” That eliminates choice (C).

29. The correct answer is (A). The key words here are Teddy Roosevelt, whom we revere as our president, who rode with the cavalry. A good word would be "horse." That eliminates choices (C), (D), and (E). The trigger for the second word is over. A good word would be "rise." That eliminates choice (B).
30. The correct answer is (B). The key words are metropolitan rush. A good word would be "city." That eliminates choices (C), (D), and (E). The trigger for the second blank is vacation. A good word would be "country." That eliminates choice (A).

YOU NEED THIS BOOK ALSO

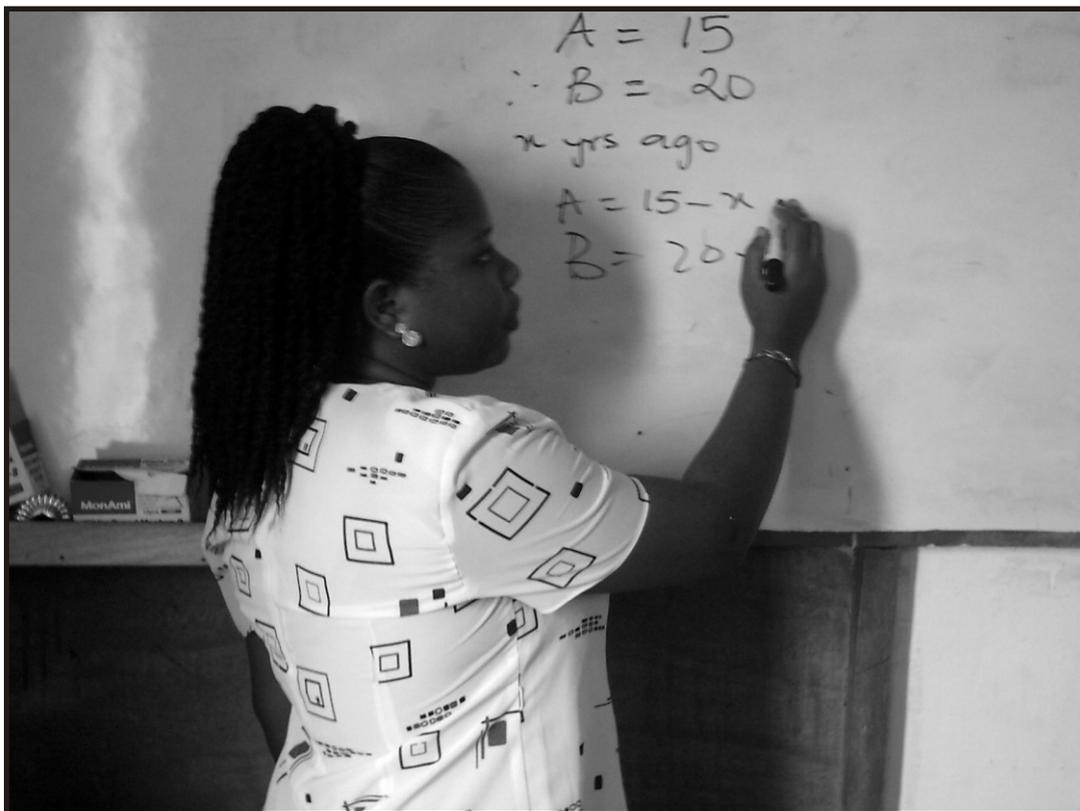


PART THREE

GRAPHICAL AND DATA ANALYSIS TESTS

**For Oil Companies, Multinationals, Marketing Firms,
Industries, Engineering Firms etc.**

Note: Some Banks might use these tests also.



IEC MONTHLY SEMINAR

GRAPHICAL ANALYSIS TEST

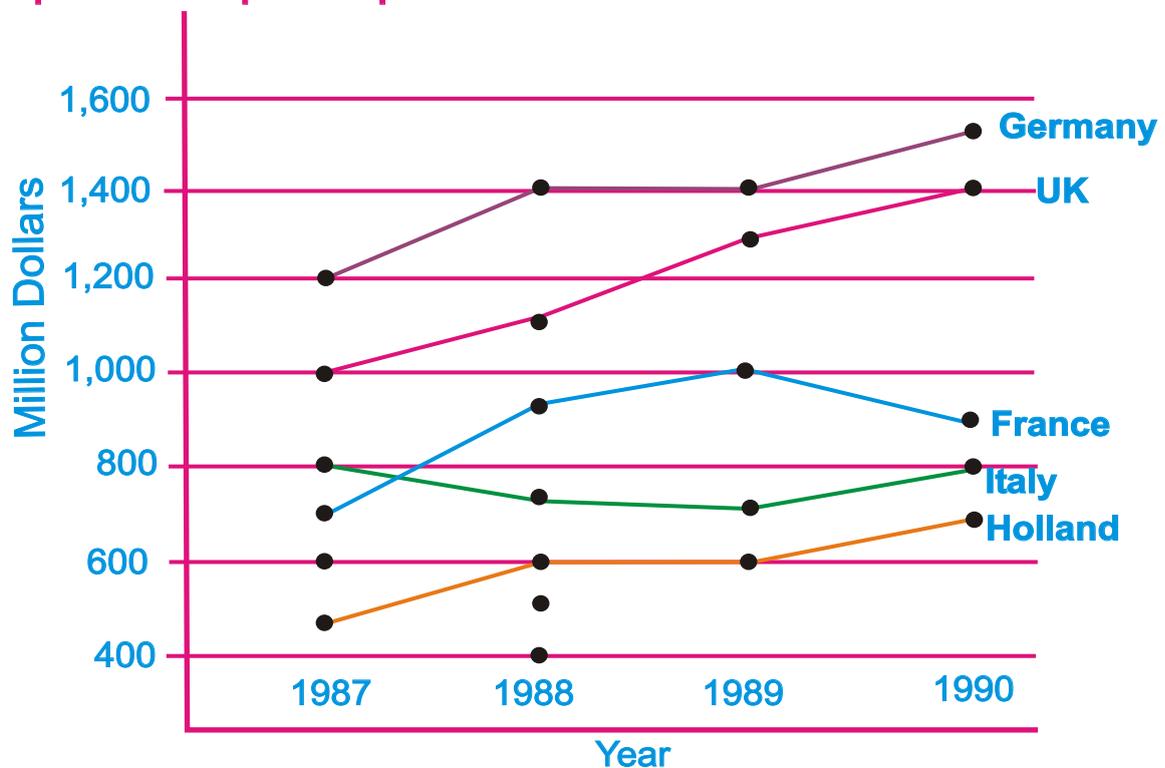
100 QUESTIONS

60 MINUTES

DIRECTIONS

Each of the questions or incomplete statements below is followed by five suggested answers or completions. Select the one that is best in each case and then completely fill in the corresponding space on the answer sheet.

Amount spent on computer imports



- In 1989, how much more than Italy did Germany spend on computer imports?
 - 650 million dollars
 - 700 million dollars
 - 750 million dollars
 - 800 million dollars
 - 850 million dollars
- If the amount spent on computer imports into the UK in 1991 was 20% lower than in 1990. What was spent in 1991?
 - 1,080 million dollars
 - 1,120 million dollars
 - 1,160 million dollars
 - 1,220 million dollars
 - 1,300 million dollars

NORTH ATLANTIC OILFIELDS THIS YEAR				
Field	Average Daily Output (000's Barrels)	Total Output as % age of previous years	Operating costs for year (Millions \$'s)	Exploration and capital costs (Millions \$'s)
Orion	150	90%	210	9,000
Jupitar	224	80%	240	6,000
Galileo	510	150%	300	8,000
Sirius	418	110%	375	12,000
Neptune	240	75%	120	12,000

1 Barrel Sells For N30

- Which field produced the most oil last year (root this year)
 - Orion
 - Jupiter
 - Galileo
 - Sirius
 - Neptune
- If output for the Neptune field increases by 50% next year, how many thousands of barrels more or less would its average daily output be next year, compared with output last year?
 - 40 less
 - 20 less
 - The same
 - 20 more
 - 40 more

FIRST DESTINATION OF GRADUATES ENTERING EMPLOYMENT				
	Men		Women	
	No	%	No	%
Public Service (Exct. Education)	4,605	22.3	4,030	33.9
Education	787	3.8	1,190	10.0
Industry	8,031	38.9	1,838	15.5
Commerce	5,662	27.5	3,667	30.9
other Employment	1,540	7.5	1,150	9.7
Total	20,625	100.0	11,875	100.0

3. Of this year's graduates, more women than men entered:
- (A) Public service & commerce combined
 - (B) commerce & industry combined
 - (C) education & public service combined
 - (D) commerce & education combined
 - (E) none of these
4. Approximately what proportion of all of this year's graduates entering employment went into industry?
- (A) 15%
 - (B) 20%
 - (Dc) 25%
 - (D) 30%
 - (E) 35%
5. Among new graduate entrants to employment in Education, what percentage are women?
- (A) 50%
 - (B) 60%
 - (D) 80%
 - (E) 90%

PURCHASE CREDIT PLAN

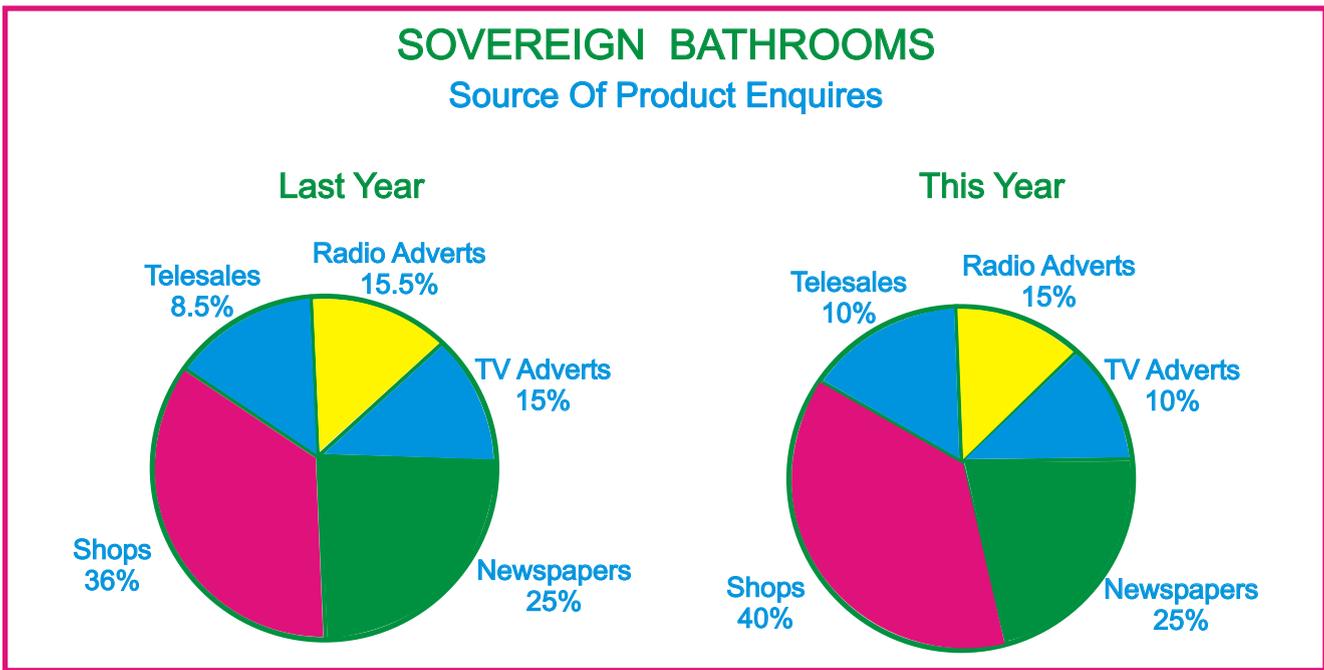
Amount Owing	Period of Repayment	
	6 Months monthly Repayments	12 Months monthly Repayment
\$250.00	\$50.10	\$27.50
\$400.00	\$75.80	\$40.95
\$600.00	\$112.50	\$59.60
\$1,000.00	\$180.65	\$95.65

6. How much more would customer have to repay each month, over a six month period, for a table priced at \$600 than a table priced at #250?
- (A) \$50.0
 - (B) \$52.40
 - (C) \$55.70
 - (D) \$58.30
 - (E) \$62.40

NUMBER OF SALES PROPOSALS ACCEPTED OR REJECTED

Sales Region	Last year		Last year	
	Accepted	Rejected	Accepted	Rejected
North West	150	58	174	132
South East	210	122	276	168

7. Of the proposals written last year, what proportion were accepted?
- (A) $\frac{1}{2}$
 - (B) $\frac{2}{3}$
 - (C) $\frac{4}{5}$
 - (D) $\frac{7}{8}$
 - (E) $\frac{11}{12}$

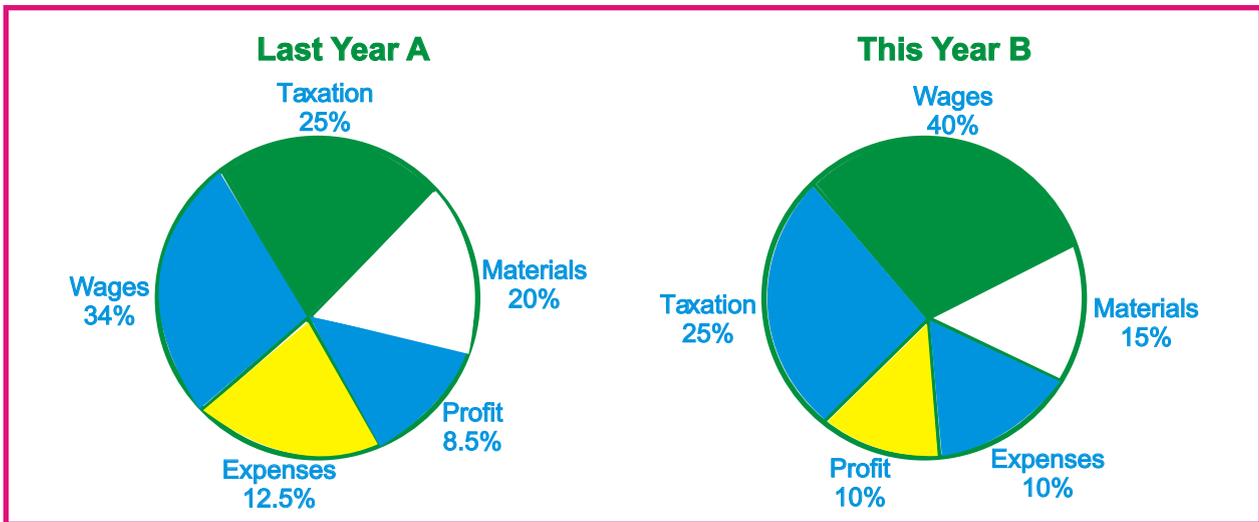


8. If newspapers generated 22,500 enquires last year how many enquiries did TV adverts produce that year?
- (A) 7,650
 - (B) 8,437
 - (C) 11,210
 - (D) 13,500
 - (E) cannot say

LINK ELECTRONICS ANNUAL APPRAISAL DATA
Reginal Performance Of Customer Service Staff

Level of Performance	Region 1	Region 2	Region 3	Region 4	Region 5
Poor	12	14	9	5	8
Acceptable	52	66	24	16	52
Good	136	120	67	79	90

9. Approximately, what percentage of all 'poor' performers work in Region 2?
- (A) 26%
 - (B) 27%
 - (C) 28%
 - (D) 29%
 - (E) 30%



10. If the tax bill for this year was \$20,000 which was an increase of 25% from last year, how much was paid out on Expenses last year?
- (A) 3,000
 - (B) 5,000
 - (C) 8,000
 - (D) 10,000
 - (E) 12,000

FACTORY OUTPUT (COMPONENTS)

Level of Quality	Factory 1	Factory 2	Factory 3	Factory 4	Factory 5
Low	9	12	6	3	8
Average	22	52	30	16	44
Good	69	136	64	81	98

11. Which factory had the highest percentage of low quality products?
- (A) factory 1
 - (B) factory 2
 - (c) factory 3
 - (D) factory 4
 - (E) factory 5

DEGREE RESULTS (BY TYPE OF SCHOOL ATTENDED)

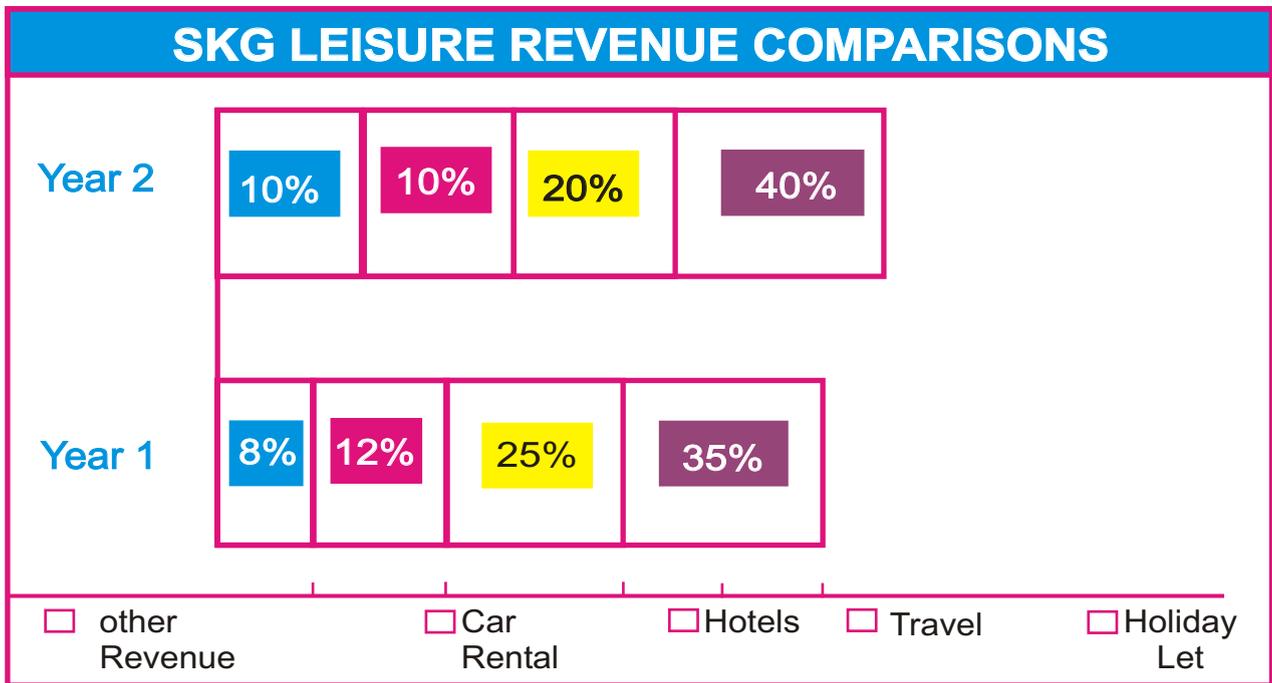
Type of School	This Year		Last Year	
	Successful	Failed	Successful	Failed
Single Sex	235	36	210	30
Co-educational	300	45	290	45

12. Among which group of degree students was there the highest success rate?
- (A) last year co-educational
 - (B) this year co-educational
 - (C) last year single sex
 - (D) this year single sex
 - (E) cannot say

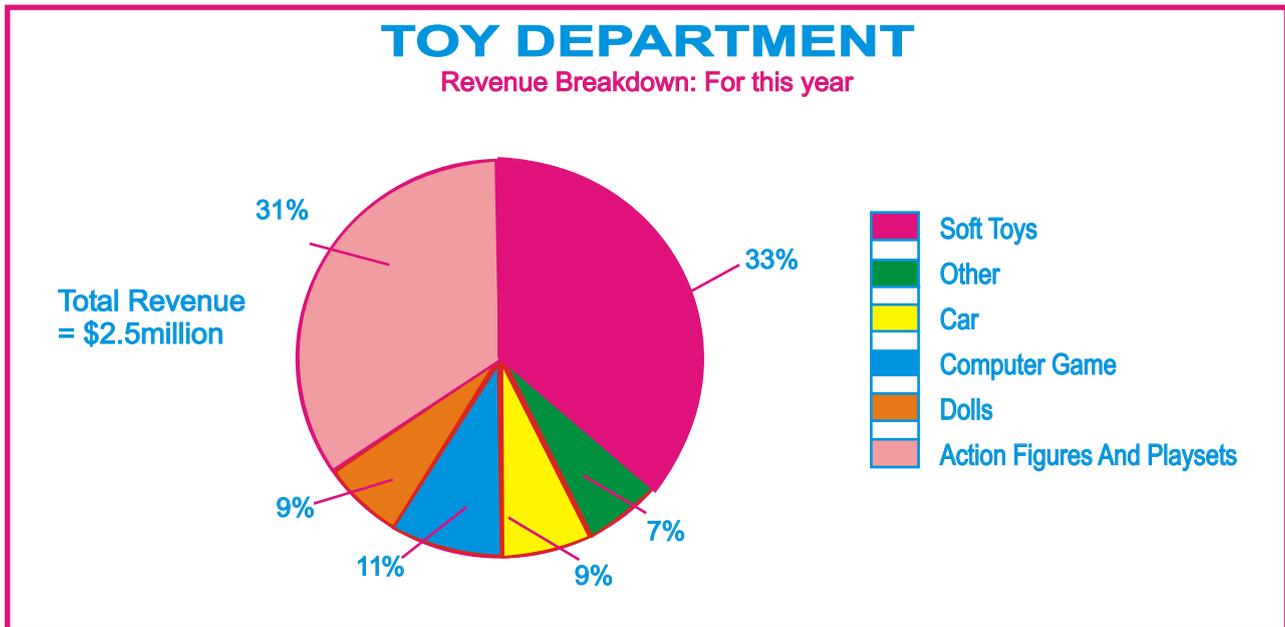
ANNUAL OUTPUT OF PRODUCTION PAINTS

	Saleable units Produced/hour (excluding rejected units)	% units rejected during production	Total hours of operation during the year
North Paint	5,520	31%	5,845
Eastern Paint	2,976	38%	4,325
Western Paint	4,503	43%	5,840
Southern Paint	4,503	21%	2,895
Central Paint	5,025	25%	4,380

13. Approximately how many units were rejected by Northern plant during production over the year?
- (A) 10,100,000
 - (B) 12,300,000
 - (C) 14,500,000
 - (D) 15,600,000
 - (E) 17,800,000



14. If the revenue for Car Rental in Year 1 was half that for Hotels in year 2 when Holiday letting accounted for 5.04m Euros, what was the revenue from Hotel in year 1?
- (A) 0.84m
 - (B) 1.05m
 - (C) 1.26m
 - (D) 2.10m
 - (E) 2.52m



15. What was the approximate sales revenue of Department/s three product types that bring most revenue?
- (A) \$1.60m
 (B) \$1.77m
 (C) \$1.83m
 (D) \$1.88m
 (E) \$2.05m
16. If the breakdown of revenue in the Toy Department had been the same last year as for this year, but last year's revenue had been \$1/2m less than that for this year, what would have been the revenue brought in by cars for This year and last year combined?
- (A) \$0.180m
 (B) #0.405m
 (C) \$0.450m
 (D) #0.495m
 (E) \$0.630m

OUTPUT FROM POWER STATIONS

Power Station	Output capacity (meg a watts)	Proportion of potential output utilized	Fixed cost	Generating cost per megawatts year(\$)
Alpha	1,000	87.5%	\$75 million	80,000
Beta	2,000	63.0%	\$15 million	200,00
Gamma	1,250	10.0%	\$150 million	80,000
Delta	1,500	47.0%	\$90 million	70,000
Omega	2,800	43.0%	\$25 million	180,000

Over Last Year

17. Which power station produced the most electricity last year?
- (A) Alpha
(B) Beta
(C) Gamam
(D) Delta
(E) Omega
18. Which power station produced the least amount of electricity last year?
- (A) Alpha
(B) Beta
(C) Gamam
(D) Delta
(E) Omega
19. What was the total output of power stations Gamma and Delta last year (in megawatts over one year)?
- (A) 570
(B) 830
(C) 1,160
(D) 1,980
(E) 2,750

ANNUAL EUROPEAN RETAIL STATISTICS

Country	Output capacity (megawatts)	Proportion of potential output utilized	Fixed cost	Generating cost per megawatts year(\$)
UK	56,753	737,886	65,506	28,262
Demark	5,134	117,238	10,582	3,246
France	55,385	935,579	105,354	41,515
Italy	57,221	757,177	128,082	29,050
Netherlands	14,704	253,206	21,773	7,973

20. Which country has the highest GDP per head population?
(A) UK
(B) Denmark
(C) france
(D) Italy
(E) Netherlands
21. How much higher is the GDP per head of population in the Netherlands than in the UK?
(A) \$1,583
(B) \$2,894
(C) 4,218
(D) \$6,790
(E) \$8,421
22. On average, how much does each French person spend on food per day? (Figures relates to a 365 day Period)
(A) #2.04
(B) #3.67
(C) \$5.21
(D) \$7.28
(E) \$9.62

BREAKDOWN BY CROSS BORDERS CONSTRUCTION

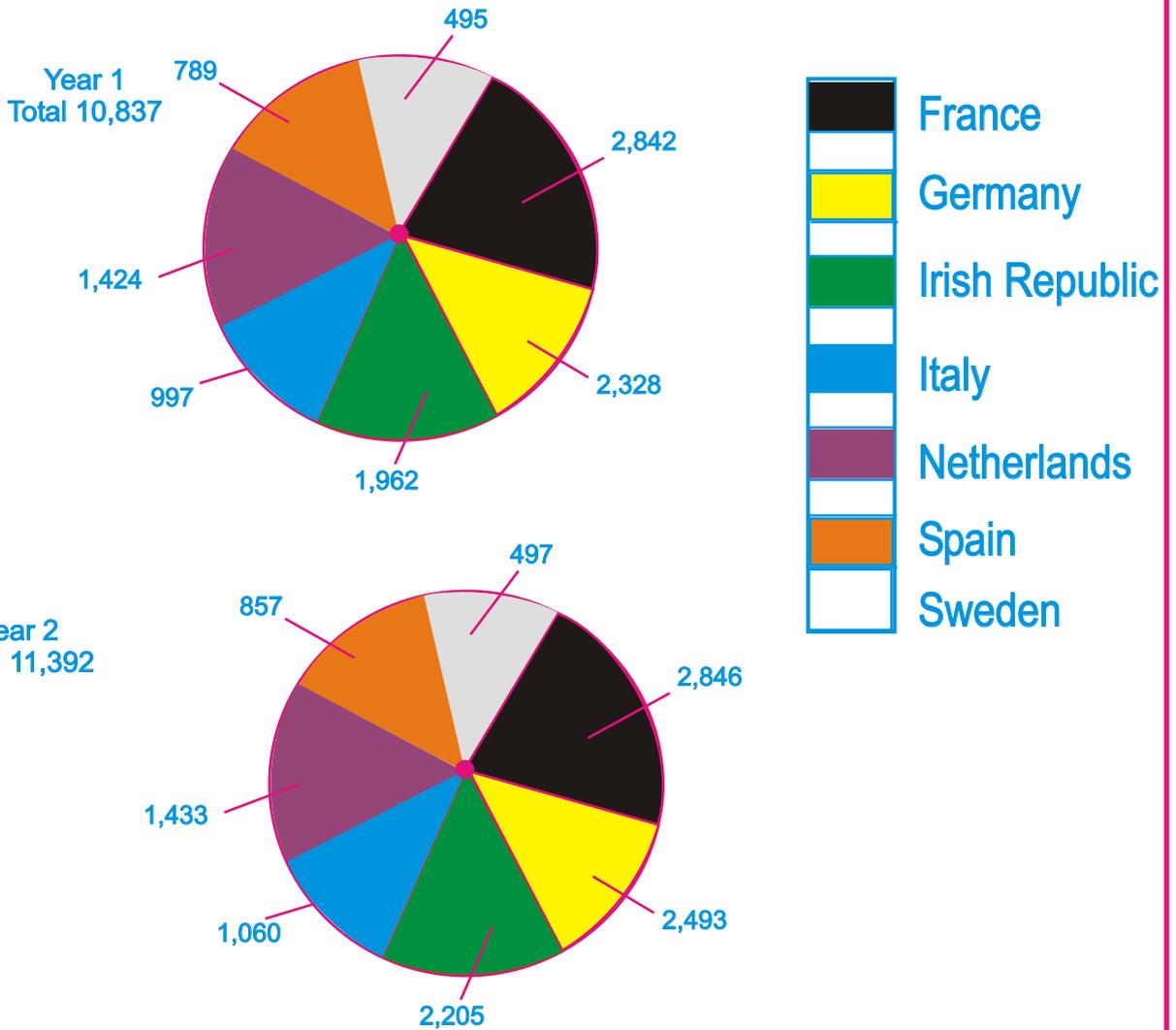
Company	Working Capital (in \$s)	Annual Turnover (in \$s)	Operating Profit (in \$s)	Share Price (pence)	Number of Shares
PPB Construction	85	68	18	216	1.25
Toleo Cement	76	9	(4)	60	1.35
Euro Architects	160	40	(8)	43	0.68
Easy Build Prefab	81	37	6	68	1.07
Terra Firma Holdings	43	20	4	146	2.40

*In Millions Note: All figures in brackets are negatives.

23. To the nearest whole number, what percentage of Terra Firm's turnover is profit?
- (A) 5%
 - (B) 9%
 - (C) 16%
 - (D) 20%
 - (E) 46%
24. What company has the lowest capital per share?
- (A) PPB
 - (B) Toleo
 - (C) Euro
 - (D) Easy Build
 - (E) terra Firma
25. If Euro Architects' turnover represents on 25% increase, what was its turnover in the previous year?
- (A) 24m
 - (B) 30m
 - (C) 32m
 - (D) 34m
 - (E) 36m

NUMBER OF EU NATIONALITIES VISITING THE UK

Revenue Breakdown: For this year



26. If in Year 2, 80% of the total number of visitors to the UK traveled in parties of 2 or more persons how many single travelers were visiting the UK from France in that year (in thousands)?
- (A) 570
 - (B) 1,236
 - (C) 1,895
 - (D) 2,278
 - (E) cannot say
27. What was the increase in the percentage of Germans visiting the UK between Year 1 and Year 2?
- (A) 2.91%
 - (B) 3.38%
 - (C) 6.62%
 - (D) 7.09%
 - (E) 9.24%

BANA PRICE INDEX

Year	General Inflation Rate for the year (Jan - Dec)	Banana Price Index at start of year
Year 1	5%	100
Year 2	8%	132
Year 3	10%	145
Year 4	5%	110
Year 5	15%	128

28. How much higher was the banana index at the beginning of Year 3 than if it had risen with the general inflation rate Year 1 and Year 2?
- (A) 31.6
(B) 323.0
(C) 32.3
(D) 34.2
(E) 36.8
29. Which start of year banana price shared the greatest percentage change, relative to the price a year earlier?
- (A) Year 1
(B) Year 2
(C) Year 3
(D) Year 4
(E) Year 5
30. During which year was the rise in banana price steepest in relation to the general inflation rate.
- (A) Year 1
(B) Year 2
(C) Year 3
(D) Year 4
(E) Year 5



31. If the share price had kept up with an inflation rate of 10% from December Year 2, how much greater than the actual value would the share price have been in December Year 4?
 - (A) 15.3p
 - (B) 16.2p
 - (C) 21.6p
 - (D) 25.5p
 - (E) 26.5p

32. In December Year 2, employees were offered the opportunity to buy shares at 10% below their market value. If an employee purchased 150 shares, what was the total increase or decrease in value one year later?
 - (A) +\$31.95
 - (B) +\$22.95
 - (C) +\$4.95
 - (D) -\$18.00
 - (E) -\$31.95

33. If the shareholder who bought 80 share in June Year 3 and sold them in June Year 4 broke even on the shares over the year, how much dividend per share was paid that year?
 - (A) 1.8p
 - (B) 2.4p
 - (C) 3.2p
 - (D) 4.0p
 - (E) 4.6p

BIOCHEMISTRY, CELL AND MOLECULAR BIOLOGY TEST

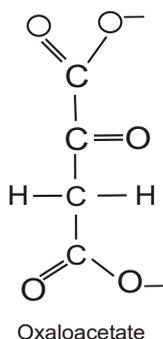
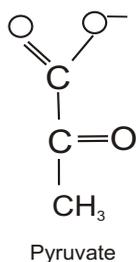
100 QUESTIONS

60 MINUTES

DIRECTIONS

Each of the questions or incomplete statements below is followed by five suggested answers or completions. Select the one that is best in each case and then completely fill in the corresponding space on the answer sheet.

1. RNA molecules that exhibit catalytic activity are called
- (A) mRNAs
 - (B) ribonucleases
 - (C) ribosomes
 - (D) ribozymes
 - (E) ribonucleotides



2. The conversion of pyruvate to oxaloacetate (structures shown above) is likely to require which of the following coenzymes?
- (A) Biotin
 - (B) Vitamin B₁₂
 - (C) Thiamine pyrophosphate
 - (D) pyridoxal phosphate
 - (E) Flavin adenine dinucleotide
3. Which of the following hormones initiates biological actions by crossing the plasma membrane and then binding to a receptor?
- (A) Glucagon
 - (B) Estradiol
 - (C) Insulin
 - (D) Norepinephrine
 - (E) Adrenocorticotrophic hormone

4. Which of the following takes place during oxidative phosphorylation in mitochondria?
- (A) Protons are pumped from the matrix to the intermembrane space.
 - (B) Protons are pumped from the intermembrane space to the matrix
 - (C) Electrons are pumped from the matrix to the intermembrane space.
 - (D) Electrons are pumped from the intermembrane space to the matrix
 - (E) NADH is pumped from the matrix to the intermembrane space.
5. An enzyme that catalyzes the reaction A → B changes the
- (A) heat of reaction
 - (B) equilibrium constant
 - (C) equilibrium concentration of A
 - (D) entropy of the reaction
 - (E) rate of both the forward and reverse reactions
6. The major mechanism of turnover of molecular components of the plasma membrane occurs through
- (A) endocytosis of patches of membrane
 - (B) diffusion of individual molecules into the cytoplasm
 - (C) recovery of specific components by selective receptors
 - (D) expulsion of integral molecules into the extracellular medium
 - (E) the concerted action of multifunctional enzyme complexes.
7. Cells with abundant apical microvilli are characteristically found in
- (A) exocrine glands
 - (B) the reticuloendothelial system
 - (C) adipose tissue
 - (D) neuronal dendrites
 - (E) absorptive epithelia

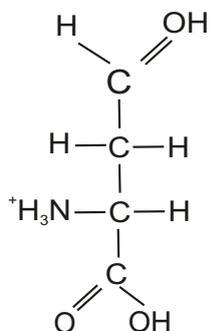
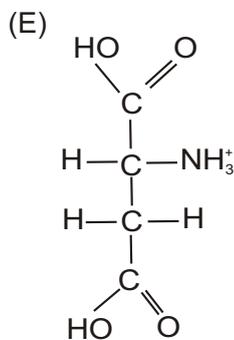
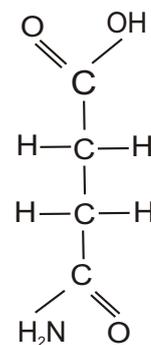
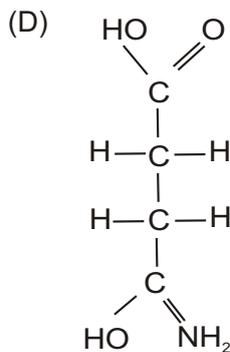
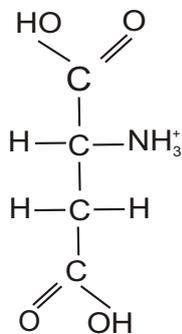
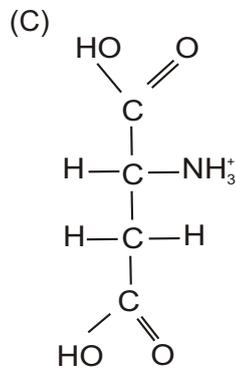
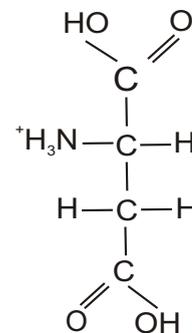
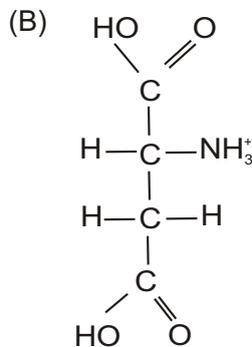
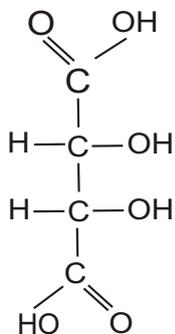
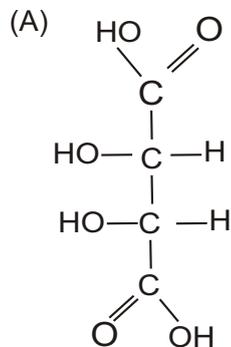
8. Diacylglycerol activates which of the following enzymes?
(A) Protein kinase A
(B) Protein kinase C
(C) MAP kinase
(D) Tyrosine kinase
(E) Phosphorylase *b* kinase
9. Cellular proteins destined for secretion are sorted and packaged in the
(A) lysosomes
(B) endosomes
(C) endoplasmic reticulum
(D) *trans* Golgi network
(E) peroxisomes
10. Incubation of gram-negative bacteria with lysozyme in an isotonic medium causes rod-shaped bacteria to assume a spherical shape. The cause of this phenomenon is
(A) absorption of water
(B) destruction of the cell wall
(C) destruction of the cytoskeleton
(D) damage to the plasma membrane
(E) change in gene expression
11. Virus-mediated transfer of cellular genetic material from one bacterial cell to another by means of virus particles is called
(A) induction
(B) transfection
(C) transformation
(D) transposition
(E) transduction
12. Which of the following processes leads to formation of polytene chromosomes?
(A) Nondisjunction of chromatids during meiosis
(B) Recombination between adjacent chromosome segments
(C) Sister chromatid exchange
(D) Inactivation of one chromosome of each homologous pair
(E) Repeated replication without separation of chromatids.
13. True statements about retrotransposons include which of the following?
I. They replicate through an RNA intermediate
II. They utilize reverse transcriptase for replication.
III. They may contain introns.
(A) I only
(B) III only
(C) I and III only
(D) II and III only
(E) I, II and III
14. Which of the following is true about a circular double-stranded DNA genome that is determined by chemical means to be 21 percent adenosine?
(A) The genome is 10.5% guanosine
(B) The genome is 21% guanosine
(C) The genome is 29% guanosine
(D) The genome is 58% guanosine
(E) The base percent composition of guanosine in the genome cannot be determined from the information given.
15. In the classical model of transcriptional control described by Jacob and Monod, a repressor protein binds to
(A) an enhancer
(B) an AUG sequence
(C) an operator
(D) a ribosome-binding site
(E) a TATA box
16. In an intact cell, the free energy change ($\Delta G'$) associated with an enzyme-catalyzed reaction is frequently different from the standard free energy change (ΔG°) of the same reaction because in the intact cell the
(A) activation energy is different
(B) reaction is always near equilibrium
(C) enzyme may be regulated allosterically
(D) reactants are not at 1M concentrations
(E) reaction may be catalyzed by more than one enzyme.

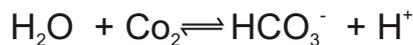
Half-reaction	E° (V)
Fumarate + $2H^{+}$ + $2e^{-}$ → succinate	0.031
Oxaloacetate + $2H^{+}$ + $2e^{-}$ → malate	-0.166
Pyruvate + $2H^{+}$ + $2e^{-}$ → lactate	-0.185
Acetaldehyde + $2H^{+}$ + $2e^{-}$ → ethanol	-0.197
NAD^{+} + H^{+} + $2e^{-}$ → NADH	-0.320
Acetoacetate + $2H^{+}$ + $2e^{-}$ → β -hydroxybutyrate	-0.346

17. Which of the following redox reactions would be expected to proceed as written? (Assume standard conditions and the Presence of appropriate enzymes; E° values are shown above).
- (A) Malate + NAD^{+} → oxaloacetate + NADH + H^{+}
 (B) Acetoacetate + NADH + H^{+} → β -hydroxybutyrate + NAD^{+}
 (C) Pyruvate + β -hydroxybutyrate → lactate + acetoacetate
 (D) Malate + pyruvate → oxaloacetate + lactate
 (E) Acetaldehyde + succinate → ethanol + fumarate
18. Plants and some bacteria differ from animals in that plants and some bacteria can
- (A) form polymers from glucose
 (B) use carbon dioxide to increase their biomass
 (C) produce NADH via reductive reactions
 (D) synthesize glutamate and aspartate
 (E) use glucose by the glycolytic pathway
19. Which of the following can act as a nucleophile in metabolic reactions?
- I. Nitrogen of an amino group
 II. Oxygen of a hydroxyl group
 III. Carbon of a carbonyl group
- (A) I only
 (B) II only
 (C) III only
 (D) I and II only
 (E) I, II and III
20. In addition to proteins, major components of very low density lipoproteins (VLDL) circulating in the blood of a normally fed mammal include
- (A) triacylglycerol, cholesterol, and phospholipid
 (B) triacylglycerol, squalene, and phospholipid
 (C) triacylglycerol, squalene, and sphingosine
 (D) monoacylglycerol, cholesterol, and phospholipid
 (E) monoacylglycerol, squalene, and sphingosine
21. Elevation of intracellular inositol trisphosphate (IP_3) results in a release of Ca^{2+} from which of the following organelles?
- (A) Peroxisome
 (B) Lysosome
 (C) Mitochondrion
 (D) Nucleus
 (E) Smooth endoplasmic reticulum
22. Which of the following is the last to occur after the binding of a sea urchin sperm to an egg?
- (A) Increase in cytosolic pH
 (B) Increase in calcium concentration
 (C) Activation of protein synthesis
 (D) Initiation of mRNA synthesis
 (E) Exocytosis of cortical granules
23. All of the following are true about heterotrimeric G proteins EXCEPT:
- (A) They bind either GDP or GTP
 (B) They have GTPase activity
 (C) They act as binary (on-off) switches
 (D) They help amplify a hormone's signal
 (E) They phosphorylate proteins.
24. The completion of the S phase of the cell cycle of a mammalian cell is marked by all of the following EXCEPT:
- (A) Histone content per cell is double that of cells in G_1 .
 (B) In replicated DNA, newly incorporated bases are paired with parental bases.
 (C) each replicated chromosome has four telomeres.
 (D) Sister chromatids disjoin from one another.
 (E) the nucleus contains the equivalent amount of DNA of a tetraploid cell in G_1 .

25. In the lysosomal storage disease called I-cell disease, all of the hydrolases normally found in lysosomes are instead found in the bloodstream. Which of the following is the most likely cause of this disease?
- (A) Lack of phosphorylation of lysosomal enzymes
 - (B) a nonfunctional proton pump in the lysosomal membrane
 - (C) a mutation in the clathrin gene
 - (D) inability of the endoplasmic reticulum to form lysosomal vesicles
 - (E) Absence of sialic acid on glycolipids in the Golgi complex
26. All of the following contribute to promoter binding by RNA polymerase in *E. coli* EXCEPT the
- (A) rho factor
 - (B) -10 consensus sequence
 - (C) -35 consensus sequence
 - (D) β' subunit of RNA polymerase
 - (E) β subunit of RNA polymerase
27. "Zinc fingers" are important in cellular regulation because they are
- (A) at the catalytic site of many kinases
 - (B) a structural motif in many DNA-binding proteins
 - (C) characteristic of palindromic stretches of unique-sequence DNA
 - (D) restricted to the cytoplasmic domain of growth-factor receptors
 - (E) structures with high redox potential
28. In prokaryotes, environmental sensing frequently involves regulatory proteins (two-component systems) that sense and respond to changes in surroundings. These two-component systems may involve which of the following?
- I. Protein phosphorylation
 - II. Transcriptional regulation
 - III. Membrane proteins
- (A) I only
 - (B) II only
 - (C) III only
 - (D) II and III only
 - (E) I, II and III
29. In the cross $AaBb \times AaBb$, Mendel's principle of independent assortment predicts that the ratio of the four possible phenotypes of the offspring will be.
- (A) 1 : 1 : 1 : 1
 - (B) 3 : 2 : 2 : 1
 - (C) 4 : 2 : 2 : 1
 - (D) 9 : 3 : 3 : 1
 - (E) 9 : 7 : 3 : 1
30. Common lesions found in DNA after exposure to ultraviolet light are
- (A) pyrimidine dimers
 - (B) single strand breaks
 - (C) base deletions
 - (D) purine dimers
 - (E) transpositions

31. Which of the following pairs of structures depicts stereoisomers according to conventional rules of projections?





32. The reaction shown above is conducted in a closed system containing gaseous CO_2 and a buffered aqueous solution. If the reaction is allowed to reach equilibrium, the final concentration of bicarbonate ions in the aqueous phase would most likely be increased by
- (A) adding water while keeping the partial pressure of CO_2 constant
 - (B) adding carbonic anhydrase
 - (C) increasing the pH of the buffered aqueous solution
 - (D) reducing the partial pressure of CO_2
 - (E) reducing the temperature of the reaction solution
33. Which of the following types of bonds or interactions are LEAST likely to be involved in stabilizing the three-dimensional folding of most proteins?
- (A) Hydrogen bonds
 - (B) Electrostatic bonds
 - (C) Hydrophobic interactions
 - (D) Disulfide bonds
 - (E) Ester bonds
34. In animals, an enzyme unique to gluconeogenesis is
- (A) enolase
 - (B) phosphoglyceromutase
 - (C) glyceraldehyde 3-phosphate dehydrogenase
 - (D) aldolase
 - (E) fructose 1,6 bisphosphatase
35. Approximately how many moles of ATP will be generated as a result of the oxidation of one mole of FADH_2 in an actively respiring mitochondrion?
- (A) 0
 - (B) 2.0
 - (C) 3.0
 - (D) 4.5
 - (E) 6.0
36. If a subcellular fraction from liver tissue exhibits a high level of acid phosphatase activity, it most likely contains
- (A) nuclei
 - (B) lysosomes
 - (C) endoplasmic reticulum
 - (D) coated vesicles
 - (E) mitochondria
37. Evidence indicating that chloroplasts were originally free-living prokaryotes that subsequently evolved a symbiotic relationship with a eukaryotic host includes all of the following EXCEPT the
- (A) similarities of rRNA sequences between chloroplasts and free-living prokaryotes
 - (B) similarities in structure between chloroplasts and some contemporary free-living prokaryotes
 - (C) presence of circular DNA in chloroplasts and in free-living prokaryotes
 - (D) susceptibility of chloroplasts to inhibitors of prokaryotic protein synthesis
 - (E) ability of chloroplasts to synthesize all their own proteins
38. Which of the following is NOT a characteristic of intermediate filaments?
- (A) they form the nuclear lamina
 - (B) they provide mechanical stability to animal cells
 - (C) their protein composition is tissue specific
 - (D) They are composed of globular monomers that polymerize to form fibers.
 - (E) They include the keratin filaments of epithelial cells.
39. The amino acid sequence of a novel membrane protein contains four immunoglobulin-like domains and six fibronectin-like repeats. This protein is most likely a
- (A) cell adhesion molecule
 - (B) hormone-responsive ion channel
 - (C) G protein
 - (D) protein-serine/threonine kinase
 - (E) transcription factor
40. Which of the following is correct concerning the evolution of Photosystem II in cyanobacteria?
- (A) it made Photosystem I in these organisms unnecessary for photosynthetic fixation of carbon dioxide.
 - (B) it provided these organisms with an almost inexhaustible supply of electrons from water.
 - (C) it allowed these organisms to use any electron donor to replace electrons lost from excited chlorophyll a molecules.
 - (D) it allowed photochemically produced ATP to be exported to the cytoplasm.
 - (E) it allowed these organisms to generate ATP for the fixation of carbon dioxide into sugars without chemiosmosis.

41. Which of the following sequences of events occurs when *E. Coli* are released from catabolite repression by transfer to low-glucose medium?
- (A) cAMP levels rise, cAMP binds to CAP, cAMP-CAP complex binds to a site on DNA and activates transcription
 - (B) cAMP levels rise, cAMP binds to CAP, cAMP-CAP complex binds to a site on DNA and represses transcription.
 - (C) cAMP levels rise, cAMP binds to CAP, cAMP-CAP complex is removed from a site on DNA and activates transcription.
 - (D) cAMP levels fall, cAMP is removed from CAP, CAP binds to a site on DNA and activates transcription.
 - (E) cAMP levels fall, cAMP is removed from CAP, CAP binds to a site on DNA and represses transcription.
42. The ability of yeast to produce invertase, an enzyme necessary to metabolize sucrose, was abolished by either of two mutations, m-1 and m-2, that arose spontaneously in two separate yeast cultures. A heterozygote formed by mating m-1 mutant cells with m-2 mutant cells would be expected to restore the yeast's ability to produce invertase if m-1 and m-2 are
- (A) mutations of two separate nonallelic genes
 - (B) in the same complementation groups
 - (C) identical alleles of the same gene
 - (D) suppressible by the same suppressor
 - (E) both temperature-sensitive mutations
43. All of the following components of a retrovirus are encoded by the viral genome EXCEPT
- (A) matrix proteins
 - (B) viral RNA's
 - (C) capsid proteins
 - (D) envelope lipids
 - (E) receptor-binding proteins
44. Some viruses have increased the coding potential of their genome by
- (A) integrating into the host genome
 - (B) using host ribosomes for translation
 - (C) using alternative splicing sites
 - (D) using a degenerate triplet code
 - (E) covalently linking a protein to the genome
45. Which of the following is most likely to lead to a loss of gene function?
- (A) a missense mutation in the open reading frame
 - (B) a change from TAA codon to a TAG codon in the coding region
 - (C) A changing from T to C in the promoter region
 - (D) A frameshift mutation in the coding region
 - (E) A sequence change in the 3' untranslated region
46. The molar absorption coefficient (extinction coefficient) of NADH at 340 nanometers is 6,220 liters per mole per centimeter, whereas that of NAD at 340 nanometers is 0. What absorbance will be observed when light at 340 nanometers passes through a 1-centimeter cuvette containing 10-micromolar NADH and 10-micromolar NAD?
- (A) 0.0031
 - (B) 0.062
 - (C) 0.124
 - (D) 0.31
 - (E) 0.62
47. All of the following processes occur in the mitochondria of mammalian cells EXCEPT
- (A) fatty acid biosynthesis
 - (B) protein synthesis
 - (C) DNA synthesis
 - (D) beta oxidation of fatty acids
 - (E) the citric acid cycle
48. Rubisco catalyzes the carboxylation and also the oxygenation of ribulose 1, 4-bisphosphate. The initial products of these reactions include which of the following?
- I. Glyceraldehyde 3 - phosphate
 - II. 2-Phosphoglycolate
 - III. 3-Phosphoglycerate
- (A) I only
 - (B) II only
 - (C) III only
 - (D) I and II
 - (E) II and III
49. Which of the following is meant by the statement that glucose and mannose are epimers?
- (A) One is an aldose and the other is a ketose
 - (B) One is a pyranose and the other is a furanose
 - (C) They are mirror images of each other
 - (D) They rotate the plane of light in opposite directions.
 - (E) They differ only in the configuration about one carbon atom.

50. A solution contains DNA polymerase I, Mg^{2+} salts of dATP, dGTP, dCTP, and dTTP, and an appropriate buffer. Which of the following DNA molecules would serve as a template for DNA synthesis when added to this solution?
- (A) A single stranded closed circle
 - (B) A single-stranded closed circle base-paired to a shorter linear strand with a 3' - terminal hydroxyl
 - (C) A single-stranded closed circle base-paired to a shorter linear strand with a 3' -terminal phosphate
 - (D) a double-stranded closed circle
 - (E) A blunt-ended, double stranded linear molecule with a 3' terminal hydroxyl at each end.
51. Which of the following enzymes plays a direct role in the biosynthesis of collagen?
- (A) Prolyl hydroxylase
 - (B) Tyrosine hydroxylase
 - (C) Choline oxidase
 - (D) Monoamine oxidase
 - (E) Tryptophan oxygenase
52. Organized clathrin structures are typically associated with the
- (A) nuclear envelope and endoplasmic reticulum
 - (B) lysosomes
 - (C) *trans* Golgi network and plasma membrane
 - (D) extracellular matrix
 - (E) inner membrane complexes of mitochondria and chloroplasts
53. If the M-phase-promoting factor is injected into a *Xenopus* primary oocyte, which of the following occurs?
- (A) S phase begins
 - (B) The oocyte enters G_0
 - (C) Apoptosis begins
 - (D) The germinal vesicle (nucleus) breaks down
 - (E) Mitosis is completed
54. Actin filaments are found in all of the following EXCEPT the
- (A) flagella of bacteria
 - (B) sarcomeres of skeletal muscle cells
 - (C) stress fibers of fibroblasts
 - (D) microvilli of the intestinal brush border
 - (E) contractile rings of dividing animal cells
55. Which of the following does NOT make direct use of a pH or proton gradient?
- (A) Mitochondrion
 - (B) Chloroplast
 - (C) Cyanobacterium
 - (D) Protozoan cilium
 - (E) Bacterial flagellum
56. A study is done on a mammalian cell line that has a doubling time of 24 hours. These cells are synchronized in G_1 and then labeled for 2 days with BrdU (an analog of thymidine that increases the density of DNA into which it is incorporated). At the end of the labeling period, chromosomal DNA is isolated from the cells and its density analyzed by equilibrium centrifugation in cesium chloride gradients. Which of the following patterns would be expected to be seen? (H = heavy, L = light)
- (A) 100% H/H
 - (B) 100% H/L
 - (C) 50% H/H, 50% H/L
 - (D) 50% H/H, 50% L/L
 - (E) 25% H/H, 50% H/L, 25% L/L
57. Which of the following statements is correct concerning a homocysteine?
- (A) it is part of the promoter in eukaryotic genes that code for proteins involved in segmentation
 - (B) it is a conserved protein structure found in glycolytic pathway enzymes
 - (C) it is a conserved protein structure found in tRNA-binding proteins
 - (D) it is a conserved DNA sequence found in genes that code for proteins that regulate development
 - (E) it is a conserved DNA sequence found in genes that code for proteins that regulate homeostasis
58. Which of the following best describes the function of the sigma subunit in the RNA polymerase of *E. Coli*?
- (A) it is essential for elongation of the RNA transcript
 - (B) it is essential for the recognition of and binding to the promoter sequence
 - (C) it increases RNA polymerase binding to any DNA template
 - (D) it is required for transcription termination
 - (E) it keeps the core complex from dissociating
59. **When bacteriophage lambda infects a sensitive bacterium, one of the first messenger RNA species synthesized is very short, beginning at a site P_L and extending just through an adjacent gene *N*. After the appearance of the gene *N* protein, messages become much longer, still beginning at P_L but extending far beyond gene *N*. The *N* gene encodes.**
- (A) an antiterminator acting just beyond gene *N*
 - (B) a new sigma factor acting on a promoter beyond gene *N*
 - (C) an activator for a promoter beyond gene *N*
 - (D) an antirepressor that removes a protein repressor bound at gene *N*
 - (E) a protein that stabilizes the longer message.

Master Job Aptitude Test

Biochemistry, Cell and Molecular Biology Test

60. When the coding region of a prokaryotic gene is cloned into the *lac Z* gene downstream from the translational initiator, the chance of an in-frame fusion is
- (A) $\frac{1}{2}$
 - (B) $\frac{1}{3}$
 - (C) $\frac{1}{5}$
 - (D) $\frac{1}{6}$
 - (E) $\frac{1}{9}$
61. What is the pK_a for trimethylammonium in water if the base ionization constant (K_b) for trimethylamine is 7.4×10^{-5} ? (Log $7.4 \times 10^{-5} = -4.13$)
- (A) -4.13
 - (B) 2.87
 - (C) 4.13
 - (D) 9.87
 - (E) 11.13
62. The source of oxygen for O_2 production during photosynthesis by higher plants is
- (A) CO_2
 - (B) HCO_3^-
 - (C) H_2O
 - (D) ATP
 - (E) Chlorophyll
63. The rate-limiting step for fatty acid synthesis is catalyzed by
- (A) acetyl CoA carboxylase
 - (B) ATP citrate lyase
 - (C) malic enzyme
 - (D) pyruvate dehydrogenase
 - (E) thiolase
64. Which of the following is true about the change in enthalpy (ΔH) of a reaction that is spontaneous at room temperature?
- (A) it is equal to $T \Delta S$
 - (B) It is positive and the reaction is exothermic
 - (C) It is negative and the reaction is endothermic
 - (D) it must be equal to zero
 - (E) it can be either positive or negative.
65. Which of the following intermediate compounds is involved when a peptide is hydrolyzed by chymotrypsin?
- (A) An ester between the substrate's acyl carbon and the serine of the active site
 - (B) a thioester between the substrate's acyl carbon and the cysteine of the active site
 - (C) An amide between the substrate's acyl carbon and the lysine of the active site
 - (D) An amide between the substrate's acyl carbon and the asparagine of the active site
 - (E) An amide between the substrate's α amino group and the aspartate of the active site
66. Heat-shock proteins were originally described as proteins produced in response to heat stress. Some are now known to act as
- (A) molecular chaperones that regulate protein folding
 - (B) protein-tyrosine kinases
 - (C) proteases that degrade ubiquitin-tagged proteins
 - (D) GTPase-activating proteins
 - (E) ionophores that dissipate H^+ gradients
67. All of the following statements about type-B cyclin proteins are correct EXCEPT
- (A) Their presence is required for exit from mitosis
 - (B) They are present in cells during the G_2 phase.
 - (C) They are degraded via the ubiquitin pathway.
 - (D) They activate the Cdc2 kinase
 - (E) They are newly synthesized during every cell cycle.
68. Which of the following is an advantage of confocal microscopy over conventional fluorescence microscopy?
- (A) The interaction of a laser beam with the surface allows the imaging of individual macromolecules.
 - (B) The use of electrons instead of light to image the specimen results in greatly increased resolving power.
 - (C) Optical sections can be taken at different depths in a specimen.
 - (D) Only scattered light enters the microscope lens, making the object appear illuminate against a dark background.
 - (E) The inherent contrast of an unstained specimen is enhanced.
69. Which of the following properties is common all cytoskeletal motor proteins (such as kinesins, dyneins, and myosins)?
- (A) An actin-binding domain
 - (B) Two globular-head domains
 - (C) The ability to bind to biological membranes
 - (D) ATPase activity
 - (E) Two heavy chains and four light chains
70. Which of the following is NOT involved in the processing of mRNA precursors in eukaryotic cells?
- (A) capping of the 5' end
 - (B) Addition of polyA
 - (C) Excision of introns
 - (D) Splicing of exons
 - (E) Transport of the pre-mRNA to the cytoplasm

Master Job Aptitude Test

Biochemistry, Cell and Molecular Biology Test

71. DNA polymerase contain a lysine residue that is important for binding to DNA. Mutations were found that converted this lysine to either glutamate, glycine, valine, or arginine. Which mutations would be predicted to be the most and least harmful to the ability of the enzyme to bind DNA?

	<u>Most</u>	<u>Least</u>
(A)	Valine	Aspartate
(B)	Glycine	Arginine
(C)	Arginine	Glycine
(D)	Glutamate	Valine
(E)	Glutamate	Arginine

72. A mammalian zygote resulted from the fusion of a normal gamete with a gamete that formed after a nondisjunction event in one chromosome during meiosis II. Which of the following best describes the zygote?

- (A) Diploid
 (B) Haploid
 (C) Aneuploid
 (D) Polyploid
 (E) Polysomic

73. The specialized structures located at the ends of eukaryotic chromosomes are called

- (A) terminators
 (B) telomeres
 (C) long terminal repeats (LTR's)
 (D) centromeres
 (E) kinetochores

Black body, flat wings:	12.5%
Black body, curved wings:	37.5%
Yellow body, curved wings:	12.5%
Yellow body, flat wings:	37.5%

74. A homozygous male fruit fly with black body color and curved wings is crossed with a virgin homozygous female fruit fly with yellow body color and flat wings. All the offspring of this cross display yellow body color and flat wings. If a virgin female selected from these offspring is mated to a homozygous male fruit fly with black body color and curved wings, four types of offspring will occur in the proportions shown above. Which of the following conclusions can be drawn about the nature of inheritance on the basis of these data?

- (A) Black body color and curved wings are dominant over yellow body color and flat wings.
 (B) The results do not fit the typical 9 : 3 : 3 : 1 ratio, making this an example of multiple allelic inheritance rather than a normal dihybrid cross.
 (C) Recombinant types of offspring, as in this case, appear more frequently than do parental types.
 (D) These genes for body color and wing shape are independently assorting from each other.
 (E) These genes for body color and wing shape are linked.

75. A bacterial protein-coding gene contains a terminator codon in the middle of the coding region, yet expression of the gene in the bacterium produces a functional protein. Translation of the gene probably requires.

- (A) the excision of an intron
 (B) a suppressor tRNA
 (C) ribosomes that lack 5S RNA
 (D) an mRNA with no ribosome binding site
 (E) an mRNA with no secondary structure

76. Which of the following is NOT a potential problem associated with expressing a eukaryotic, protein-coding nuclear gene in prokaryotic cells?

- (A) Lack of an intron-splicing mechanism in prokaryotes
 (B) Differences in the translation initiation codons used by eukaryotic cells and prokaryotic cells.
 (C) Susceptibility of the protein product to prokaryotic proteases.
 (D) Stability of mRNA in prokaryotic cells
 (E) Differences in transcriptional signals between eukaryotic cells and prokaryotic cells.

77. Treatment of intact mitochondria with an uncoupler, such as 2,4-dinitrophenol, in the presence of ADP, P_i, succinate, and oxygen would have which of the following effects on the rates of electron transport and ATP synthesis?

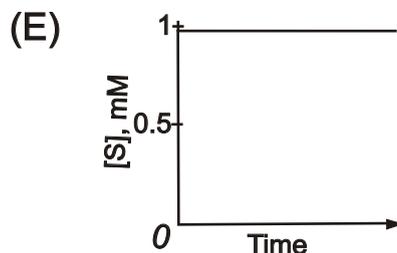
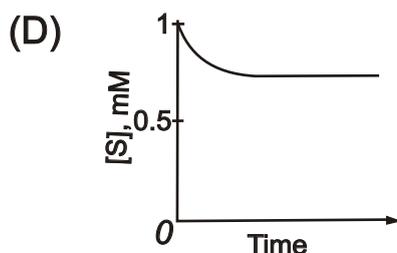
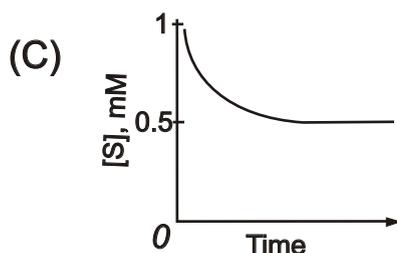
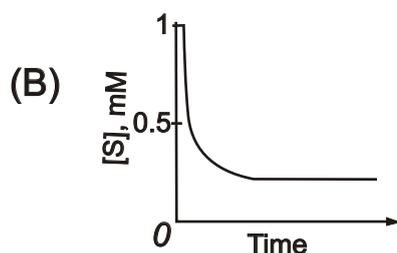
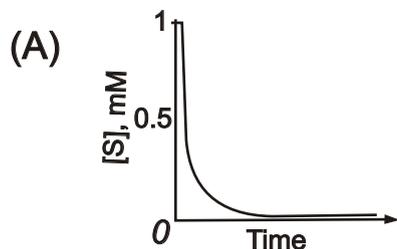
(+ = stimulation; o = no effect; - = inhibition)

	Rate of Electron Transport	Rate of ATP Synthesis
(A)	+	+
(B)	-	-
(C)	+	-
(D)	-	+
(E)	+	0

Master Job Aptitude Test

Biochemistry, Cell and Molecular Biology Test

78. For the enzyme-catalyzed reaction $S \rightleftharpoons P$, $K_{eq} = 5$, which of the following curves best represents the changes in $[S]$ that occurs with time when S is added to a solution containing the appropriate enzyme?



79. All of the following compounds are capable of forming hydrogen bonds with water EXCEPT
- methanol
 - acetamide
 - methyl acetate
 - ethanolamine
 - hexane

80. a water-soluble globular protein is not likely to have the highest proportion of which of the following amino acid residues buried within its core?

- Serine
- Histidine
- Isoleucine
- Glutamate
- Lysine

81. Hexokinase activity in a desalted cell extract can be measured in a spectrophotometric assay at 340 nanometers. In addition to buffer, Mg^{2+} and lysate, the reaction mixture should contain

- glucose, ATP, NADPH, and excess glucose 6-phosphate dehydrogenase
- glucose, ATP, NADP⁺, and excess glucose 6-phosphate dehydrogenase
- glucose, ADP, NADP⁺ and excess glucose 6-phosphate dehydrogenase
- glucose, ATP, NADP⁺ and excess 6-phosphogluconate dehydrogenase
- glucose 6-phosphate, ATP, NADP⁺, and excess glucose 6-phosphate dehydrogenase

Ester Substrate	Rate of Reaction (micromoles per second)
Methyl acetate	3×10^{-3}
Ethyl acetate	5×10^{-3}
Butyl acetate	2×10^{-2}
Pentyl acetate	5×10^{-2}

82. An esterase with rates of reaction for the hydrolysis of various esters above probably has an enzyme active site that

- contains a thiol
- contains a hydrophobic recognition site
- contains a thiamine pyrophosphate cofactor
- is very similar to that of trypsin
- shows allosteric control

83. Which of the following processes is NOT an example of allosteric regulation?

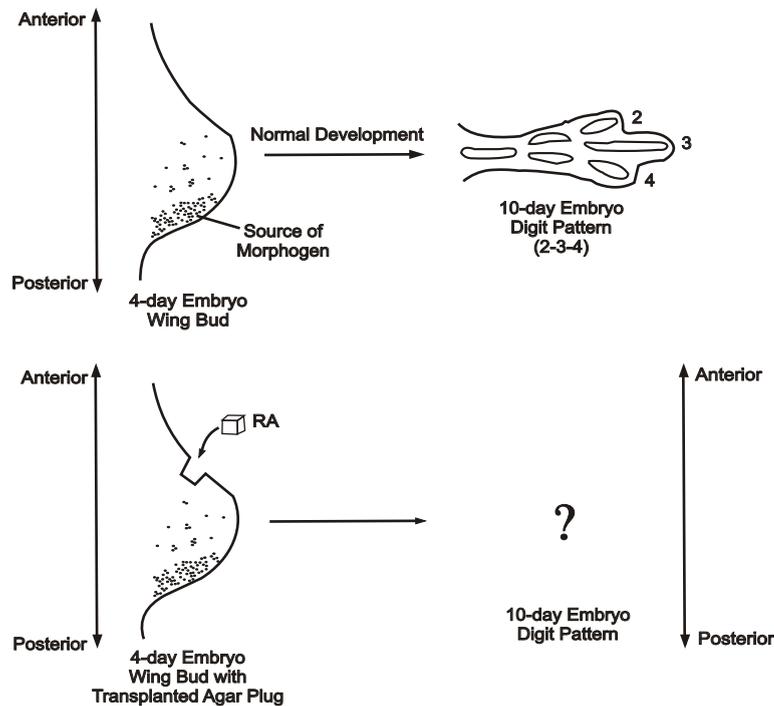
- Regulation of phosphofructokinase activity by fructose 2,6-bisphosphate
- Inactivation of nitrogenase by ADP-ribosylation
- Regulation of the lac operon by allolactose in *E. coli*
- Catabolite repression by CAP in *E. coli*
- Activation of second-messenger synthesis within a cell in response to receptor-ligand binding at the cell surface.

Master Job Aptitude Test

Biochemistry, Cell and Molecular Biology Test

84. Which of the following is closest to the pH of a solution that contains 5 millimoles per liter of H^+ ions?
- (A) 1.2
(B) 2.3
(C) 3.7
(D) 6.5
(E) 7.5
85. Although multiple disulfide bonds are possible during the formation of the tertiary structure of some secretory proteins, only the "correct" ones are found in the secreted product. This is primarily due to the fact that
- (A) incorrectly folded proteins are degraded by lysosomes
(B) processing and folding is continued in the endosomes
(C) a protein facilitates the formation of correct disulfide bonds in the endoplasmic reticulum
(D) only correctly folded proteins are translated in the endoplasmic reticulum
(E) arginine residues guide the proper positioning of disulfide bonds

86. Actin filaments and microtubules share all of the following properties EXCEPT:
- (A) they are involved in cell motility
(B) They are intrinsically polar structures
(C) They can associate with motor proteins
(D) They are assembled from subunits that are heterodimers.
(E) They can be cross-linked into bundles.



87. During wing development in the chicken embryo, the digit pattern (2-3-4) is thought to be controlled by a morphogen concentration gradient that originates in the posterior of the young wing bud as indicated in the diagram above. An agar plug soaked in retinoic acid (RA) can mimic the action of the morphogen. Which of the following digit pattern would be expected to result if an agar plug soaked in retinoic acid were placed in the anterior of a developing wing bud?
- (A) 2 - 3 - 4 only
(B) 4 - 3 - 2 only
(C) 2 - 3 - 4 - 4 - 3 - 2
(D) 4 - 3 - 2 - 2 - 3 - 4
(E) 4 - 3 - 2 - 4 - 3 - 2

Master Job Aptitude Test

Biochemistry, Cell and Molecular Biology Test

88. The recognition site of the restriction endonuclease *Ava*I is CPyCGPuG, where Py is any pyrimidine and Pu is any purine. What is the expected average distance, in nucleotide pairs, between *Ava*I cleavage sites in a random DNA sequence?
 (A) 4,096
 (B) 1,024
 (C) 782
 (E) 64
 (E) 6
89. In a bacterial cell, a mutation in an aminoacyl-tRNA synthetase leads to charging of the entire tRNA^{ser} population with alanine. Which of the following describes the result of using these aminoacyl-tRNAs for protein synthesis in the cell?
 (A) The alanyl-tRNA^{ser} will not function in protein synthesis.
 (B) Proteins synthesized using the alanyl-tRNA^{ser} will contain neither alanine nor serine.
 (C) Proteins synthesized using the alanyl-tRNA^{ser} will contain only serine where alanine would normally occur.
 (D) Proteins synthesized using the alanyl-tRNA^{ser} will contain only alanine where serine would normally occur.
 (E) Proteins synthesized using the alanyl-tRNA^{ser} will randomly contain either alanine or serine where serine would normally occur.
90. Which of the following matings between *E. coli* strains would result in a high frequency of transfer of chromosomal genes?
 (A) F⁺ x F⁺
 (B) F⁺ x F⁻
 (C) F⁻ x F⁻
 (D) Hfr x Hfr
 (E) Hfr x F⁻
91. In genetics, suppression of a mutation refers to
 (A) restoration of the original phenotype due to a second mutation
 (B) restoration of the original DNA sequence by mutation
 (C) prevention of expression of the mutant gene by metabolic regulation.
 (D) appearance of the recessive phenotype in a heterozygous diploid
 (E) inactivation of the gene by methylation

Tissue	Factor A	Protein Kinase Activity	Protein Phosphatase Activity
Muscle	+	-	-
Heart	+	+	-
Brain	+	-	+

92. Transcription of gene X is controlled by transcription factor A. Gene X is only transcribed when factor A is phosphorylated. Data on the tissue distribution of factor A and activities of a protein kinase and a protein phosphatase specific for factor A are presented in the table above. Of these three tissues, gene X will be transcribed in
 (A) muscle only
 (B) heart only
 (C) brain only
 (D) brain and heart only
 (E) muscle, heart, and brain
93. Which of the following pairs of compounds are interconvertible in the liver by a single polypeptide chain containing two different catalytic sites?
 (A) Glucose and glucose 6-phosphate
 (B) 3-Phosphoglycerate and phosphoenolpyruvate
 (C) phosphoenolpyruvate and pyruvate
 (D) fructose 6-phosphate and fructose 1,6-bisphosphate
 (E) fructose 6-phosphate and fructose 2,6-bisphosphate.
94. In terms of energy yield, phosphorylation is preferable to hydrolysis in the breakdown of glycogen or starch because
 (A) most phosphorylases have lower K_m values than do the corresponding phosphatases
 (B) glucose 1-phosphate yields more ATP than does free glucose when subsequently catabolized to pyruvate.
 (C) the products of hydrolysis cannot be metabolized by the glycolytic pathway.
 (D) the abundance of inorganic phosphate in the cell ensures that the reaction will function in the degradative and not the synthetic direction.
 (E) the debranching process requires phosphorylated glucose residues.

Master Job Aptitude Test

Biochemistry, Cell and Molecular Biology Test

95. Which of the following six-membered ring compounds has the most planar structure?
- (A) Glucose
 - (B) Cytosine
 - (C) Cyclohexane
 - (D) Inositol
 - (E) Mannose
96. Substrate-level phosphorylation in the citric acid (Krebs) cycle depends directly on the energy of the
- (A) thioester bond of succinyl CoA
 - (B) oxidative decarboxylation of isocitrate to α -ketoglutarate
 - (C) formation of citrate from oxaloacetate and acetyl CoA
 - (D) FAD-dependent oxidation of succinate to fumarate
 - (E) phosphoanhydride bond of 1,3-bisphosphoglycerate
97. Two-dimensional (2-D) gel electrophoresis performed under denaturing conditions can be used to separate proteins according to which of the following characteristics?
- | First Dimension | Second Dimension |
|------------------------------|--------------------------|
| (A) Subunit molecular weight | Density |
| (B) Density | Charge |
| (C) Amino acid composition | Charge |
| (D) Isoelectric point (pI) | Subunit molecular weight |
| (E) Hydrophobicity | Subunit molecular weight |
98. All of the following are known to involve a Ca^{2+} -activated, vesicle-mediated secretory event EXCEPT
- (A) synaptic transmission
 - (B) elevation of the fertilization membrane of the sea urchin
 - (C) release of histamine from mast cells
 - (D) sperm acrosomal reaction
 - (E) constitutive secretion of collagen
99. A mutant cell whose cilia lack central pair microtubules and radial spokes would be unable to perform which of the following cilia-associated processes?
- (A) ATP hydrolysis
 - (B) Bend propagation (beating)
 - (C) Outer doublet microtubule sliding
 - (D) Ciliary regeneration
 - (E) Proper length control
100. Labeling of mesoderm with vital dyes in the vertebrate embryo would result in labeling of which of the following adult tissues?
- I. Neural
 - II. Interstitial epithelial
 - III. Skeletal muscle
- (A) I only
 - (B) II only
 - (C) III only
 - (D) I and II
 - (E) II and III

Answer Key

1.	D	21.	E	41.	A	61.	D	81.	B
2.	A	22.	D	42.	A	62.	C	82.	B
3.	B	23.	E	43.	D	63.	A	83.	B
4.	A	24.	D	44.	C	64.	E	84.	B
5.	E	25.	A	45.	D	65.	A	85.	C
6.	A	26.	A	46.	B	66.	A	86.	D
7.	E	27.	B	47.	A	67.	A	87.	D
8.	B	28.	E	48.	E	68.	C	88.	B
9.	D	29.	D	49.	E	69.	D	89.	D
10.	B	30.	A	50.	B	70.	E	90.	E
11.	E	31.	B	51.	A	71.	E	91.	A
12.	E	32.	C	52.	C	72.	C	92.	B
13.	E	33.	E	53.	D	73.	B	93.	E
14.	C	34.	E	54.	A	74.	E	94.	B
15.	C	35.	B	55.	D	75.	B	95.	B
16.	D	36.	B	56.	C	76.	B	96.	A
17.	C	37.	E	57.	D	77.	C	97.	D
18.	B	38.	D	58.	B	78.	B	98.	E
19.	D	39.	A	59.	A	79.	E	99.	B
20.	A	40.	B	60.	D	80.	C	100.	C

PHYSICS TEST

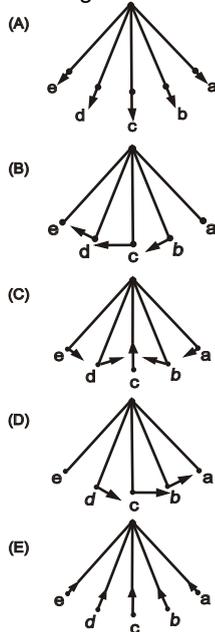
100 QUESTIONS

60 MINUTES

DIRECTIONS

Each of the questions or incomplete statements below is followed by five suggested answers or completions. Select the one that is best in each case and then completely fill in the corresponding space on the answer sheet.

1. Which of the following best illustrates the acceleration of a pendulum bob at points a through e?



2. The coefficient of static friction between a small coin and the surface of a turntable is 0.30. The turntable rotates at 33.3 revolutions per minute. What is the maximum distance from the center of the turntable at which the coin will not slide?
- (A) 0.024 m
 (B) 0.048 m
 (C) 0.121 m
 (D) 0.242 m
 (E) 0.484 m

3. A satellite of mass m orbits a planet of mass M in a circular orbit of radius R . The time required for one revolution is
- (A) independent of M
 (B) proportional to \sqrt{m}
 (C) linear in R
 (D) proportional to $R^{3/2}$
 (E) proportional to R^2

4. In a nonrelativistic, one-dimensional collision, a particle of mass $2m$ collides with a particle of mass m at rest. If the particles stick together after the collision, what fraction of the initial kinetic energy is lost in the collision?

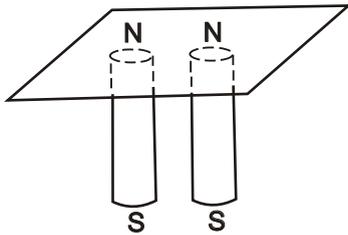
- (A) 0
 (B) $\frac{1}{4}$
 (C) $\frac{1}{3}$
 (D) $\frac{1}{2}$
 (E) $\frac{2}{3}$

5. A three-dimensional harmonic oscillator is in thermal equilibrium with a temperature reservoir at temperature T . The average total energy of the oscillator is

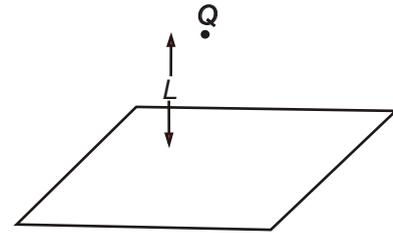
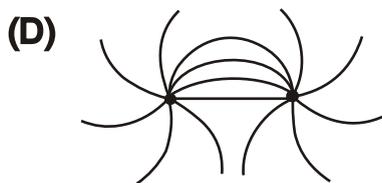
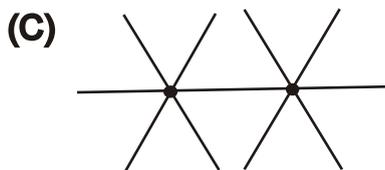
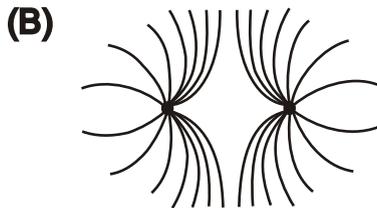
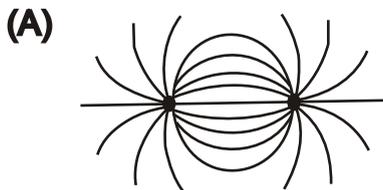
- (A) $\frac{1}{2}kT$
 (B) kT
 (C) $\frac{3}{2}kT$
 (D) $3kT$
 (E) $6kT$

6. An ideal monatomic gas expands quasi-statically to twice its volume. If the process is isothermal, the work done by the gas is W_i . If the process is adiabatic, the work done by the gas is W_a . Which of the following is true?

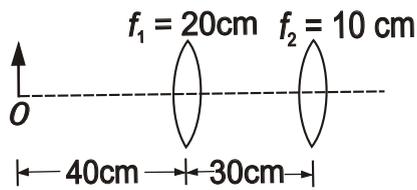
- (A) $W_i = W_a$
 (B) $0 = W_i < W_a$
 (C) $0 < W_i < W_a$
 (D) $0 = W_a < W_i$
 (E) $0 < W_a < W_i$



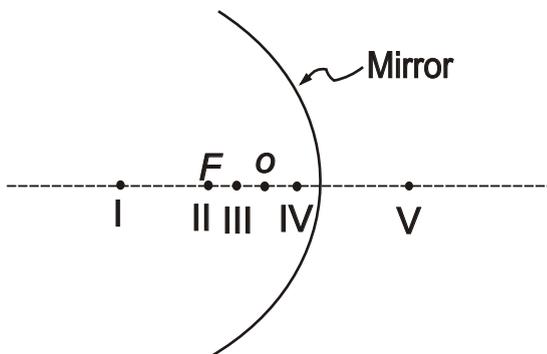
7. Two long, identical bar magnets are placed under a horizontal piece of paper, as shown in the figure above. The paper is covered with iron filings. When the two north poles are a small distance apart and touching the paper, the iron filings move into a pattern that shows the magnetic field lines. Which of the following best illustrates the pattern that results?



8. A positive charge Q is located at a distance L above an infinite grounded conducting plane, as shown in the figure above. What is the total charge induced on the plane?
- (A) $2Q$
 (B) Q
 (C) 0
 (D) $-Q$
 (E) $-2Q$
9. Five positive charges of magnitude q are arranged symmetrically around the circumference of a circle of radius r . What is the magnitude of the electric field at the center of the circle?
 ($k = 1/4 \epsilon_0$)
- (A) 0
 (B) kq/r^2
 (C) $5kq/r^2$
 (D) $(kq/r^2)\cos(2/5)$
 (E) $(5kq/r^2)\cos(2/5)$
10. A 3-microfarad capacitor is connected in series with a 6-microfarad capacitor. When a 300-volt potential difference is applied across this combination, the total energy stored in the two capacitors is
- (A) 0.09 J
 (B) 0.18 J
 (C) 0.27 J
 (D) 0.41 J
 (E) 0.81 J

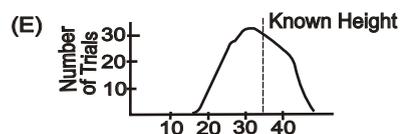
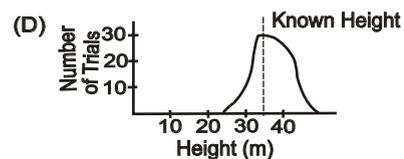
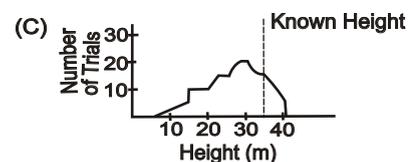
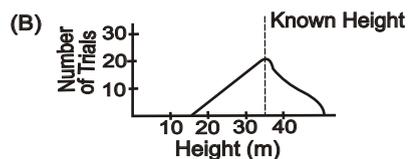
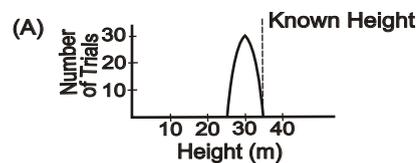


11. An object is located 40 centimeters from the first of two thin converging lenses of focal lengths 20 centimeters and 10 centimeters, respectively, as shown in the figure above. The lenses are separated by 30 centimeters. The final image formed by the two-lens system is located
- (A) 5.0 cm to the right of the second lens
 - (B) 13.3 cm to the right of the second lens
 - (C) infinitely far to the right of the second lens
 - (D) 13.3 cm to the left of the second lens
 - (E) 100 cm to the left of the second lens

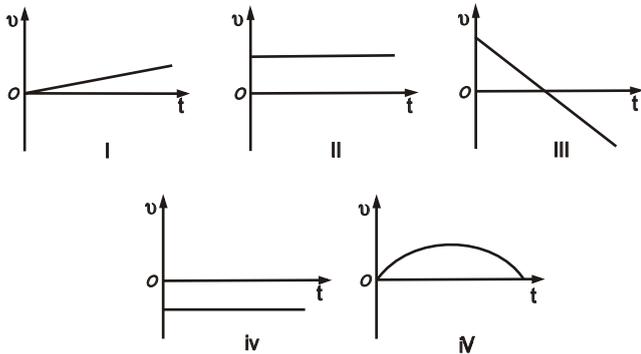


12. A spherical, concave mirror is shown in the figure above. The focal point F and the location of the object O are indicated. At what point will the image be located?
- (A) I
 - (B) II
 - (C) III
 - (D) IV
 - (E) V

13. Two stars are separated by an angle of 3×10^{-5} radians. What is the diameter of the smallest telescope that can resolve the two stars using visible light (600 nanometers)? (Ignore any effects due to Earth's atmosphere.)
- (A) 1 mm
 - (B) 2.5 cm
 - (C) 10 cm
 - (D) 2.5 m
 - (E) 10 m
14. An 8-centimeter-diameter by 8-centimeter-long NaI(Tl) detector detects gamma rays of a specific energy from a point source of radioactivity. When the source is placed just next to the detector at the center of the circular face, 50 percent of all emitted gamma rays at that energy are detected. If the detector is moved to 1 meter away, the fraction of detected gamma rays drops to
- (A) 10^{-4}
 - (B) 2×10^{-4}
 - (C) 4×10^{-4}
 - (D) 8×10^{-4}
 - (E) 16×10^{-4}
15. Five classes of students measure the height of a building. Each class uses a different method and each measures the height many different times. The data for each class are plotted below. Which class made the most precise measurement?

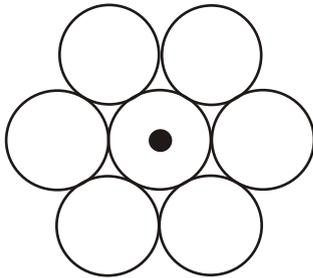


16. A student makes 10 one-second measurements of the disintegration of a sample of a long-lived radioactive isotope and obtains the following values.
- 3, 0, 2, 1, 2, 4, 0, 1, 2, 5
- How long should the student count to establish the rate to an uncertainty of 1 percent?
- (A) 80 s
(B) 160 s
(C) 2,000 s
(D) 5,000 s
(E) 6,400 s
17. The ground state electron configuration for phosphorus, which has 15 electrons, is
- (A) $1s^2 2s^2 2p^6 3s^1 3p^4$
(B) $1s^2 2s^2 2p^6 3s^2 3p^3$
(C) $1s^2 2s^2 2p^6 3s^2 3d^1$
(D) $1s^2 2s^2 2p^6 3s^1 3d^4$
(E) $1s^2 2s^2 2p^6 3p^2 3d^3$
18. The energy required to remove both electrons from the helium atom in its ground state is 79.0 eV. How much energy is required to ionize helium (i.e., to remove one electron)?
- (A) 24.6 eV
(B) 39.5 eV
(C) 51.8 eV
(D) 54.4 eV
(E) 65.4 eV
19. The primary source of the Sun's energy is a series of thermonuclear reactions in which the energy produced is c^2 times the mass difference between
- (A) two hydrogen atoms and one helium atom
(B) four hydrogen atoms and one helium atom
(C) six hydrogen atoms and two helium atoms
(D) three helium atoms and one carbon atom
(E) two hydrogen atoms plus two helium atoms and one carbon atom
20. In the production of X rays, the term "bremsstrahlung" refers to which of the following?
- (A) The cut-off wavelength, λ_{min} , of the X-ray tube
(B) The discrete X-ray lines emitted when an electron in an outer orbit fills a vacancy in an inner orbit of the atoms in the target metal of the X-ray tube
(C) The discrete X-ray lines absorbed when an electron in an inner orbit fills a vacancy in an outer orbit of the atoms in the target metal of the X-ray tube
(D) The smooth, continuous X-ray spectra produced by high-energy blackbody radiation from the X-ray tube
(E) The smooth, continuous X-ray spectra produced by rapidly decelerating electrons in the target metal of the X-ray tube
21. In the hydrogen spectrum, the ratio of the wavelengths for Lyman- α radiation ($n = 2$ to $n = 1$) to Balmer- α radiation ($n = 3$ to $n = 2$) is
- (A) 5/48
(B) 5/27
(C) 1/3
(D) 3
(E) 27/5
22. An astronomer observes a very small moon orbiting a planet and measures the moon's minimum and maximum distances from the planet's center and the moon's maximum orbital speed. Which of the following CANNOT be calculated from these measurements?
- (A) Mass of the moon
(B) Mass of the planet
(C) Minimum speed of the moon
(D) Period of the orbit
(E) Semimajor axis of the orbit
23. A particle is constrained to move in a circle with a 10-meter radius. At one instant, the particle's speed is 10 meters per second and is increasing at a rate of 10 meters per second squared. The angle between the particle's velocity and acceleration vectors is
- (A) 0°
(B) 30°
(C) 45°
(D) 60°
(E) 90°

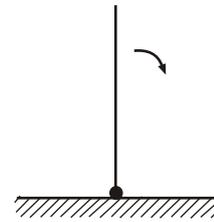


24. A stone is thrown at an angle of 45° above the horizontal x -axis in the $+x$ -direction. If air resistance is ignored, which of the velocity *versus* time graphs shown above best represents v_x *versus* t and v_y *versus* t , respectively?

	v_x vs. t	v_y vs. t
(A)	I	IV
(B)	II	I
(C)	II	III
(D)	II	V
(E)	IV	V



25. Seven pennies are arranged in a hexagonal, planar pattern so as to touch each neighbor, as shown in the figure above. Each penny is a uniform disk of mass m and radius r . What is the moment of inertia of the system of seven pennies about an axis that passes through the center of the central penny and is normal to the plane of the pennies?
- (A) $(7/2)mr^2$
 (B) $(13/2)mr^2$
 (C) $(29/2)mr^2$
 (D) $(49/2)mr^2$
 (E) $(55/2)mr^2$



26. A thin uniform rod of mass M and length L is positioned vertically above an anchored frictionless pivot point, as shown above, and then allowed to fall to the ground. With what speed does the free end of the rod strike the ground?
- (A) $\sqrt{\frac{1}{3}gL}$
 (B) \sqrt{gL}
 (C) $\sqrt{3gL}$
 (D) $\sqrt{12gL}$
 (E) $\sqrt{12gL}$
27. The eigenvalues of a Hermitian operator are always
- (A) real
 (B) imaginary
 (C) degenerate
 (D) linear
 (E) positive

$$|\psi_1\rangle = 5|1\rangle - 3|2\rangle + 2|3\rangle$$

$$|\psi_2\rangle = |1\rangle - 5|2\rangle + x|3\rangle$$

28. The states $|1\rangle$, $|2\rangle$, and $|3\rangle$ are orthonormal. For what value of x are the states $|\psi_1\rangle$ and $|\psi_2\rangle$ given above orthogonal?
- (A) 10
 (B) 5
 (C) 0
 (D) -5
 (E) -10

29. The state $\Psi = \frac{1}{\sqrt{6}}\psi_{-1} + \frac{1}{\sqrt{2}}\psi_1 + \frac{1}{\sqrt{3}}\psi_2$

is a linear combination of three orthonormal eigenstates of the operator \hat{O} corresponding to eigenvalues -1 , 1 , and 2 . What is the expectation value of \hat{O} for this state?

- (A) $\frac{2}{3}$
 (B) $\sqrt{\frac{7}{6}}$
 (C) 1
 (D) $\frac{4}{3}$
 (E) $\frac{(\sqrt{3} + 2\sqrt{2} - 1)}{6}$

30. Which of the following functions could represent the radial wave function for an electron in an atom? (r is the distance of the electron from the nucleus; A and b are constants.)

I. Ae^{-br}
 II. $A \sin(br)$
 III. A/r

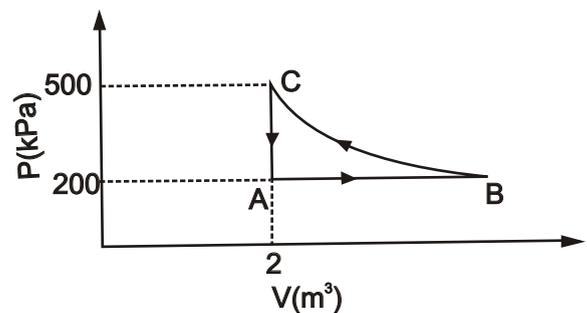
- (A) I only
 (B) II only
 (C) I and II only
 (D) I and III only
 (E) I, II, and III
31. Positronium is an atom formed by an electron and a positron (antielectron). It is similar to the hydrogen atom, with the positron replacing the proton. If a positronium atom makes a transition from the state with $n = 3$ to a state with $n = 1$, the energy of the photon emitted in this transition is closest to
- (A) 6.0 eV
 (B) 6.8 eV
 (C) 12.2 eV
 (D) 13.6 eV
 (E) 24.2 eV
32. If the total energy of a particle of mass m is equal to twice its rest energy, then the magnitude of the particle's relativistic momentum is
- (A) $mc/2$
 (B) $mc\sqrt{2}$
 (C) mc
 (D) $\sqrt{3}mc$
 (E) $2mc$
33. If a charged pion that decays in 10^{-8} second in its own rest frame is to travel 30 meters in the laboratory before decaying, the pion's speed must be most nearly
- (A) 0.43×10^8 m/s
 (B) 2.84×10^8 m/s
 (C) 2.90×10^8 m/s
 (D) 2.98×10^8 m/s
 (E) 3.00×10^8 m/s
34. In an inertial reference frame S , two events occur on the x -axis separated in time by Δt and in space by Δx . In another inertial reference frame S' , moving in the x -direction relative to S , the two events could occur at the same time under which, if any, of the following conditions?
- (A) For any values of Δx and Δt
 (B) Only if $|\Delta x/\Delta t| < c$
 (C) Only if $|\Delta x/\Delta t| > c$
 (D) Only if $|\Delta x/\Delta t| = c$
 (E) Under no condition

35. If the absolute temperature of a blackbody is increased by a factor of 3, the energy radiated per second per unit area does which of the following?

(A) Decreases by a factor of 81.
 (B) Decreases by a factor of 9.
 (C) Increases by a factor of 9.
 (D) Increases by a factor of 27.
 (E) Increases by a factor of 81.

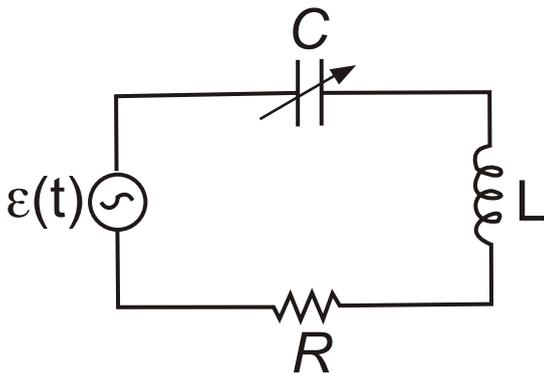
36. Consider the quasi-static adiabatic expansion of an ideal gas from an initial state i to a final state f . Which of the following statements is NOT true?

(A) No heat flows into or out of the gas.
 (B) The entropy of state i equals the entropy of state f .
 (C) The change of internal energy of the gas is $-\int PdV$.
 (D) The mechanical work done by the gas is $\int PdV$.
 (E) The temperature of the gas remains constant.

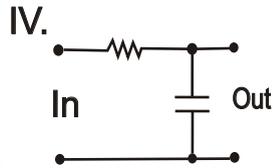
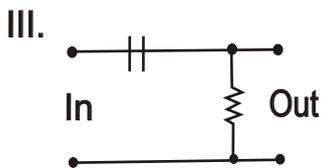
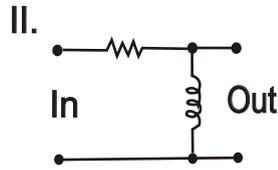
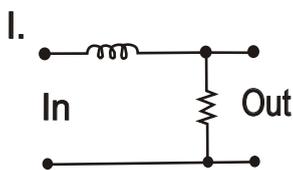


37. A constant amount of an ideal gas undergoes the cyclic process $ABCA$ in the PV diagram shown above. The path BC is isothermal. The work done by the gas during one complete cycle, beginning and ending at A , is most nearly

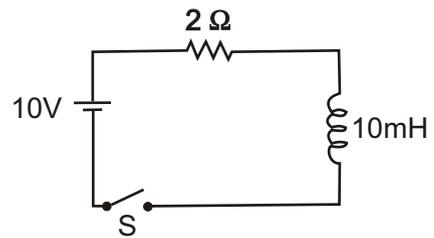
(A) 600 kJ
 (B) 300 kJ
 (C) 0
 (D) -300 kJ
 (E) -600 kJ



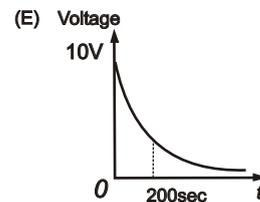
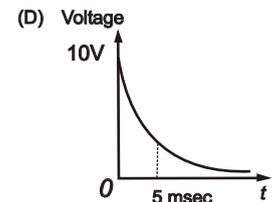
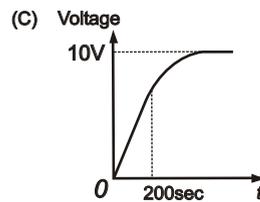
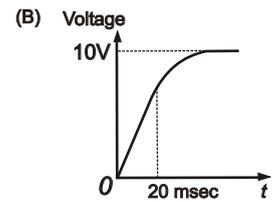
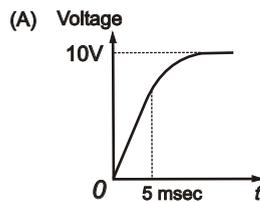
38. An AC circuit consists of the elements shown above, with $R = 10,000$ ohms, $L = 25$ millihenries, and C an adjustable capacitance. The AC voltage generator supplies a signal with an amplitude of 40 volts and angular frequency of 1,000 radians per second. For what value of C is the amplitude of the current maximized?
- (A) 4 nF
 (B) 40 nF
 (C) 4 μ F
 (D) 40 μ F
 (E) 400 μ F
39. Which two of the following circuits are high-pass filters?



- (A) I and I
 (B) I and III
 (C) I and IV
 (D) II and III
 (E) II and IV



40. In the circuit shown above, the switch S is closed at $t = 0$. Which of the following best represents the voltage across the inductor, as seen on an oscilloscope?



41. Maxwell's equations can be written in the form shown below. If magnetic charge exists and if it is conserved, which of these equations will have to be changed?

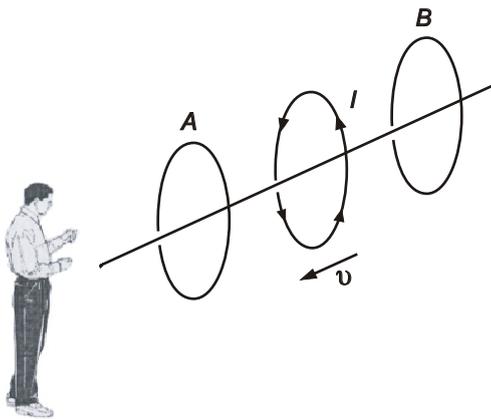
I. $\nabla \cdot \mathbf{E} = \rho/\epsilon_0$

II. $\nabla \cdot \mathbf{B} = 0$

III. $\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$

IV. $\nabla \times \mathbf{B} = \mu_0 \mathbf{J} + \mu_0 \epsilon_0 \frac{\partial \mathbf{E}}{\partial t}$

- (A) I only
 (B) II only
 (C) III only
 (D) I and IV
 (E) II and III



42. Three wire loops and an observer are positioned as shown in the figure above. From the observer's point of view, a current I flows counterclockwise in the middle loop, which is moving towards the observer with a velocity u . Loops A and B are stationary. This same observer would notice that

- (A) clockwise currents are induced in loops A and B
- (B) counterclockwise currents are induced in loops A and B
- (C) a clockwise current is induced in loop A, but a counterclockwise current is induced in loop B
- (D) a counterclockwise current is induced in loop A, but a clockwise current is induced in loop B
- (E) a counterclockwise current is induced in loop A, but no current is induced in loop B

43. The components of the orbital angular momentum operator $\mathbf{L} = (L_x, L_y, L_z)$ satisfy the following commutation relations.

$$[L_x, L_y] = ih L_z,$$

$$[L_y, L_z] = ih L_x,$$

$$[L_z, L_x] = ih L_y.$$

What is the value of the commutator $[L_x L_y, L_z]$?

- (A) $2ihL_x L_y$
- (B) $ih(L_x^2 + L_y^2)$
- (C) $-ih(L_x^2 + L_y^2)$
- (D) $ih(L_x^2 - L_y^2)$
- (E) $-ih(L_x^2 - L_y^2)$

44. The energy eigenstates for a particle of mass m in a box of length L have wave functions

$$\phi_n(x) = \sqrt{2/L} \sin(n\pi x/L) \text{ and energies}$$

$$E_n = n^2 \hbar^2 / 2mL^2, \text{ where } n = 1, 2, 3, \dots$$

At time $t = 0$, the particle is in a state described as follows.

$$\psi(t=0) = \frac{1}{\sqrt{14}} [\phi_1 + 2\phi_2 + 3\phi_3]$$

Which of the following is a possible result of a measurement of energy for the state ψ ?

- (A) $2E_1$
- (B) $5E_1$
- (C) $7E_1$
- (D) $9E_1$
- (E) $14E_1$

45. Let $|n\rangle$ represent the normalized n^{th} energy eigenstate of the one-dimensional harmonic oscillator, $H|n\rangle = \hbar\omega \left(n + \frac{1}{2}\right) |n\rangle$.

$$H|n\rangle = \hbar\omega \left(n + \frac{1}{2}\right) |n\rangle.$$

If $|\psi\rangle$ is a normalized ensemble state that can be expanded as a linear combination

$$|\psi\rangle = \frac{1}{\sqrt{14}} |1\rangle - \frac{2}{\sqrt{14}} |2\rangle + \frac{3}{\sqrt{14}} |3\rangle$$

of the eigenstates, what is the expectation value of the energy operator in this ensemble state?

- (A) $\frac{102}{14} \hbar\omega$
- (B) $\frac{43}{14} \hbar\omega$
- (C) $\frac{23}{14} \hbar\omega$
- (D) $\frac{17}{14} \hbar\omega$
- (E) $\frac{7}{\sqrt{14}}$

46. A free particle with initial kinetic energy E and de Broglie wavelength λ enters a region in which it has potential energy V . What is the particle's new de Broglie wavelength?

- (A) $\lambda(1 + E/V)$
- (B) $\lambda(1 - V/E)$
- (C) $\lambda(1 - E/V)^{-1}$
- (D) $\lambda(1 + V/E)^{1/2}$
- (E) $\lambda(1 - V/E)^{-1/2}$

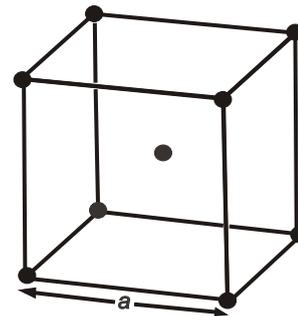
47. A sealed and thermally insulated container of total volume V is divided into two equal volumes by an impermeable wall. The left half of the container is initially occupied by n moles of an ideal gas at temperature T . Which of the following gives the change in entropy of the system when the wall is suddenly removed and the gas expands to fill the entire volume?
- (A) $2nR \ln 2$
 (B) $nR \ln 2$
 (C) $\frac{1}{2}nR \ln 2$
 (D) $-nR \ln 2$
 (E) $-2nR \ln 2$

48. A gaseous mixture of O_2 (molecular mass 32 u) and N_2 (molecular mass 28 u) is maintained at constant temperature. What is the ratio $\frac{v_{rms}(N_2)}{v_{rms}(O_2)}$ of the root-mean-square speeds of the molecules?
- (A) $\frac{7}{8}$
 (B) $\sqrt{\frac{7}{8}}$
 (C) $\sqrt{\frac{8}{7}}$
 (D) $\left(\frac{8}{7}\right)^2$
 (E) $\ln\left(\frac{8}{7}\right)$

49. In a Maxwell-Boltzmann system with two states of energies ϵ and 2ϵ , respectively, and a degeneracy of 2 for each state, the partition function is
- (A) $e^{-\epsilon/kT}$
 (B) $2e^{-2\epsilon/kT}$
 (C) $2e^{-3\epsilon/kT}$
 (D) $e^{-\epsilon/kT} + e^{-2\epsilon/kT}$
 (E) $2[e^{-\epsilon/kT} + e^{-2\epsilon/kT}]$

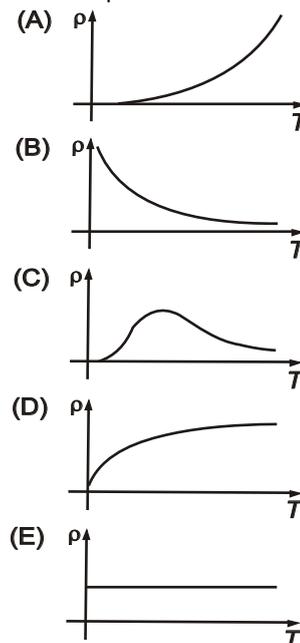
50. At $20^\circ C$, a pipe open at both ends resonates at a frequency of 440 hertz. At what frequency does the same pipe resonate on a particularly cold day when the speed of sound is 3 percent lower than it would be at $20^\circ C$?
- (A) 414 Hz
 (B) 427 Hz
 (C) 433 Hz
 (D) 440 Hz
 (E) 453 Hz

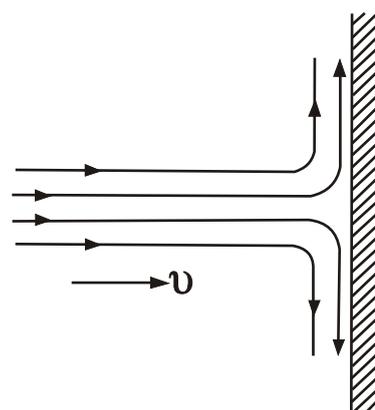
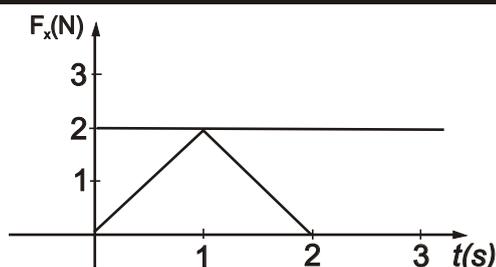
51. Unpolarized light of intensity I_0 is incident on a series of three polarizing filters. The axis of the second filter is oriented at 45° to that of the first filter, while the axis of the third filter is oriented at 90° to that of the first filter. What is the intensity of the light transmitted through the third filter?
- (A) 0
 (B) $I_0/8$
 (C) $I_0/4$
 (D) $I_0/2$
 (E) $I_0/\sqrt{2}$



52. The conventional unit cell of a body-centered cubic Bravais lattice is shown in the figure above. The conventional cell has volume a^3 . What is the volume of the primitive unit cell?
- (A) $a^3/8$
 (B) $a^3/4$
 (C) $a^3/2$
 (D) a^3
 (E) $2a^3$

53. Which of the following best represents the temperature dependence of the resistivity of an undoped semiconductor?





54. The figure above shows a plot of the time dependent force $F_x(t)$ acting on a particle in motion along the x-axis. What is the total impulse delivered to the particle?
- (A) 0
 (B) 1 kg m/s
 (C) 2 kg m/s
 (D) 3 kg m/s
 (E) 4 kg m/s



55. A particle of mass m is moving along the x-axis with speed u when it collides with a particle of mass $2m$ initially at rest. After the collision, the first particle has come to rest, and the second particle has split into two equal-mass pieces that move at equal angles $\theta > 0$ with the x-axis, as shown in the figure above. Which of the following statements correctly describes the speeds of the two pieces?
- (A) Each piece moves with speed v .
 (B) One of the pieces moves with speed v , the other moves with speed less than v .
 (C) Each piece moves with speed $v/2$.
 (D) One of the pieces moves with speed $v/2$, the other moves with speed greater than $v/2$.
 (E) Each piece moves with speed greater than $v/2$.

56. A balloon is to be filled with helium and used to suspend a mass of 300 kilograms in air. If the mass of the balloon is neglected, which of the following gives the approximate volume of helium required? (The density of air is 1.29 kilograms per cubic meter and the density of helium is 0.18 kilogram per cubic meter.)
- (A) 50 m³
 (B) 95 m³
 (C) 135 m³
 (D) 270 m³
 (E) 540 m³

57. A stream of water of density ρ , cross-sectional area A , and speed u strikes a wall that is perpendicular to the direction of the stream, as shown in the figure above. The water then flows sideways across the wall. The force exerted by the stream on the wall is
- (A) $\rho v^2 A$
 (B) $\rho v A/2$
 (C) $\rho g h A$
 (D) $v^2 A/\rho$
 (E) $v^2 A/2\rho$

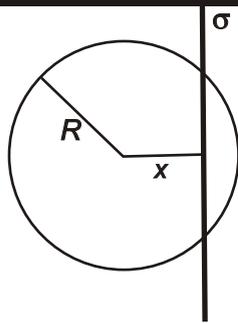
58. A proton moves in the +z-direction after being accelerated from rest through a potential difference V . The proton then passes through a region with a uniform electric field E in the +x-direction and a uniform magnetic field B in the +y-direction, but the proton's trajectory is not affected. If the experiment were repeated using a potential difference of $2V$, the proton would then be
- (A) deflected in the +x-direction
 (B) deflected in the -x-direction
 (C) deflected in the +y-direction
 (D) deflected in the -y-direction
 (E) undeflected

59. For an inductor and capacitor connected in series, the equation describing the motion of charge is

$$L \frac{d^2 Q}{dt^2} + \frac{1}{C} Q = 0,$$

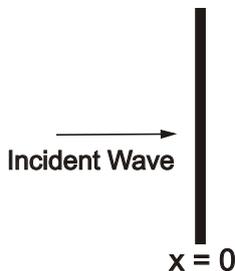
where L is the inductance, C is the capacitance, and Q is the charge. An analogous equation can be written for a simple harmonic oscillator with position x , mass m , and spring constant k . Which of the following correctly lists the mechanical analogs of L , C , and Q ?

	L	C	Q
(A)	m	k	x
(B)	m	$1/k$	x
(C)	k	x	m
(D)	$1/k$	$1/m$	x
(E)	x	$1/k$	$1/m$



60. An infinite, uniformly charged sheet with surface charge density σ cuts through a spherical Gaussian surface of radius R at a distance x from its center, as shown in the figure above. The electric flux Φ through the Gaussian surface is

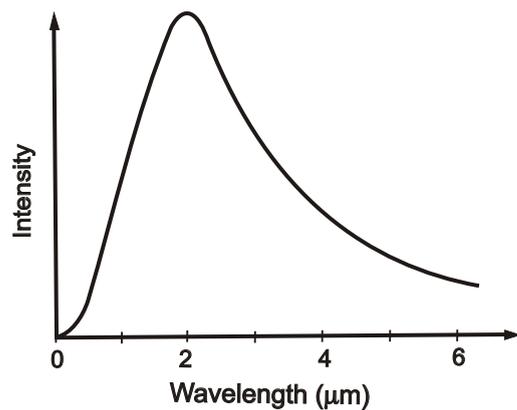
- (A) $\frac{\pi R^2 \sigma}{\epsilon_0}$
 (B) $\frac{2\pi R^2 \sigma}{\epsilon_0}$
 (C) $\frac{\pi(R-x)^2 \sigma}{\epsilon_0}$
 (D) $\frac{\pi(R^2 - x^2) \sigma}{\epsilon_0}$
 (E) $\frac{2\pi(R^2 - x^2) \sigma}{\epsilon_0}$



61. An electromagnetic plane wave, propagating in vacuum, has an electric field given by $E_0 \cos(kx - \omega t)$ and is normally incident on a perfect conductor at $x = 0$, as shown in the figure above. Immediately to the left of the conductor, the total electric field E and the total magnetic field B are given by which of the following?

- | | | |
|-----|----------------------|--------------------------|
| | \underline{E} | \underline{B} |
| (A) | 0 | 0 |
| (B) | $2E_0 \cos \omega t$ | 0 |
| (C) | 0 | $(2E_0/c) \cos \omega t$ |
| (D) | $2E_0 \cos \omega t$ | $(2E_0/c) \cos \omega t$ |
| (E) | $2E_0 \cos \omega t$ | $(2E_0/c) \sin \omega t$ |

62. A nonrelativistic particle with a charge twice that of an electron moves through a uniform magnetic field. The field has a strength of $\pi/4$ tesla and is perpendicular to the velocity of the particle. What is the particle's mass if it has a cyclotron frequency of 1,600 hertz?
- (A) 2.5×10^{-23} kg
 (B) 1.2×10^{-22} kg
 (C) 3.3×10^{-22} kg
 (D) 5.0×10^{-21} kg
 (E) 7.5×10^{-21} kg



63. The distribution of relative intensity $I(\lambda)$ of blackbody radiation from a solid object versus the wavelength λ is shown in the figure above. If the Wien displacement law constant is 2.9×10^{-3} m.K, what is the approximate temperature of the object?
- (A) 10 K
 (B) 50 K
 (C) 250 K
 (D) 1,500 K
 (E) 6,250 K

64. Electromagnetic radiation provides a means to probe aspects of the physical universe. Which of the following statements regarding radiation spectra is NOT correct?
- (A) Lines in the infrared, visible, and ultraviolet regions of the spectrum reveal primarily the nuclear structure of the sample.
 (B) The wavelengths identified in an absorption spectrum of an element are among those in its emission spectrum.
 (C) Absorption spectra can be used to determine which elements are present in distant stars.
 (D) Spectral analysis can be used to identify the composition of galactic dust.
 (E) Band spectra are due to molecules.

$$C = 3kN_A \left(\frac{h\nu}{kT}\right)^2 \frac{e^{h\nu/kT}}{(e^{h\nu/kT} - 1)^2}$$

65. Einstein's formula for the molar heat capacity C of solids is given above. At high temperatures, C approaches which of the following?

(A) 0
 (B) $3kN_A \left(\frac{h\nu}{kT}\right)$
 (C) $3kN_A h\nu$
 (D) $3kN_A$
 (E) $N_A h\nu$

66. A sample of radioactive nuclei of a certain element can decay only by γ -emission and β -emission. If the half-life for γ -emission is 24 minutes and that for β -emission is 36 minutes, the half-life for the sample is

(A) 30 minutes
 (B) 24 minutes
 (C) 20.8 minutes
 (D) 14.4 minutes
 (E) 6 minutes

67. The ^{238}U nucleus has a binding energy of about 7.6 MeV per nucleon. If the nucleus were to fission into two equal fragments, each would have a kinetic energy of just over 100 MeV. From this, it can be concluded that

(A) ^{238}U cannot fission spontaneously
 (B) ^{238}U has a large neutron excess
 (C) nuclei near $A = 120$ have masses greater than half that of ^{238}U
 (D) nuclei near $A = 120$ must be bound by about 6.7 MeV/nucleon
 (E) nuclei near $A = 120$ must be bound by about 8.5 MeV/nucleon

68. When ^7_4Be transforms into ^7_3Li , it does so by

(A) emitting an alpha particle only
 (B) emitting an electron only
 (C) emitting a neutron only
 (D) emitting a positron only
 (E) electron capture by the nucleus with emission of a neutrino

69. Blue light of wavelength 480 nanometers is most strongly reflected off a thin film of oil on a glass slide when viewed near normal incidence. Assuming that the index of refraction of the oil is 1.2 and that of the glass is 1.6, what is the minimum thickness of the oil film (other than zero)?

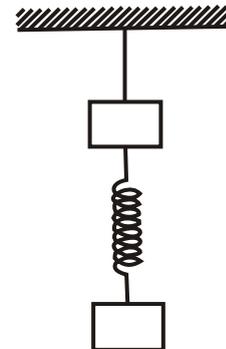
(A) 150 nm
 (B) 200 nm
 (C) 300 nm
 (D) 400 nm
 (E) 480 nm

70. Light from a laser falls on a pair of very narrow slits separated by 0.5 micrometer, and bright fringes separated by 1.0 millimeter are observed on a distant screen. If the frequency of the laser light is doubled, what will be the separation of the bright fringes?

(A) 0.25 mm
 (B) 0.5 mm
 (C) 1.0 mm
 (D) 2.0 mm
 (E) 2.5 mm

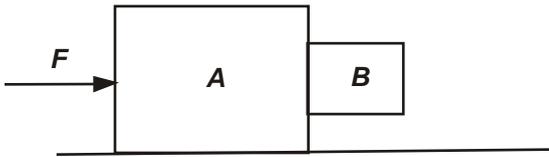
71. The ultraviolet Lyman alpha line of hydrogen with wavelength 121.5 nanometers is emitted by an astronomical object. An observer on Earth measures the wavelength of the light received from the object to be 607.5 nanometers. The observer can conclude that the object is moving with a radial velocity of

(A) 2.4×10^8 m/s toward Earth
 (B) 2.8×10^8 m/s toward Earth
 (C) 2.4×10^8 m/s away from Earth
 (D) 2.8×10^8 m/s away from Earth
 (E) 12×10^8 m/s away from Earth



72. Two identical blocks are connected by a spring. The combination is suspended, at rest, from a string attached to the ceiling, as shown in the figure above. The string breaks suddenly. Immediately after the string breaks, what is the downward acceleration of the upper block?

(A) 0
 (B) $g/2$
 (C) g
 (D) $\sqrt{2}g$
 (E) $2g$



73. For the system consisting of the two blocks shown in the figure above, the minimum horizontal force F is applied so that block B does not fall under the influence of gravity. The masses of A and B are 16.0 kilograms and 4.00 kilograms, respectively. The horizontal surface is frictionless and the coefficient of friction between the two blocks is 0.50. The magnitude of F is most nearly
- (A) 50 N
 (B) 100 N
 (C) 200 N
 (D) 400 N
 (E) 1,600 N

74. The Lagrangian for a mechanical system is

$$L = aq^2 + bq^4,$$

where q is a generalized coordinate and a and b are constants. The equation of motion for this system is

- (A) $q = \sqrt{\frac{b}{a}} q^2$
 (B) $q = \frac{2b}{a} q^3$
 (C) $q = -\frac{2b}{a} q^3$
 (D) $q = +\frac{2b}{a} q^3$
 (E) $q = \frac{b}{a} q^3$

$$\begin{pmatrix} a'_x \\ a'_y \\ a'_z \end{pmatrix} = \begin{bmatrix} 1/2 & \sqrt{3}/2 & 0 \\ -\sqrt{3}/2 & 1/2 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{pmatrix} a_x \\ a_y \\ a_z \end{pmatrix}$$

75. The matrix shown above transforms the components of a vector in one coordinate frame S to the components of the same vector in a second coordinate frame S' . This matrix represents a rotation of the reference frame S by
- (A) 30° clockwise about the x -axis
 (B) 30° counterclockwise about the z -axis
 (C) 45° clockwise about the z -axis
 (D) 60° clockwise about the y -axis
 (E) 60° counterclockwise about the z -axis

76. The mean kinetic energy of the conduction electrons in metals is ordinarily much higher than kT because
- (A) electrons have many more degrees of freedom than atoms do
 (B) the electrons and the lattice are not in thermal equilibrium
 (C) the electrons form a degenerate Fermi gas
 (D) electrons in metals are highly relativistic
 (E) electrons interact strongly with phonons

77. An ensemble of systems is in thermal equilibrium with a reservoir for which $kT = 0.025$ eV. State A has an energy that is 0.1 eV above that of state B . If it is assumed the systems obey Maxwell-Boltzmann statistics and that the degeneracies of the two states are the same, then the ratio of the number of systems in state A to the number in state B is
- (A) e^{+4}
 (B) $e^{+0.25}$
 (C) 1
 (D) $e^{-0.25}$
 (E) e^{-4}

78. The muon decays with a characteristic lifetime of about 10^{-6} second into an electron, a muon neutrino, and an electron antineutrino. The muon is forbidden from decaying into an electron and just a single neutrino by the law of conservation of
- (A) charge
 (B) mass
 (C) energy and momentum
 (D) baryon number
 (E) lepton number

79. A particle leaving a cyclotron has a total relativistic energy of 10 GeV and a relativistic momentum of 8 GeV/c. What is the rest mass of this particle?
- (A) 0.25 GeV/c²
 (B) 1.20 GeV/c²
 (C) 2.00 GeV/c²
 (D) 6.00 GeV/c²
 (E) 16.0 GeV/c²

80. A tube of water is traveling at $1/2 c$ relative to the lab frame when a beam of light traveling in the same direction as the tube enters it. What is the speed of light in the water relative to the lab frame? (The index of refraction of water is $4/3$.)
- (A) $1/2 c$
 (B) $2/3 c$
 (C) $5/6 c$
 (D) $10/11 c$
 (E) c

81. Which of the following is the orbital angular momentum eigenfunction $Y_l^m(\theta, \phi)$ in a state for which the operators L^2 and L_z have eigenvalues $6\hbar^2$ and $-\hbar$, respectively?
- (A) $Y_2^1(\theta, \phi)$
- (B) $Y_2^{-1}(\theta, \phi)$
- (C) $\frac{1}{\sqrt{2}} [Y_2^1(\theta, \phi) + Y_2^{-1}(\theta, \phi)]$
- (D) $Y_3^2(\theta, \phi)$
- (E) $Y_3^{-1}(\theta, \phi)$

82. Let $|\alpha\rangle$ represent the state of an electron with spin up and $|\beta\rangle$ the state of an electron with spin down. Valid spin eigenfunctions for a triplet state (3S) of a two-electron atom include which of the following?
- I. $|\alpha\rangle_1 |\alpha\rangle_2$
- II. $\frac{1}{\sqrt{2}} (|\alpha\rangle_1 |\beta\rangle_2 - |\alpha\rangle_2 |\beta\rangle_1)$
- III. $\frac{1}{\sqrt{2}} (|\alpha\rangle_1 |\beta\rangle_2 + |\alpha\rangle_2 |\beta\rangle_1)$
- (A) I only
- (B) II only
- (C) III only
- (D) I and III
- (E) II and III

83. The state of a spin- $\frac{1}{2}$ particle can be represented using the eigenstates $|\uparrow\rangle$ and $|\downarrow\rangle$ of the S_z operator.

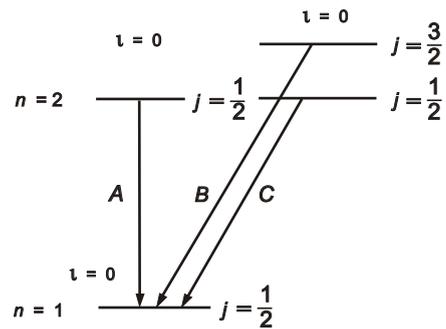
$$S_z |\uparrow\rangle = \frac{1}{2} \hbar |\uparrow\rangle$$

$$S_z |\downarrow\rangle = -\frac{1}{2} \hbar |\downarrow\rangle$$

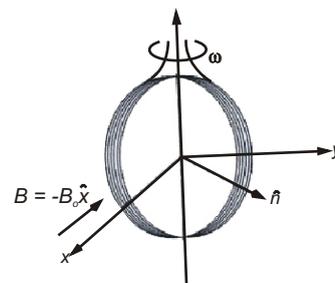
Given the Pauli matrix $\sigma_x = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$, which of

the following is an eigenstate of S_x with eigenvalue $-\frac{1}{2}\hbar$?

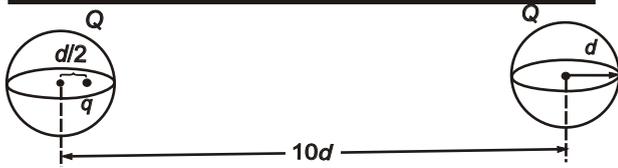
- (A) $|\downarrow\rangle$
- (B) $\frac{1}{\sqrt{2}} (|\uparrow\rangle - |\downarrow\rangle)$
- (C) $\frac{1}{\sqrt{2}} (|\uparrow\rangle + |\downarrow\rangle)$
- (D) $\frac{1}{\sqrt{2}} (|\uparrow\rangle + i|\downarrow\rangle)$
- (E) $\frac{1}{\sqrt{2}} (|\uparrow\rangle - i|\downarrow\rangle)$



84. An energy-level diagram of the $n=1$ and $n=2$ levels of atomic hydrogen (including the effects of spin-orbit coupling and relativity) is shown in the figure above. Three transitions are labeled A, B, and C. Which of the transitions will be possible electric-dipole transitions?
- (A) B only
- (B) C only
- (C) A and C only
- (D) B and C only
- (E) A, B, and C
85. One end of a Nichrome wire of length $2L$ and cross-sectional area A is attached to an end of another Nichrome wire of length L and cross-sectional area $2A$. If the free end of the longer wire is at an electric potential of 8.0 volts, and the free end of the shorter wire is at an electric potential of 1.0 volt, the potential at the junction of the two wires is most nearly equal to
- (A) 2.4 V
- (B) 3.3 V
- (C) 4.5 V
- (D) 5.7 V
- (E) 6.6 V

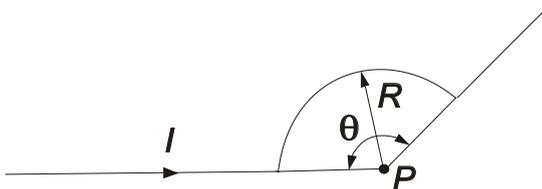


86. A coil of 15 turns, each of radius 1 centimeter, is rotating at a constant angular velocity $300 \text{ w} = \text{radians per second}$ in a uniform magnetic field of 0.5 tesla, as shown in the figure above. Assume at time $t=0$ that the normal \hat{n} to the coil plane is along the y -direction and that the selfinductance of the coil can be neglected. If the coil resistance is 9 ohms, what will be the magnitude of the induced current in milliamperes?
- (A) $225\pi \sin \omega t$
- (B) $250\pi \sin \omega t$
- (C) $0.08\pi \cos \omega t$
- (D) $1.7\pi \cos \omega t$
- (E) $25\pi \cos \omega t$



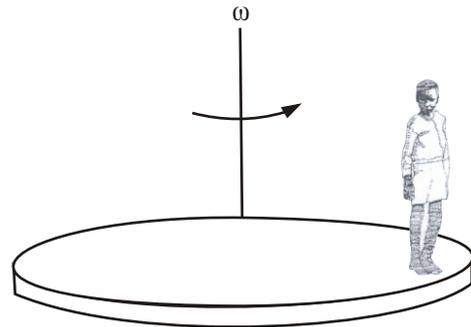
87. Two spherical, nonconducting, and very thin shells of uniformly distributed positive charge Q and radius d are located a distance $10d$ from each other. A positive pointcharge q is placed inside one of the shells at a distance $d/2$ from the center, on the line connecting the centers of the twoshells, as shown in the figure above. What is the net force on the charge q ?

- (A) $\frac{qQ}{361\pi\epsilon_0 d^2}$ to the left
 (B) $\frac{qQ}{361\pi\epsilon_0 d^2}$ to the left
 (C) $\frac{qQ}{441\pi\epsilon_0 d^2}$ to the left
 (D) $\frac{qQ}{441\pi\epsilon_0 d^2}$ to the right
 (E) $\frac{360qQ}{361\pi\epsilon_0 d^2}$ to the left



88. A segment of wire is bent into an arc of radius R and subtended angle θ , as shown in the figure above. Point P is at the center of the circular segment. The wire carries current I . What is the magnitude of the magnetic field at P ?

- (A) 0
 (B) $\frac{\mu_0 I \theta}{(2\pi)^2 R}$
 (C) $\frac{\mu_0 I \theta}{4\pi R}$
 (D) $\frac{\mu_0 I \theta}{4\pi R^2}$
 (E) $\frac{\mu_0 I}{4\pi R}$



89. A child is standing on the edge of a merry-go-round that has the shape of a solid disk, as shown in the figure above. The mass of the child is 40 kilograms. The merry-go-round has a mass of 200 kilograms and a radius of 2.5 meters, and it is rotating with an angular velocity of $2.0 \omega =$ radians per second. The child then walks slowly toward the center of the merry-go-round. What will be the final angular velocity of the merry-go-round when the child reaches the center? (The size of the child can be neglected.)

- (A) 2.0 rad/s
 (B) 2.2 rad/s
 (C) 2.4 rad/s
 (D) 2.6 rad/s
 (E) 2.8 rad/s

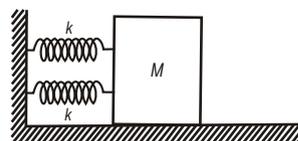


Figure 1

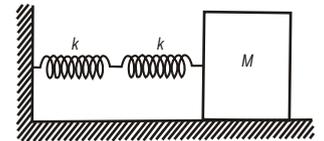
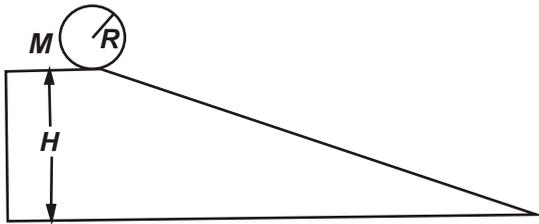


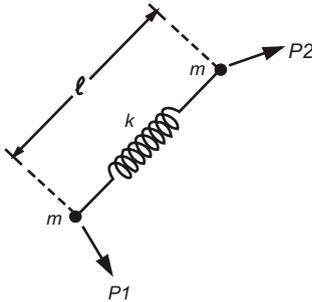
Figure 2

90. Two identical springs with spring constant k are connected to identical masses of mass M , as shown in the figures above. The ratio of the period for the springs connected in parallel (Figure 1) to the period for the springs connected in series (Figure 2) is

- (A) $\frac{1}{2}$
 (B) $\frac{\sqrt{1}}{2}$
 (C) $\frac{1}{\sqrt{2}}$
 (D) 2
 (E) 2



91. The cylinder shown above, with mass M and radius R , has a radially dependent density. The cylinder starts from rest and rolls without slipping down an inclined plane of height H . At the bottom of the plane its translational speed is $(8gH/7)^{1/2}$. Which of the following is the rotational inertia of the cylinder?
- (A) $\frac{1}{2} Mr^2$
- (B) $\frac{3}{4} MR^2$
- (C) $\frac{7}{8} MR^2$
- (D) MR^2
- (E) $\frac{7}{4} MR^2$



92. Two small equal masses m are connected by an ideal massless spring that has equilibrium length l_0 and force constant k , as shown in the figure above. The system is free to move without friction in the plane of the page. If p_1 and p_2 represent the magnitudes of the momenta of the two masses, a Hamiltonian for this system is
- (A) $\frac{1}{2} \left\{ \frac{P_1^2}{m} + \frac{P_2^2}{m} - 2k(l-l_0) \right\}$
- (B) $\frac{1}{2} \left\{ \frac{P_1^2}{m} + \frac{P_2^2}{m} + 2k(l-l_0)^2 \right\}$
- (C) $\frac{1}{2} \left\{ \frac{P_1^2}{m} + \frac{P_2^2}{m} - k(l-l_0) \right\}$
- (D) $\frac{1}{2} \left\{ \frac{P_1^2}{m} + \frac{P_2^2}{m} - k(l-l_0)^2 \right\}$
- (E) $\frac{1}{2} \left\{ \frac{P_1^2}{m} + \frac{P_2^2}{m} + k(l-l_0)^2 \right\}$

93. The solution to the Schrödinger equation for the ground state of hydrogen is

$$\psi_0 = \frac{1}{\sqrt{\pi a_0^3}} e^{-r/a_0}$$

where a_0 is the Bohr radius and r is the distance from the origin. Which of the following is the most probable value for r ?

- (A) 0
- (B) $a_0/2$
- (C) a_0
- (D) $2a_0$
- (E) ∞
94. The raising and lowering operators for the quantum harmonic oscillator satisfy

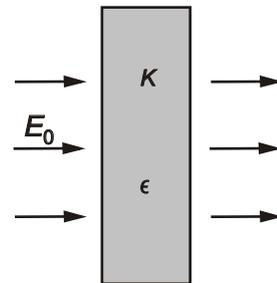
$$a^+|n\rangle = \sqrt{n+1}|n+1\rangle, a|n\rangle = \sqrt{n}|n-1\rangle$$

for energy eigenstates $|n\rangle$ with energy E_n . Which of the following gives the first-order shift in the $n=2$ energy level due to the perturbation

$$\Delta H = V(a + a^+)^2,$$

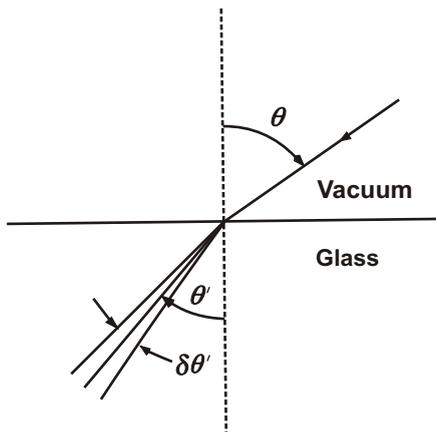
where V is a constant?

- (A) 0
- (B) V
- (C) $\sqrt{2}V$
- (D) $2\sqrt{2}V$
- (E) $5V$



95. An infinite slab of insulating material with dielectric constant K and permittivity $\epsilon = K\epsilon_0$ is placed in a uniform electric field of magnitude E_0 . The field is perpendicular to the surface of the material, as shown in the figure above. The magnitude of the electric field inside the material is
- (A) $\frac{E_0}{K}$
- (B) $\frac{E_0}{K\epsilon_0}$
- (C) E_0
- (D) $K\epsilon_0 E_0$
- (E) KE_0

96. A uniformly charged sphere of total charge Q expands and contracts between radii R_1 and R_2 at a frequency f . The total power radiated by the sphere is
- (A) proportional to Q
 - (B) proportional to f^2
 - (C) proportional to f^4
 - (D) proportional to (R_2/R_1)
 - (E) zero



97. A beam of light has a small wavelength spread $\delta\lambda$ about a central wavelength λ . The beam travels in vacuum until it enters a glass plate at an angle θ relative to the normal to the plate, as shown in the figure above. The index of refraction of the glass is given by $n(\lambda)$. The angular spread $\delta\theta$ of the refracted beam is given by

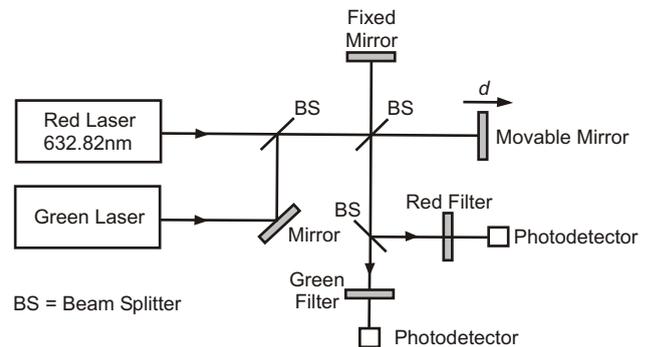
- (A) $\delta\theta' = \left| \frac{1}{n} \delta\lambda \right|$
- (B) $\delta\theta' = \left| \frac{dn(\lambda)}{d\lambda} \delta\lambda \right|$
- (C) $\delta\theta' = \left| \frac{1}{\lambda} \frac{d\lambda}{dn} \delta\lambda \right|$
- (D) $\delta\theta' = \left| \frac{\sin \theta}{\sin \theta'} \frac{\delta\lambda}{\lambda} \right|$
- (E) $\delta\theta' = \left| \frac{\tan \theta'}{n} \frac{dn(\lambda)}{d\lambda} \delta\lambda \right|$

98. Suppose that a system in quantum state i has energy E_i . In thermal equilibrium, the expression

$$\frac{\sum_i E_i e^{-E_i / kT}}{\sum_i e^{-E_i / kT}}$$

represents which of the following?

- (A) The average energy of the system
 - (B) The partition function
 - (C) Unity
 - (D) The probability to find the system with energy E_i
 - (E) The entropy of the system
99. A photon strikes an electron of mass m that is initially at rest, creating an electron-positron pair. The photon is destroyed and the positron and two electrons move off at equal speeds along the initial direction of the photon. The energy of the photon was
- (A) mc^2
 - (B) $2mc^2$
 - (C) $3mc^2$
 - (D) $4mc^2$
 - (E) $5mc^2$



100. A Michelson interferometer is configured as a wavemeter, as shown in the figure above, so that a ratio of fringe counts may be used to compare the wavelengths of two lasers with high precision. When the mirror in the right arm of the interferometer is translated through a distance d , 100,000 interference fringes pass across the detector for green light and 85,865 fringes pass across the detector for red (632.82 nm) light. The wavelength of the green laser light is
- (A) 500.33 nm
 - (B) 543.37 nm
 - (C) 590.19 nm
 - (D) 736.99 nm
 - (E) 858.65 nm

Answer Key

1.	C	21.	B	41.	E	61.	C	81.	B
2.	D	22.	A	42.	C	62.	A	82..	D
3.	D	23.	C	43.	D	63.	D	83..	C
4.	C	24.	C	44.	D	64.	A	84.	D
5.	D	25.	E	45.	B	65.	D	85.	A
6.	E	26.	C	46.	E	66.	D	86.	E
7.	B	27.	A	47.	B	67.	E	87.	A
8.	D	28.	E	48.	C	68.	E	88.	C
9.	A	29.	C	49.	E	69.	B	89.	E
10.	A	30.	A	50.	B	70.	B	90.	A
11.	A	31.	A	51.	B	71.	D	91.	B
12.	E	32.	D	52.	C	72.	E	92.	E
13.	B	33.	D	53.	B	73.	D	93.	C
14.	C	34.	C	54.	C	74.	D	94.	E
15.	A	35.	E	55.	E	75.	E	95.	A
16.	D	36.	E	56.	D	76.	C	96.	E
17.	B	37.	D	57.	A	77.	E	97.	E
18.	A	38.	D	58.	B	78.	E	98.	A
19.	B	39.	D	59.	B	79.	D	99.	D
20.	E	40.	D	60.	D	80.	D	100.	B

COMPUTER SCIENCE TEST

66 QUESTIONS

60 MINUTES

DIRECTIONS

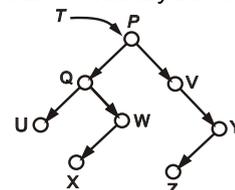
Each of the questions or incomplete statements below is followed by five suggested answers or completions. Select the one that is the best of the choices offered and then mark the corresponding space on the answer sheet.

- Suppose that a certain software product has a mean time between failures of 10,000 hours and has a mean time to repair of 20 hours. If the product is used by 100 customers, what is its availability?
 (A) 80%
 (B) 90%
 (C) 98%
 (D) 99.8%
 (E) 100%
- The object-oriented paradigm includes which of the following properties?
 I. Encapsulation
 II. Inheritance
 III. Recursion
 (A) I only
 (B) II only
 (C) I and II only
 (D) II and III only
 (E) I, II, and III
- Which of the following algorithms has running time $\Theta(n^2)$ in the worst case but $\Theta(n \log n)$ on average?
 (A) Bubblesort
 (B) Mergesort
 (C) Heapsort
 (D) Quicksort
 (E) Tournament sort
- Which of the following is the name of the data structure in a compiler that is responsible for managing information about variables and their attributes?
 (A) Abstract Syntax Tree (AST)
 (B) Attribute Grammar
 (C) Symbol Table
 (D) Semantic Stack
 (E) Parse Table

- Consider the following pseudocode.
 $x := 1;$
 $i := 1;$
 while $(x \leq 1000)$
 begin
 $x := 2^x;$
 $i := i + 1;$
 end;
 What is the value of i at the end of the pseudocode?
 (A) 4
 (B) 5
 (C) 6
 (D) 7
 (E) 8

- Suppose that $P(x, y)$ means "x is a parent of y" and $M(x)$ means "x is male". If $F(v, w)$ equals $M(v) \wedge \exists x \exists y (P(x, y) \wedge P(x, v) \wedge (y \neq v) \wedge P(y, w))$.
 What is the meaning of the expression $F(v, w)$?
 (A) v is a brother of . w
 (B) v is a nephew of . w
 (C) v is an uncle of . w
 (D) v is a grandfather of . w
 (E) v is a male cousin of . w

Question 7-8 are based on binary tree T shown below.

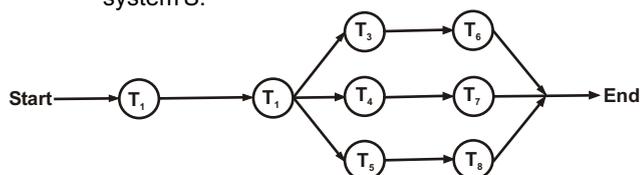


- Which of the following represents a post order traversal of T ?
 (A) PQUWXVYZ
 (B) UQXWPVZY
 (C) UXWQZYVP
 (D) UXZQWYVP
 (E) XZUWYQVP

8. If T is a binary search tree with the smaller elements in the left subtree, which of the following nodes contains the fourth smallest element in T ?
- (A) Q
(B) V
(C) W
(D) X
(E) Z
9. Which of the following statements about Ethernets is typically FALSE?
- (A) Ethernets use circuit switching to send messages.
(B) Ethernets use buses with multiple masters.
(C) Ethernet protocols use a collision-detection method to ensure that messages are transmitted properly.
(D) Networks connected by Ethernets are limited in length to a few hundred meters.
(E) Packets sent on Ethernets are limited in size.
10. A k -ary tree is a tree in which every node has at most k children. In a k -ary tree with n nodes and height h , which of the following is an upper bound for the maximum number of leaves as a function of h , k , and n ?
- (A) $\log_k n$
(B) $\log_k h$
(C) $\frac{n}{\log_k nn}$
(D) k^h
(E) h^k
11. Which of the following is (are) true about virtual memory systems that use pages?
- I. The virtual address space can be larger than the amount of physical memory.
II. Programs must be resident in main memory throughout their execution.
III. Pages correspond to semantic characteristics of the program.
- (A) I only
(B) II only
(C) I and II
(D) I and III
(E) II and III
12. Let $T(n)$ be defined by $T(1) = 7$ and $T(n+1) = 3n + T(n)$ for all integers $n \geq 1$. Which of the following represents the order of growth of $T(n)$ as a function of n ?
- (A) $\Theta(n)$
(B) $\Theta(n \log n)$
(C) $\Theta(n^2)$
(D) $\Theta(n^2 \log n)$
(E) $\Theta(2^n)$
13. One approach to handling fuzzy logic data might be to design a computer using ternary (base-3) logic so that data could be stored as "true," "false," and "unknown." If each ternary logic element is called a flit, how many flits are required to represent at least 256 different values?
- (A) 4
(B) 5
(C) 6
(D) 7
(E) 8
14. Hash tables can contribute to an efficient average-case solution for all of the problems described below EXCEPT:
- (A) Counting distinct values: Given a set of n keys, determine the number of distinct key values.
(B) Dynamic dictionary: Support the operations of insert, delete, and search in a dictionary.
(C) Range search: Given values a and b , find all the records whose key value is in the range a, b .
(D) Symbol table lookup: Given a program identifier, find its type and address.
(E) Finding intersections: Given two sets of keys, find all key values in common to both sets.
15. An invariant for the loop below is " $z * x^k = b^n$ " and $k \geq 0$
- ```
x := b; k := n; z := 1;
While (k ≠ 0)
{ if odd(k) then z := z*x;
 x := x*x;
 k := [k/2];
```
- When the loop terminates, which of the following must be true?
- (A)  $x = b^n$   
(B)  $z = b^n$   
(C)  $b = x^n$   
(D)  $b = z^n$   
(E)  $k \neq 0$

16. In the Internet Protocol (IP) suite of protocols, which of the following best describes the purpose of the Address Resolution Protocol?
- (A) To translate Web addresses to hostnames
  - (B) To determine the IP address of a given hostname
  - (C) To determine the hardware address of a given hostname
  - (D) To determine the hardware address of a given IP address
  - (E) To determine the appropriate route for a datagram
17. A certain pipelined RISC machine has 8 general-purpose registers R0, R1, . . . , R7 and supports the following operations.
- ADD Rs1, Rs2, Rd    Add Rs1 to Rs2 and put the sum in Rd
- MULRs1, Rs2, Rd    Multiply Rs1 by Rs2 and put the product in Rd
- An operation normally takes one cycle; however, an operation takes two cycles if it produces a result required by the immediately following operation in an operation sequence. Consider the expression  $AB+ABC+BC$ , where variables  $A, B, C$  are located in registers R0, R1, R2. If the contents of these three registers must not be modified, what is the minimum number of clock cycles required for an operation sequence that computes the value of  $AB+ABC+BC$ ?
- (A) 5
  - (B) 6
  - (C) 7
  - (D) 8
  - (E) 9

18. Below is a precedence graph for a set of tasks to be executed on a parallel processing system S.



Efficiency is defined as the ratio between the speedup and the number of processors. (The speedup is defined as the ratio of the time taken to perform a set of tasks on a single processor to the time taken to perform the same set of tasks on a parallel processor.)

System S has four processors (CPU's). If each of the tasks  $T_1, \dots, T_8$ , takes the same time, what is the efficiency of this precedence graph on S?

- (A) 25%
- (B)  $33\frac{1}{3}\%$
- (C) 50%
- (D) 100%
- (E) 125%

19. Let  $G = (V, E)$  be a finite directed acyclic graph with  $0 < E < \infty$ . Which of the following must be true?
- I.  $G$  has a vertex with no incoming edge.
  - II.  $G$  has a vertex with no outgoing edge.
  - III.  $G$  has an isolated vertex, that is, one with neither an incoming edge nor an outgoing edge.
- (A) I only
  - (B) II only
  - (C) III only
  - (D) I and II only
  - (E) I, II, and III

Question 20-21 are based on the following information

Array A contains 256 elements of 4 bytes each. Its first element is stored at physical address 4,096.

Array B contains 512 elements of 4 bytes each. Its first element is stored at physical address 8,192.

Assume that only arrays A and B can be cached in an initially empty, physically addressed, physically tagged, direct-mapped, 2K-byte cache with an 8-byte block size. The following loop is then executed.

```

for (i = 0; i < 256; i++)
 A[i] = A[i] + B[2*i];

```

20. During the execution of the loop, how many bytes will be written to memory if the cache has a write-through policy?
- (A) 0
  - (B) 256
  - (C) 1,024
  - (D) 2,048
  - (E) 4,096
21. During the execution of the loop, how many bytes will be written to memory if the cache has a write-back policy?
- (A) 0
  - (B) 256
  - (C) 1,024
  - (D) 2,000
  - (E) 4,000

22. According to the IEEE standard, a 32-bit, single-precision, floating-point number  $N$  is defined to be

$$N = (-1)^S \times 1.F \times 2^{E-127}$$

where  $S$  is the sign bit,  $F$  the fractional mantissa, and  $E$  the biased exponent.

A floating-point number is stored as  $S:E:F$ , where  $S$ ,  $E$ , and  $F$  are stored in 1 bit, 8 bits, and 23 bits, respectively. What is the decimal value of the floating-point number C1E00000 (hexadecimal notation)?

- (A) 26  
 (B) -15  
 (C) -26  
 (D) -28  
 (E) -59
23. Which of the following predicate calculus formulas must be true under all interpretations?

I.  $(\forall x P(x) \vee \forall x Q(x)) \rightarrow \forall x (P(x) \vee Q(x))$

II.  $\forall x (P(x) \vee Q(x)) \rightarrow (\forall x P(x) \vee \forall x Q(x))$

III.  $(\exists x P(x) \vee \exists x Q(x)) \rightarrow \exists x (P(x) \vee Q(x))$

- (A) I only  
 (B) III only  
 (C) I and II  
 (D) I and III  
 (E) II and III

### Question

procedure mystery

```
a : integer;
b : integer;
procedure enigma(x,y)
begin
y = y + b;
x = b + x;
b = x + b;
a = y;
end enigma;
```

begin

```
a = 2; b = 7;
enigma(a, b);
write(a); write(b);
end mystery;
```

The output of procedure mystery depends on the parameter-passing method used.

24. Suppose that all parameters are passed by value. Which of the following values are output when procedure mystery is called?

|     | a  | b  |
|-----|----|----|
| (A) | 2  | 7  |
| (B) | 2  | 9  |
| (C) | 9  | 14 |
| (D) | 14 | 16 |
| (E) | 30 | 30 |

25. Suppose that all parameters are passed by reference. Which of the following values are output when procedure mystery is called?

|     | a  | b  |
|-----|----|----|
| (A) | 2  | 7  |
| (B) | 2  | 9  |
| (C) | 9  | 14 |
| (D) | 14 | 16 |
| (E) | 30 | 30 |

26. Let  $A$  and  $B$  be two sets of words (strings) from  $\Sigma^*$ , for some alphabet of symbols  $\Sigma$ . Suppose that  $B$  is a subset of  $A$ . Which of the following statements must always be true of  $A$  and  $B$ ?

- I. If  $A$  is finite, then  $B$  is finite.  
 II. If  $A$  is regular, then  $B$  is regular.  
 III. If  $A$  is context-free, then  $B$  is context-free.

- (A) I only  
 (B) II only  
 (C) III only  
 (D) I and II only  
 (E) I, II, and III

27. A CPU has an arithmetic unit that adds bytes and then sets its V, C, and Z flag bits as follows. The V-bit is set if arithmetic overflow occurs (in two's complement arithmetic). The C-bit is set if a carry-out is generated from the most significant bit during an operation. The Z-bit is set if the result is zero. What are the values of the V, C, and Z flag bits after the 8-bit bytes 1100 1100 and 1000 1111 are added?

|     | V | C | Z |
|-----|---|---|---|
| (A) | 0 | 0 | 0 |
| (B) | 1 | 1 | 0 |
| (C) | 1 | 1 | 1 |
| (D) | 0 | 0 | 1 |
| (E) | 0 | 1 | 0 |

28. Let  $k$  be an integer greater than 1. Which of the following represents the order of growth of the expression as a function of  $n$ ?

- (A)  $\Theta(k^n)$   
 (B)  $\Theta(k^{n \log n})$   
 (C)  $\Theta(k^n \log n)$   
 (D)  $\Theta(k^{2n})$   
 (E)  $\Theta(n^{k+1})$

29. Mergesort works by splitting a list of  $n$  numbers in half, sorting each half recursively, and merging the two halves. Which of the following data structures will allow mergesort to work in  $(n \log n)$  time?

- I. A singly linked list  
 II. A doubly linked list  
 III. An array

- (A) None  
 (B) III only  
 (C) I and II only  
 (D) II and III only  
 (E) I, II, and III

30. Consider the following function.
- ```
double power(double base, unsigned int exponent)
{
    if (exponent == 0)
        return 1.0;
    else
        if (even(exponent))
            return power(base*base, exponent/2);
        else
            return power(base*base, exponent/2)
                *base;
}
```
- How many multiplications are executed as a result of the call `power(5.0, 12)`? (Do not include divisions in this total.)
- (A) 12
 (B) 9
 (C) 8
 (D) 6
 (E) 5

31. Which of the following statements about datagrams sent by a node in a network using IPv4 protocol is (are) true?
- Datagrams at the source must be the size of the smallest maximum transmission unit (MTU) of all the links on a path to the destination.
 - Datagrams may be fragmented during routing.
 - Datagrams are reassembled only at the destination.
- (A) I only
 (B) II only
 (C) III only
 (D) I and III
 (E) II and III

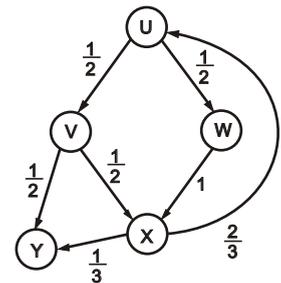
32. Of the following problems concerning a given undirected graph G , which is currently known to be solvable in polynomial time?
- (A) Finding a longest simple cycle in G
 (B) Finding a shortest cycle in G
 (C) Finding ALL spanning trees of G
 (D) Finding a largest clique in G
 (E) Finding a node coloring of G (where adjacent nodes receive distinct colors) with the minimum number of colors

33. Two processors, M-5 and M-7, implement the same instruction set. Processor M-5 uses a 5-stage pipeline and a clock cycle of 10 nanoseconds. Processor M-7 uses a 7-stage pipeline and a clock cycle of 7.5 nanoseconds. Which of the following is (are) true?

- M-7's pipeline has better maximum throughput than M-5's pipeline.
 - The latency of a single instruction is shorter on M-7's pipeline than on M-5's pipeline.
 - Programs executing on M-7 will always run faster than programs executing on—5.
- (A) I only
 (B) II only
 (C) I and III only
 (D) II and III only
 (E) I, II, and III

34. For the following code, the bias of each conditional branch in the code is labeled on the control flow graph to the right. For example, the Boolean expression `if_condition` evaluates to true on one-half of the executions of that expression.

```
Do
{
    U;
    if (if_condition)
    {
        V;
        if (break_condition)
            break;
    }
    else
        W;
    X;
}while (loop_condition);
Y;
```



- What is the expected number of times that U executes?
- (A) 0.5
 (B) 1
 (C) 1.5
 (D) 2
 (E) More than 10

35. Consider the following grammar.
- $S \rightarrow (S)$
 $S \rightarrow x$
- Which of the following statements is (are) true?
- The grammar is ambiguous.
 - The grammar is suitable for top-down parsing.
 - The grammar is suitable for bottom-up parsing.
- (A) I only
 (B) II only
 (C) III only
 (D) II and III only
 (E) I, II, and III
36. A logic circuit has three input bits: x_0 , x_1 , and x_2 , where x_0 is the least significant bit and x_2 is the most significant bit. The output from the circuit is 1 when its input is any of the 3-bit numbers 1, 4, 5, or 6; otherwise, the output is 0. Which of the following expressions represents the output from this circuit?
- (A) $\overline{x_2} + \overline{x_1} + \overline{x_0}$
 (B) $\overline{x_2}x_0 + \overline{x_2}x_1$
 (C) $\overline{x_1}x_0 + \overline{x_2}x_0$
 (D) $\overline{x_2}x_1x_0 + \overline{x_2}x_1$
 (E) $x_2 + \overline{x_1}x_0$
37. Which of the following problems can be solved by a standard greedy algorithm?
- Finding a minimum spanning tree in an undirected graph with positive-integer edge weights
 - Finding a maximum clique in an undirected graph
 - Finding a maximum flow from a source node to a sink node in a directed graph with positive-integer edge capacities
- (A) I only
 (B) II only
 (C) III only
 (D) I and II only
 (E) I, II, and III

Question 38 -39 are based on the following information.

A certain randomized algorithm A is intended to determine whether a given positive-integer input n is prime by generating a random bit string r and, based on the values of n and r , by outputting either Yes (indicating that n is prime) or No (indicating that n is composite). Execution of algorithm A guarantees the following.

- If n is prime, then the output of A is always Yes.
- If n is composite, then there is a probability $p > 0$ such that the output of A is No with probability p and is Yes with probability $1 - p$.

On an input m , algorithm A is executed k times ($k > 0$) and generates a random string r_i on the i th execution, $1 \leq i \leq k$, where r_1, r_2, \dots, r_k are mutually independent.

38. If m is composite, what is the probability that in each of the k different executions the output of A is Yes?
- (A) 1
 (B) p^k
 (C) $(1 - p)^k$
 (D) $1 - p^k$
 (E) $1 - (1 - p)^k$
39. Suppose that in each of the k different executions the output of A is No. What is the probability that m is composite?
- (A) 1
 (B) p^k
 (C) $(1 - p)^k$
 (D) $1 - p^k$
 (E) $1 - (1 - p)^k$
40. In systems with support for automatic memory management, a garbage collector typically has the responsibility for reclaiming allocated memory objects whose contents cannot affect any future legal computation. Such objects are identified by determining that they cannot be reached from a root set. Which of the following is NOT part of the root set in a typical garbage collector?
- (A) Actual parameters of the active procedures
 (B) Dynamically allocated objects on the heap
 (C) Global variables of the program
 (D) Local variables on the call stack
 (E) Values in machine registers

41. For a connected, undirected graph $G=(V, E)$ which of the following must be true?

- I. $\sum_{v \in V} \text{degree}(v)$ is even.
- II. $E \geq V-1$
- III. G has at least one vertex with degree 1.

- (A) I only
- (B) II only
- (C) III only
- (D) I and II
- (E) II and III

42. Which of the following conditions can be expressed by a Boolean formula in the Boolean variables p_1, p_2, p_3, p_4 and the connectives \wedge, \vee (without \neg)?

- I. At least three of p_1, p_2, p_3, p_4 are true.
- II. Exactly three of p_1, p_2, p_3, p_4 are true.
- III. An even number of p_1, p_2, p_3, p_4 are true.

- (A) I only
- (B) II only
- (C) III only
- (D) I and III
- (E) II and III

43. Consider the collection of all undirected graphs with 10 nodes and 6 edges. Let M and m , respectively, be the maximum and minimum number of connected components in any graph in the collection. If a graph has no self-loops and there is at most one edge between any pair of nodes, which of the following is true?

- (A) $M = 10, m = 10$
- (B) $M = 10, m = 1$
- (C) $M = 7, m = 4$
- (D) $M = 6, m = 4$
- (E) $M = 6, m = 3$

44. Consider the following pseudocode, where n is a nonnegative integer.

```
x = 0;
i = 0;
while i < n do
  x = x + 2i;
  i = i + 1;
end
```

Which of the following is a loop invariant for the while statement? (Note: a loop invariant for a while statement is an assertion that is true each time the guard is evaluated during the execution of the while statement.)

- (A) $x = 2^i - 1$ and $0 \leq i < n$
- (B) $x = 2^{i+1} - 1$ and $0 \leq i < n$
- (C) $x = 2^i - 1$ and $0 \leq i \leq n$
- (D) $x = 2^{i+1} - 1$ and $0 \leq i \leq n$
- (E) $x > 0$ and $1 \leq i < n$

45. In order to find a solution x^* to the equation $f(x) = 0$ for a polynomial $f(x)$ of degree ≥ 2 with derivative $f'(x^*) \neq 0$, Newton's method does iterations of the form

$$x_{t+1} = x_t - \frac{f(x_t)}{f'(x_t)}$$

starting with some initial value $x_0 \neq x^*$ sufficiently close to the desired solution x^* to ensure convergence to x^* . For fixed values of x_0 and x^* , which of the following represents the order of growth of the minimal number of iterations required to compute x^* to b bits of accuracy as a function of b ?

- (A) $O(1)$
- (B) $O(\log \log b)$
- (C) $O(\log b)$
- (D) $O(b)$
- (E) $O(b^2)$

46. Which of the following statements about a remote procedure call is true?

- (A) It is used to call procedures with addresses that are farther than 16 2 bytes away.
- (B) It cannot return a value.
- (C) It cannot pass parameters by reference.
- (D) It cannot call procedures implemented in a different language.
- (E) It is used to call procedures at an outer nesting level.

47. Let M be a single-tape, deterministic Turing machine with tape alphabet $\{blank, \dots, 0, 1\}$ and let C denote the (possibly infinite) computation of M starting with a blank tape. The input to each problem below is M , together with a positive integer n . Which of the following problems is (are) decidable?

- I. The computation C lasts for at least n steps.
- II. The computation C lasts for at least n steps, and M prints a 1 at some point after the n th step.
- III. M scans at least n distinct tape squares during the computation C .

- (A) None
- (B) III only
- (C) I and II only
- (D) I and III only
- (E) I, II, and III

48. Which of the following is NOT a property of bitmap graphics?
- (A) Fast hardware exists to move blocks of pixels efficiently.
 - (B) Realistic lighting and shading can be done.
 - (C) All line segments can be displayed as straight.
 - (D) Polygons can be filled with solid colors and textures.
 - (E) The complexity of the image representation is independent of the image.
49. In a pipelined RISC computer where all arithmetic instructions have the same CPI (cycles per instruction), which of the following actions would improve the execution time of a typical program?
- I. Increasing the clock cycle rate
 - II. Disallowing any forwarding in the pipeline
 - III. Doubling the sizes of the instruction cache and the data cache without changing the clock cycle time
- (A) I only
 - (B) II only
 - (C) III only
 - (D) I and II
 - (E) I and III

Question 50 - 51 refer to the following information.

The All Pairs Shortest Path Problem can be specified as follows.

Input:

Directed graph $G(V, E)$ where $V = \{1, 2, \dots, n\}$

Cost $C(i, j) \in \mathbb{U} \cup \{\infty\}$ for all $i, j \in V$, where $C(i, j) = \infty$ if and only if $(i, j) \notin E$

Definition:

$D(i, j)$ is the length of the shortest path from i to j for all $i, j \in V$.

If there is no path from i to j , then $D(i, j) = \infty$.

If $i = j$, then $D(i, j) = 0$

Problem:

Find $D(i, j)$ for all $i, j \in V$

The Floyd-Warshall algorithm gives a dynamic programming solution to the problem by defining an array $A(k, i, j)$ for $0 \leq k \leq n$ and $i, j \in V$, by the following condition.

$A(k, i, j)$ is the length of a shortest path from i to j such that all intermediate nodes on the path are in $\{1, 2, \dots, k\}$ (where no intermediate nodes are allowed if $k=0$).

Then $D(i, j) = A(n, i, j)$

The algorithm computes $A(k, i, j)$ using a recurrence on k , where the initial step is given as follows.

$A(0, i, j) = C(i, j)$ for all $i, j \in V$, such that $i \neq j$

$A(0, i, i) = 0$ for all $i \in V$

50. Which of the following is the general step in the recurrence, where $1 \leq k \leq n$?

(A) $A(k, i, j) = \min_{l < k} \{A(l, i, k) + A(l, k, j)\}$

(B) $A(k, i, j) = \min_{l < k} \{A(k-1, i, l) + A(k-1, l, j)\}$

(C) $A(k, i, j) = \min\{A(k-1, i, j), A(k-1, i, k) + A(k-1, k, j)\}$

(D) $A(k, i, j) = \min\{C(i, j), A(k, i, k) + A(k, k, j)\}$

(E) $A(k, i, j) = \min\{C(i, j), A(k-1, i, k) + A(k-1, k, j)\}$

51. What is the running time of the Floyd-Warshall algorithm?

(A) $\Theta(n)$

(B) $\Theta(n^2)$

(C) $\Theta(n^3)$

(D) $\Theta(n^3 \log n)$

(E) $\Theta(n^4)$

52. A transaction schedule is serializable if its effect is equivalent to that of some serial schedule. Consider a bookkeeping operation consisting of two transactions — T_1 and T_2 — that are required to keep the sum $A + B + C$ unchanged. Which of the following pairs of transactions will always result in a serializable schedule?

I.	$\overline{T_1}$	$\overline{T_2}$
	Lock A;	Lock B;
	$A = A - 10;$	$B = B - 20;$
	Unlock A;	Unlock B;
	$B = B + 10;$	$C = C + 20;$

II.	$\overline{T_1}$	$\overline{T_2}$
	$A = A - 10;$	Lock B;
	Lock B;	$B = B - 20;$
	$B = B + 10;$	Unlock B;
	Unlock B;	$C = C + 20;$

- III. T_1 T_2
 LockA; LockA;
 A = A - 10; B = B - 20;
 UnlockA; UnlockA;
 B = B + 10; C = C + 20;\
- (A) I only
 (B) II only
 (C) III only
 (D) I and II
 (E) II and III
53. Which of the following is NOT a reasonable justification for choosing to busy-wait on an asynchronous event?
 (A) The wait is expected to be short.
 (B) A busy-wait loop is easier to code than an interrupt handler.
 (C) There is no other work for the processor to do.
 (D) The task must meet some hard real-time deadlines.
 (E) The program executes on a time-sharing system.
54. The Singleton design pattern is used to guarantee that only a single instance of a class may be instantiated. Which of the following is (are) true of this design pattern?
 I. The Singleton class has a static factory method to provide its instance.
 II. The Singleton class can be a subclass of another class.
 III. The Singleton class has a private constructor.
 (A) I only
 (B) II only
 (C) III only
 (D) I and III only
 (E) I, II, and III
55. Assume that a target t is an integer value stored in some element of integer array x , which is sorted in nondecreasing order, and consider the following outline of a loop to search for t .
- ```
<initialization of h and k>
While (x[h] ≠ t)
{
 P;
}
```
- If <initialization> establishes the invariant " $x[h] \leq t < x[k]$ ", which of the following definitions for  $P$ , taken individually, would ensure that the loop terminates with  $x[h] = t$  assuming that  $t$  appears in the array?  
 I. if  $x[h] < t$  then  $h := h + 1$   
 II.  $h := h + 1$   
 III.  $k := k - 1$   
 (A) I only  
 (B) II only  
 (C) III only  
 (D) I and II  
 (E) I and III
56. Assume that a debugger places a breakpoint at a load instruction at virtual address  $0x77E81234$  (hexadecimal notation) in a debugged process  $P$ . If the text segment of  $P$  begins at  $0x77E80000$  in  $P$ 's virtual address space and if the debugger has mapped this same text segment at  $0x01000000$  in its virtual address space, which of the following is the virtual address used by the debugger in its WRITE operation, along with a description of how the debugger has mapped the virtual memory page containing this address?  
 (A)  $0x01001234$ ; page mapped with READ/WRITE access  
 (B)  $0x01001234$ ; page mapped with COPY-ON-WRITE access  
 (C)  $0x76E81234$ ; page mapped with READ/WRITE access  
 (D)  $0x76E81234$ ; page mapped with COPY-ON-WRITE access  
 (E)  $0x77E81234$ ; page mapped with READ/WRITE access
57. Company X shipped 5 computer chips, 1 of which was defective, and Company Y shipped 4 computer chips, 2 of which were defective. One computer chip is to be chosen uniformly at random from the 9 chips shipped by the companies. If the chosen chip is found to be defective, what is the probability that the chip came from Company Y?  
 (A)  $\frac{2}{9}$   
 (B)  $\frac{4}{9}$   
 (C)  $\frac{1}{2}$   
 (D)  $\frac{2}{3}$   
 (E)  $\frac{5}{7}$
58. An Euler circuit of an undirected graph is a circuit in which each edge of the graph appears exactly once. Which of the following undirected graphs must have an Euler circuit?  
 I. A complete graph with 12 vertices  
 II. A complete graph with 13 vertices  
 III. A tree with 13 vertices  
 (A) I only  
 (B) II only  
 (C) III only  
 (D) I and II  
 (E) I and III

59. Consider the following two languages.
- $L_1 = \{x \in \{a, b\}^* \mid x \text{ has equally many } a\text{'s and } b\text{'s}\}$
- $L_2 = \{x \in \{a, b, c\}^* \mid x \text{ has equally many } a\text{'s, } b\text{'s, and } c\text{'s}\}$
- Which of the following is true about  $L_1$  and  $L_2$ ?
- (A)  $L_1$  and  $L_2$  are both regular.  
 (B)  $L_1$  is regular, and  $L_2$  is context-free but not regular.  
 (C) Neither  $L_1$  nor  $L_2$  is regular, but both are context-free.  
 (D)  $L_1$  is context-free but not regular, and  $L_2$  is not context-free.  
 (E) Neither  $L_1$  nor  $L_2$  is context-free.
60. Consider the following possible data structures for a set of  $n$  distinct integers.
- I. Amin-heap
  - II. An array of length  $n$  sorted in increasing order
  - III. A balanced binary search tree
- For which of these data structures is the number of steps needed to find and remove the 7th largest element  $O(\log n)$  in the worst case?
- (A) I only  
 (B) II only  
 (C) I and II  
 (D) I and III  
 (E) II and III
61. Which of the following problems is (are) decidable?
- I. Given a (finite) string  $w$ , is  $w$  a prefix of the decimal expansion of  $\pi$ ?
  - II. Given a program and an input, is the program's output the decimal expansion of  $\pi$ ?
  - III. Given a program that takes as input a pre fix of the decimal expansion of  $\pi$ , is the program's output always the same for every prefix?
- (A) I only  
 (B) II only  
 (C) III only  
 (D) I and II only  
 (E) I, II, and III
62. Which of the following problems would have polynomial time algorithms if it is assumed that  $\mathbf{PN} \neq \mathbf{P}$ ?
- I. Given a combinational circuit with  $n$  inputs and  $m$  outputs and  $n^2$  gates, where each gate is either AND, OR, or NOT, and given  $m$  values  $c_1, \dots, c_m$  in  $\{0, 1\}$  either find a string of  $n$  input values  $b_1 b_2 \dots b_n$  in  $\{0, 1\}$  that would produce  $c_1, c_2, \dots, c_m$  as output or determine that  $c_1, \dots, c_m$  is not a possible output of the circuit.
  - II. Given an  $n$  by  $n$  matrix  $A$  with rational number entries, either find the exact inverse  $A^{-1}$  of  $A$  or determine that  $A^{-1}$  does not exist. (Assume that each rational number is expressed as a pair  $a/b$  of integers ( $b \neq 0$ ), where  $a$  and  $b$  are expressed in binary notation.)
  - III. Given a directed graph with nodes numbered  $1, 2, \dots, n$ , and given positive integer weights assigned to the edges, either find the length of a shortest path from node 1 to node  $n$  or determine that no such path exists. (Here the length of a path is the sum of the lengths of the edge weights on the path.)
- (A) I only  
 (B) II only  
 (C) III only  
 (D) I and II  
 (E) II and III
63. Which of the following characteristics of a programming language is best specified using a context-free grammar?
- (A) Identifier length  
 (B) Maximum level of nesting  
 (C) Operator precedence  
 (D) Type compatibility  
 (E) Type conversion
64. Consider the following function.
- ```
f(k)
{
  x = 2;
  for i = 1 to k
    x = x * x;
  return x;
}
```
- If n and k are positive integers, then the least value of k such that $f(k) > n$ is approximately
- (A) $\log_2(\log_2 n)$
 (B) $\log_2 n$
 (C) n
 (D) $\log_2 n$
 (E) 2^n

65. Let T be a depth-first search tree of a connected undirected graph G . For each vertex v of T , let $pre(v)$ be the number of nodes visited up to and including v during a preorder traversal of T , and $post(v)$ be the number of nodes visited up to and including v during a postorder traversal of T .
- The lowest common ancestor of vertices u and v in T is a vertex w of T such that w is an ancestor of both u and v , and no child of w is an ancestor of both u and v .
- Let (u, v) be an edge in G that is not in T , such that $pre(u) < pre(v)$. Which of the following statements about u and v must be true?
- $post(u) < post(v)$
 - u is an ancestor of v in T .
 - If w is the lowest common ancestor of u and v in T , then $w = u$
- (A) I only
(B) II only
(C) III only
(D) I and II
(E) II and III
66. Consider languages L and L_1 , each over the alphabet $\{a, b\}$, where
- $$L_1 = \{w/w \text{ contains some } x \in L \text{ as a substring}\}.$$
- Which of the following must be true about L and L_1 ?
- If L is regular, then L_1 is regular.
 - If L is context-free, then L_1 is context-free.
 - If L is recursive, then L_1 is recursive.
- (A) I only
(B) III only
(C) I and III only
(D) II and III only
(E) I, II, and III
67. For each nonnegative integer n , let R_n be the greatest possible number of regions into which the plane can be partitioned by n straight lines. For example, $R_0 = 1$ and $R_1 = 2$. Then R_n has order
- (A) $\Theta(n)$
(B) $\Theta(n \log n)$
(C) $\Theta(n^2)$
(D) $\Theta(2^n)$
(E) $\Theta(n!)$
68. Which of the following comes closest to being a perfectly secure encryption scheme?
- (A) The Caesar Cipher, a substitution cipher
(B) DES (Data Encryption Standard), a symmetric-key algorithm
(C) Enigma, a transposition cipher
(D) One-time pad
(E) RSA, a public-key algorithm
69. Suppose Q and R are languages. Assuming $P \neq NP$, which of the following implies that R is not in P ?
- (A) R is in NP .
(B) Q is in NP and Q is polynomial-time reducible to R .
(C) Q is in NP and R is polynomial-time reducible to Q .
(D) Q is NP -complete and Q is polynomial-time reducible to R .
(E) Q is NP -complete and R is polynomial-time reducible to Q .
70. Let N be the set of all natural numbers. Which of the following sets are countable?
- The set of all functions from N to $\{0, 1\}$
 - The set of all functions from $\{0, 1\}$ to N
 - The largest subset of N
- (A) None
(B) I and II only
(C) I and III only
(D) II and III only
(E) I, II, and III

Answer Key

| | | | | | | | | | | | | |
|-----|---|-----|---|-----|---|-----|---|-----|---|-----|---|------|
| 1. | D | 11. | A | 21. | A | 31. | E | 41. | D | 51. | C | 61.A |
| 2. | C | 12. | C | 22. | | 32. | B | 42. | A | 52. | B | 62.E |
| 3. | D | 13. | C | 23. | D | 33. | A | 43. | C | 53. | C | 63.C |
| 4. | C | 14. | C | 24. | D | 34. | D | 44. | C | 54. | E | 64.A |
| 5. | B | 15. | B | 25. | E | 35. | D | 45. | C | 55. | E | 65.E |
| 6. | C | 16. | D | 26. | A | 36. | C | 46. | C | 56. | A | 66.E |
| 7. | | 17. | B | 27. | B | 37. | A | 47. | D | 57. | D | 67. |
| 8. | | 18. | C | 28. | A | 38. | C | 48. | C | 58. | B | 68.D |
| 9. | A | 19. | D | 29. | E | 39. | A | 49. | E | 59. | D | 69.D |
| 10. | D | 20. | C | 30. | | 40. | B | 50. | C | 60. | E | 70.D |

MATHEMATICS TEST

100 QUESTIONS

60 MINUTES

DIRECTIONS

Each of the questions or incomplete statements below is followed by five suggested answers or completions. In each case, select the one that is the best of the choices offered and then mark the corresponding space on the answer sheet.

Note: In this examination:

- (1) All logarithms with an unspecified base are natural logarithms (that is, with base e).
- (2) The set of all real numbers x such that $a < x < b$ is denoted by (a, b) .
- (3) The symbols \mathbb{Z} , \mathbb{Q} , \mathbb{R} , and \mathbb{C} denote the sets of integers, rational numbers, real numbers, and complex numbers, respectively.

1. If $F(x) = \int_e^x \log t \, dt$ for all positive x , then $F'(x) =$

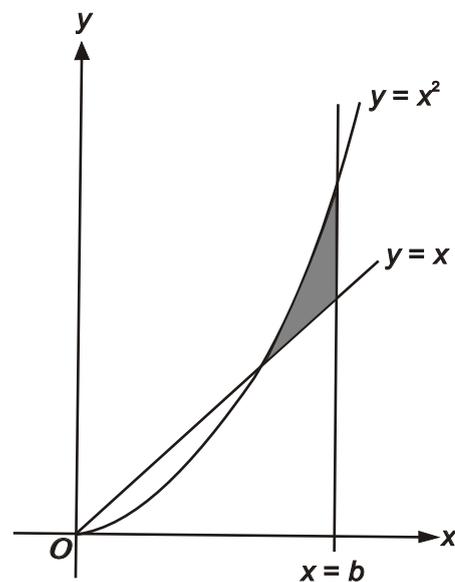
- (A) x
- (B) $\frac{1}{x}$
- (C) $\log x$
- (D) $x \log x$
- (E) $x \log -1$

2. If $F(1) = 2$ and $F(n) = F(n - 1) + \frac{1}{2}$ for all integers $n > 1$, then $F(101) =$

- (A) 49
- (B) 50
- (C) 51
- (D) 52
- (E) 53

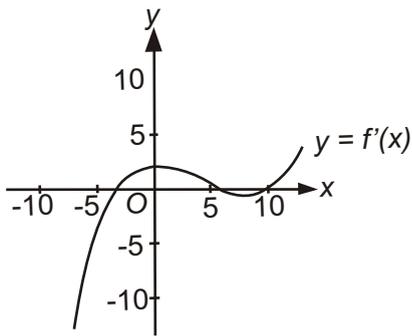
3. If $\begin{pmatrix} a & -b \\ b & a \end{pmatrix}$ is invertible under matrix multiplication, then its inverse is

- (A) $\begin{pmatrix} a & -b \\ b & a \end{pmatrix}$
- (B) $\frac{1}{a^2 + b^2} \begin{pmatrix} a & -b \\ b & a \end{pmatrix}$
- (C) $\frac{1}{a^2 + b^2} \begin{pmatrix} a & b \\ -b & a \end{pmatrix}$
- (D) $\begin{pmatrix} a & b \\ -b & a \end{pmatrix}$
- (E) $\frac{1}{a^2 - b^2} \begin{pmatrix} -b & a \\ a & b \end{pmatrix}$

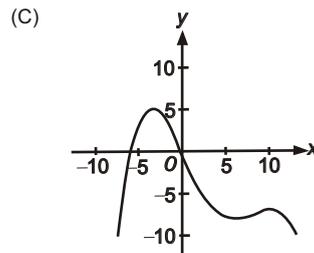
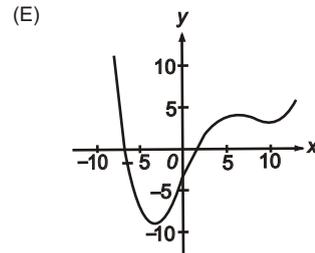
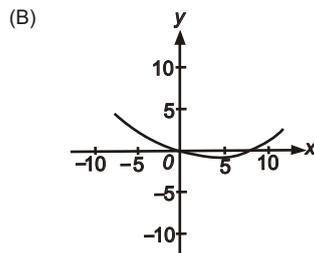
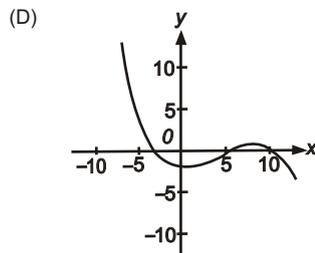
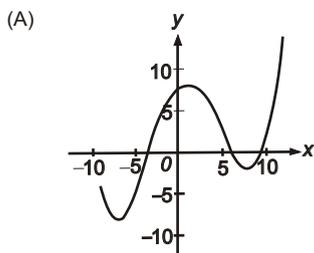


4. If $b > 0$ and if $\int_0^b x \, dx = \int_0^b x^2 \, dx$, then the area of the shaded region in the figure above is

- (A) $\frac{1}{12}$
- (B) $\frac{1}{6}$
- (C) $\frac{1}{4}$
- (D) $\frac{1}{3}$
- (E) $\frac{1}{2}$



5. If the figure above is the graph of $y = f'(x)$, which of the following could be the graph of $y = f(x)$?



6. Consider the following sequence of instructions

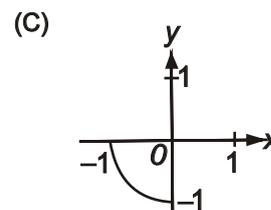
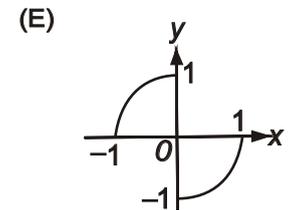
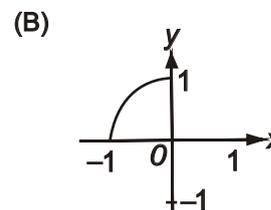
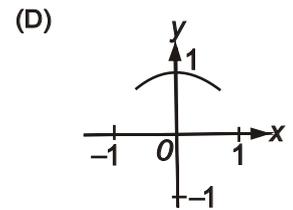
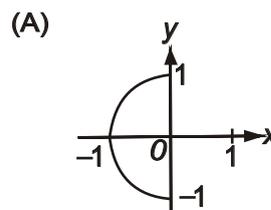
1. Set $k=999$, $i=1$, and $p=0$
2. If $k > i$, then go to step 3; otherwise to get step 5.
3. Replace i with $2i$ and replace p with $p+1$
4. Go to step 2
5. Print p .

If these instructions are followed, what number will be printed at step 5?

- (A) 1
- (B) 2
- (C) 10
- (D) 512
- (E) 999

7. Which of the following indicates the graph of

$$\left\{ (\sin t, \cos t) : -2 \leq t \leq 0 \right\} \text{ in the } xy\text{-plane?}$$



8. $\int_0^1 \frac{x}{1+x^2} dx =$

- (A) 1
 - (B) $\frac{\pi}{4}$
 - (C) $\tan^{-1} \frac{\sqrt{2}}{2}$
 - (D) $\log 2$
 - (E) $\log \sqrt{2}$
9. If S is a nonempty finite set with k elements, then the number of one-to-one functions from S onto S is
- (A) $k!$
 - (B) k^2
 - (C) k^k
 - (D) 2^k
 - (E) 2^{k+1}
10. Let g be the function defined on the set of all real numbers by

$$g(x) = \begin{cases} 1 & \text{if } x \text{ is rational,} \\ e^x & \text{if } x \text{ is irrational.} \end{cases}$$

Then the set of numbers at which g is continuous is

- (A) the empty set
 - (B) (0)
 - (C) (1)
 - (D) the set of rational numbers
 - (E) the set of irrational numbers
11. For all real numbers x and y , the expression $\frac{x+y+|x-y|}{2}$ is equal to
- (A) the maximum of x and y
 - (B) the minimum of x and y
 - (C) $x+y$
 - (D) the average of x and y
 - (E) the average of $x+y$ and $x-y$
12. Let B be a nonempty bounded set of real numbers and let b be the least upper bound of B . If b is not a member of B , which of the following is necessarily true?
- (A) B is closed
 - (B) B is not closed
 - (C) b is a limit point of B
 - (D) No sequence in B converges to b
 - (E) There is an open interval containing b but containing no point of B

13. A drawer contains 2 blue, 4 red, and 2 yellow socks. If 2 socks are to be randomly selected from the drawer, what is the probability that they will be the same color?

- (A) $\frac{2}{7}$
- (B) $\frac{2}{5}$
- (C) $\frac{3}{7}$
- (D) $\frac{1}{2}$
- (E) $\frac{3}{5}$

14. Let R be the set of real numbers and let f and g be functions from R into R . The negation of the statement

"For each s in R , there exists, an r in R such that if $f(r) > 0$, then $g(s) > 0$."
Is which of the following?

- (A) for each s in R , there does not exist an r in R such that if $f(r) > 0$, then $g(s) > 0$.
- (B) for each s in R , there exists an r in R such that $f(r) > 0$ and $g(s) \leq 0$.
- (C) There exists an s in R such that for each r in R , $f(r) > 0$ and $g(s) \leq 0$.

15. If g is a function defined on the open interval (a, b) such that $a < g(x) < x$ for all $x \in (a, b)$, then g is

- (A) an unbounded function
- (B) a nonconstant function
- (C) a nonnegative function
- (D) a strictly increasing function
- (E) a polynomial function of degree 1

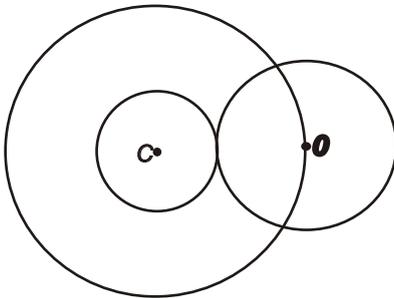
16. For what value (or values) of m is the vector $(1, 2, m, 5)$ a linear combination of the vectors $(0, 1, 1, 1)$, $(0, 0, 0, 1)$, and $(1, 1, 2, 0)$?

- (A) for no value of m
- (B) -1 only
- (C) 1 only
- (D) 3 only
- (E) for infinitely many values of m

17. For a function f , the finite differences $\Delta f(x)$ and $\Delta^2 f(x)$ are defined by $\Delta f(x) = f(x+1) - f(x)$ and $\Delta^2 f(x) = \Delta f(x+1) - \Delta f(x)$. What is the value of $f(4)$, given the following partially completed finite difference table?

| x | $f(x)$ | $\Delta f(x)$ | $\Delta^2 f(x)$ |
|-----|--------|---------------|-----------------|
| 1 | -1 | 4 | |
| 2 | | -2 | 6 |
| 3 | | | |
| 4 | | | |

- (A) -5
(B) -1
(C) 1
(D) 3
(E) 5



18. In the figure above, the annulus with center C has inner radius r and outer radius 1. As r increases, the circle with centre O contracts and remains tangent to the inner circle. If $A(r)$ is the area of the annulus and $a(r)$ is the area of the circular region with center O , then $\lim_{r \rightarrow 1} \frac{A(r)}{a(r)} =$

- (A) 0
(B) $\frac{2}{\pi}$
(C) 1
(D) $\frac{\pi}{2}$
(E) ∞

19. Which of the following are multiplication tables for groups with four elements?

| | | | | | |
|----|--|-----|--|------|--|
| I. | $\begin{array}{c cccc} & a & b & c & d \\ \hline a & a & b & c & d \\ b & b & c & d & a \\ c & c & d & a & b \\ d & d & a & b & c \end{array}$ | II. | $\begin{array}{c cccc} & a & b & c & d \\ \hline a & a & b & c & d \\ b & b & a & d & c \\ c & c & d & a & a \\ d & d & c & a & b \end{array}$ | III. | $\begin{array}{c cccc} & a & b & c & d \\ \hline a & a & b & c & d \\ b & b & a & d & c \\ c & c & d & a & a \\ d & d & c & a & b \end{array}$ |
|----|--|-----|--|------|--|

- (A) None
(B) I Only
(C) I and II only
(D) II and III only
(E) I, II and III

20. Which of the following statements are true for every function f , defined on the set of

all real numbers, such that $\lim_{x \rightarrow 0} \frac{f(x)}{x}$ is a

real number L and $f(0) = 0$?

- I. f is differentiable at 0
II. $L = 0$
III. $\lim_{x \rightarrow 0} f(x) = 0$
- (A) None
(B) I only
(C) III only
(D) I and III only
(E) I, II and III

21. What is the area of the region bounded by the coordinate axes and the line tangent

to the graph of $y = \frac{1}{8}x^2 + \frac{1}{2}x + 1$ at the point $(0, 1)$

- (A) $\frac{1}{16}$
(B) $\frac{1}{8}$
(C) $\frac{1}{4}$
(D) 1
(E) 2

22. Let Z be the group of all integers under the operation of addition. Which of the following subsets of Z is NOT a subgroup of Z ?

- (A) $\{0\}$
(B) $\{n \in Z : n \geq 0\}$
(C) $\{n \in Z : n \text{ is an even integer}\}$
(D) $\{n \in Z : n \text{ is divisible by both 6 and 9}\}$
(E) Z

23. In the Euclidean plane, point A is on a circle centered at point O , and O is on a circle centered at A . The circles intersect at points B and C . What is the measure of angle BAC ?

- (A) 60°
(B) 90°
(C) 120°
(D) 135°
(E) 150°

24. Which of the following sets of vectors is a basis for the subspace of Euclidean 4-space consisting of all vectors that are orthogonal to both $(0, 1, 1, 1)$ and $(1, 1, 1, 0)$?
- (A) $\{(0, -1, 1, 0)\}$
 (B) $\{(1, 0, 0, 0), (0, 0, 0, 1)\}$
 (C) $\{(-2, 1, 1, -2), (0, 1, -1, 0)\}$
 (D) $\{(1, -1, 0, 1), (-1, 1, 0, -1), (0, 1, -1, 0)\}$
 (E) $\{(0, 0, 0, 0), (-1, 1, 0, -1), (0, 1, -1, 0)\}$
25. Let f be the function defined by $f(x, y) = 5x - 4y$ on the region in the xy -plane satisfying the inequalities $x \leq 2$, $y \geq 0$, $x + y \geq 1$, and $y - x \leq 0$. The maximum value of f on this region is
- (A) 1
 (B) 2
 (C) 5
 (D) 10
 (E) 15
26. Let f be the function defined by
- $$f(x) = \begin{cases} -x^2 + 4x - 2 & \text{if } x < 1, \\ -x^2 + 2 & \text{if } x \geq 1. \end{cases}$$
- Which of the following statements about f is true?
- (A) f has an absolute maximum at $x = 0$
 (B) f has an absolute maximum at $x = 1$
 (C) f has an absolute maximum at $x = 2$
 (D) f has no absolute maximum
 (E) f has local maxima at both $x = 0$ and $x = 2$
27. Let f be a function such that $f(x) = f(1-x)$ for all real numbers x . If f is differentiable everywhere, then $f'(0) =$
- (A) $f(0)$
 (B) $f(1)$
 (C) $-f(0)$
 (D) $f'(1)$
 (E) $-f'(1)$
28. If V_1 and V_2 are 6-dimensional subspaces of a 10-dimensional vector space V , what is the smallest possible dimension that $V_1 \cap V_2$ can have?
- (A) 0
 (B) 1
 (C) 2
 (D) 4
 (E) 6
29. Assume that p is a polynomial function on the set of real numbers. If $p(0) = p(2) = 3$ and $p'(0) = p'(2) = -1$, then $\int_0^2 xp''(x) dx =$
- (A) -3
 (B) -2
 (C) -1
 (D) 1
 (E) 2
30. Suppose B is a basis for a real vector space V of dimension greater than 1. Which of the following statements could be true?
- (A) The zero vector of V is an element of B .
 (B) B has a proper subset that spans V .
 (C) B is a proper subset of a linearly independent subset of V .
 (D) There is a basis for V that is disjoint from B .
 (E) one of the vectors in B is a linear combination of the other vectors in B .
31. Which of the following CANNOT be a root of a polynomial in x of the form $9x^5 + ax^3 + b$, where a and b are integers?
- (A) -9
 (B) -5
 (C) $\frac{1}{4}$
 (D) $\frac{1}{3}$
 (E) 9
32. When 20 children in a classroom line up for lunch, Pat insists on being somewhere ahead of Lynn. If Pat's demand is to be satisfied, in how many ways can the children line up?
- (A) 20!
 (B) 19!
 (C) 18!
 (D) $\frac{20!}{2}$
 (E) 20.19

33. How many integers from 1 to 1,000 are divisible by 30 but not by 16?
- (A) 29
(B) 31
(C) 32
(D) 33
(E) 38
34. Suppose f is a differentiable function for which $\lim_{x \rightarrow \infty} f(x)$ and $\lim_{x \rightarrow \infty} f'(x)$ both exist and are finite. Which of the following must be true?
- (A) $\lim_{x \rightarrow \infty} f'(x) = 0$
(B) $\lim_{x \rightarrow \infty} f''(x) = 0$
(C) $\lim_{x \rightarrow \infty} f(x) = \lim_{x \rightarrow \infty} f'(x)$
(D) f is a constant function
(E) f' is a constant function
35. In xyz -space, an equation of the plane tangent to the surface $z = e^{-x} \sin y$ at the point where $x=0$ and $y = \frac{\pi}{2}$ is
- (A) $x + y = 1$
(B) $x + z = 1$
(C) $x - z = 1$
(D) $y + z = 1$
(E) $y - z = 1$
36. For each real number x , let $\mu(x)$ be the mean of the numbers 4, 9, 7, 5, and x ; and let $\eta(x)$ be the median of these five numbers. For how many values of x is $\mu(x) = \eta(x)$?
- (A) None
(B) One
(C) Two
(D) Three
(E) Infinitely many
37.
$$\sum_{k=1}^{\infty} \frac{k^2}{k!} =$$
- (A) e
(B) $2e$
(C) $(e+1)(e-1)$
(D) e^2
(E) ∞
38. Which of the following integrals on the interval $\left[0, \frac{\pi}{4}\right]$ has the greatest value?
- (A) $\int_0^{\frac{\pi}{4}} \sin t \, dt$
(B) $\int_0^{\frac{\pi}{4}} \cos t \, dt$
(C) $\int_0^{\frac{\pi}{4}} \cos 2t \, dt$
(D) $\int_0^{\frac{\pi}{4}} \cos 2t \, dt$
(E) $\int_0^{\frac{\pi}{4}} \sin t \cos t \, dt$
39. Consider the function f defined by $f(x) = e^{-x}$ on the interval $[0, 10]$. Let $n > 1$ and let x_0, x_1, \dots, x_n be numbers such that $0 = x_0 < x_1 < x_2 < \dots < x_{n-1} < x_n = 10$. Which of the following is greatest?
- (A) $\sum_{j=1}^n f(x_j)(x_j - x_{j-1})$
(B) $\sum_{j=1}^n f(x_{j-1})(x_j - x_{j-1})$
(C) $\sum_{j=1}^n f\left(\frac{x_j + x_{j-1}}{2}\right)(x_j - x_{j-1})$
(D) $\int_0^{10} f(x) \, dx$
(E) 0
40. A fair coin is to be tossed 8 times. What is the probability that more of the tosses will result in heads than will result in tails?
- (A) $\frac{1}{4}$
(B) $\frac{1}{3}$
(C) $\frac{87}{256}$
(D) $\frac{23}{64}$
(E) $\frac{93}{256}$

41. The function $f(x, y) = xy - x^3 - y^3$ has a relative maximum at the point.
- (A) (0, 0)
 (B) (1, 1)
 (C) (-1, -1)
 (D) (1, 3)
 (E) $\left(\frac{1}{3}, \frac{1}{3}\right)$
42. Consider the points $A = (-1, 2)$, $B = (6, 4)$, and $C = (1, -20)$ in the plane. For how many different points D in the plane are A , B , C , and D the vertices of a parallelogram?
- (A) None
 (B) One
 (C) Two
 (D) Three
 (E) Four
43. If A is a 3×3 matrix such that $A \begin{pmatrix} 0 \\ 1 \\ 2 \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}$ and $A \begin{pmatrix} 3 \\ 4 \\ 5 \end{pmatrix} = \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix}$ then the product A is
- (A) $\begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}$
 (B) $\begin{pmatrix} -1 \\ 2 \\ 0 \end{pmatrix}$
 (C) $\begin{pmatrix} 1 \\ -1 \\ 0 \end{pmatrix}$
 (D) $\begin{pmatrix} 9 \\ 10 \\ 11 \end{pmatrix}$
 (E) not uniquely determined by the information given
44. Let f denote the function defined for all $x > 0$ by $f(x) = \frac{1}{x^2}$. Which of the following statements is FALSE?
- (A) $\lim_{x \rightarrow 0^+} f(x) = 1$
 (B) $\lim_{x \rightarrow \infty} f(x) = \infty$
 (C) $f(x) = x^{x^2}$ for all $x > 0$
 (D) The derivative $f'(x)$ is positive for all $x > 0$.
 (E) The derivative $f'(x)$ is increasing for all $x > 0$.
45. An experimental car is found to have a fuel efficiency $E(v)$, in miles per gallon of fuel, where v is the speed of the car, in miles per hour. For a certain 40hour trip, if $v = v(t)$ is the speed of the car t hours after the trip started, which of the following integrals represents the number of gallons of fuel that the car used on the trip?
- (A) $\int_0^4 \frac{v(t)}{E(v(t))} dt$
 (B) $\int_0^4 \frac{E(v(t))}{v(t)} dt$
 (C) $\int_0^4 \frac{tv(t)}{E(v(t))} dt$
 (D) $\int_0^4 \frac{tE(v(t))}{v(t)} dt$
 (E) $\int_0^4 v(t)E(v(t)) dt$
46. For $0 < t < \pi$, the matrix $\frac{\cos t}{\sin t} \begin{pmatrix} t & -\sin t \\ \sin t & \cos t \end{pmatrix}$ has distinct complex eigenvalues λ_1 and λ_2 . For what value of t , $0 < t < \pi$, is $\lambda_1 + \lambda_2 = 1$?
- (A) $\frac{\pi}{6}$
 (B) $\frac{\pi}{4}$
 (C) $\frac{\pi}{3}$
 (D) $\frac{\pi}{2}$
 (E) $\frac{2\pi}{3}$

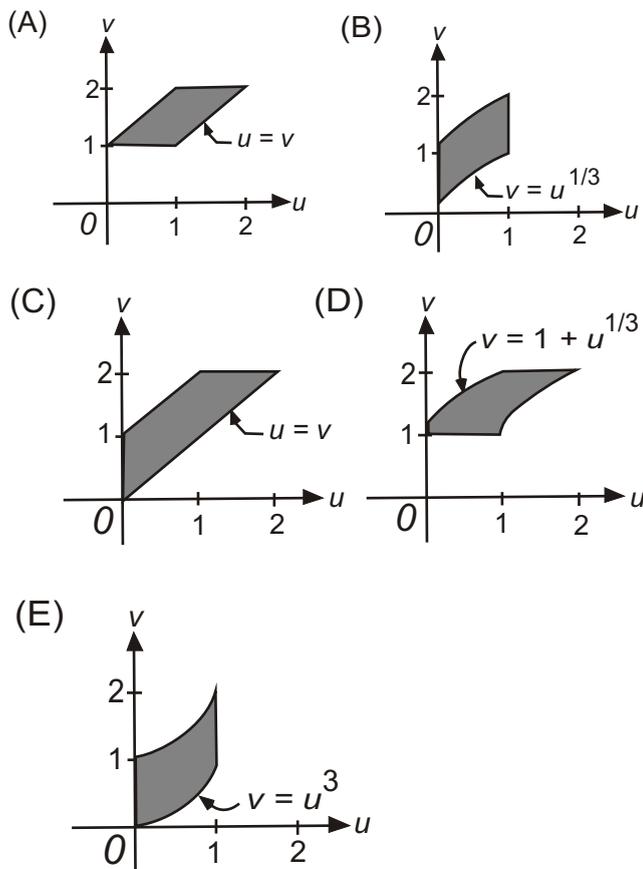
47. Let x and y be uniformly distributed, independent random variables on $\{0, 1\}$. The probability that the distance between x and y is less than $\frac{1}{2}$ is

- (A) $\frac{1}{4}$
 (B) $\frac{1}{3}$
 (C) $\frac{1}{2}$
 (D) $\frac{2}{3}$
 (E) $\frac{3}{4}$

48. Consider the change of variables from the xy -plane to the uv -plane given by the equations

$$\begin{aligned} u &= x^{1/3} + y \\ v &= 1 + y \end{aligned}$$

Under this transformation the image of the region $\{(x, y): 0 \leq x \leq 1 \text{ and } 0 \leq y \leq 1\}$ is which of the following shaded regions?



49. If f is a continuous function on the set of real numbers and if a and b are real numbers, which of the following must be true?

I. $\int_a^b f(x) dx = \int_{a+3}^{b+3} f(x-3) dx$

II. $\int_a^b f(x) dx = \int_A^3 f(x) dx - \int_b^3 f(x) dx$

III. $\int_{3a}^{3b} f(x) dx = 3 \int_a^b f(3x) dx$

- (A) I only
 (B) II only
 (C) I and II only
 (D) II and III only
 (E) I, II and III

50. How many continuous real-valued functions f are there with domain $\{-1, 1\}$ such that $(f(x))^2 = x^2$ for each x in $[-1, 1]$?

- (A) one
 (B) Two
 (C) Three
 (D) Four
 (E) Infinitely many

51. Let D be the region in the xy -plane in which the series $\sum_{k=1}^{\infty} \frac{(x+2y)^k}{k}$ converges.

Then the interior of D is

- (A) an open disk
 (B) the open region bounded by an ellipse
 (C) the open region bounded by a quadrilateral
 (D) the open region between two parallel lines
 (E) an open half plane

52. Consider the following system of linear equation over the real numbers, where x , y , and z are variables and b is a real constant.

$$\begin{aligned}x + y + z &= 0 \\x + 2y + 3z &= 0 \\x + 3y + bz &= 0\end{aligned}$$

Which of the following statements are true?

- I. There exists a value of b for which the system has no solution.
- II. There exists a value of b for which the system has exactly one solution.
- III. There exists a value of b for which the system has more than one solution.

- (A) II only
- (B) I and II only
- (C) I and III only
- (D) II and III only
- (E) I, II, and III

53. In the complex plane, let C be the circle $|z| = 2$ with positive (counterclockwise) orientation. Then

$$\int_C \frac{dz}{(z-1)(z+3)^2}$$

- (A) 0
- (B) $2\pi i$
- (C) $\frac{\pi i}{2}$
- (D) $\frac{\pi i}{8}$
- (E) $\frac{\pi i}{16}$

54. The inside of a certain water tank is a cube measuring 10 feet on each edge and having vertical sides and no top. Let $h(t)$ denote the water level, in feet, above the floor of the tank at time t seconds. Starting at time $t = 0$, water pours into the tank at a constant rate of 1 cubic foot per second, and simultaneously, water is removed from the tank at a rate of $0.25h(t)$ cubic feet per second. As t , what is the limit of the volume of the water in the tank?

- (A) 400 cubic feet
- (B) 600 cubic feet
- (C) 1,000 cubic feet
- (D) The limit does not exist
- (E) The limit exists, but it cannot be determined without knowing $h(0)$.

55. Suppose that f is a twice-differentiable function on the set of real numbers and that $f(0)$, $f'(0)$ and $f''(0)$ are all negative. Suppose f'' has all three of the following properties.

- I. It is increasing on the interval $(0, \infty)$
- II. It has a unique zero in the interval $(0, \infty)$
- III. It has unbounded on the interval $(0, \infty)$

Which of the same three properties does f necessarily have?

- (A) I only
- (B) II only
- (C) III only
- (D) II and III only
- (E) I, II and III

56. For every set S and every metric d on S , which of the following is a metric on S ?

- (A) $4 + d$
- (B) $e^d - 1$
- (C) $d - |d|$
- (D) d^2
- (E) \sqrt{d}

57. Let R be the field of real numbers and $R(x)$ the ring of polynomials in x with coefficient in R . Which of the following subsets of $R(x)$ is a subring of $R(x)$?

- I. All polynomials whose coefficient of x is zero
- II. All polynomials whose degree is an even integer, together with the zero polynomial
- III. All polynomials whose coefficients are rational numbers.

- (A) I only
- (B) II only
- (C) I and III only
- (D) II and III only
- (E) I, II and III

58. Let f be a real-valued function defined and continuous on the set of real numbers R . Which of the following must be true of the set $S = \{f(c) : 0 < c < 1\}$?

- I. S is a connected subset of R
- II. S is an open subset of R
- III. S is a bounded subset of R .

- (A) I only
- (B) I and II only
- (C) I and III only
- (D) II and III only
- (E) I, II and III

59. A cyclic group of order 15 has an element x such that the set $\{x^3, x^5, x^9\}$ has exactly two elements. The number of elements in the set $\{x^{13n} : n \text{ is a positive integer}\}$ is
- (A) 3
(B) 5
(C) 8
(D) 15
(E) infinite
60. If S is a ring with the property that $s = s^2$ for each $s \in S$, which of the following must be true?
- I. $S + s = 0$ for each $s \in S$
 II. $(S + 1)^2 = S^2 + 2$ for each $s, t \in S$.
 III. S is commutative
- (A) III only
(B) I and II only
(C) I and III only
(D) II and III only
(E) I, II, and III
61. What is the greatest integer that divides $p^4 - 1$ for every prime number p greater than 5?
- (A) 12
(B) 30
(C) 48
(D) 120
(E) 240
62. The coefficient of x^3 in the expansion of $(1+x)^3(2+x^2)^{10}$ is
- (A) 2^{14}
(B) 31
(C) $\binom{3}{3} + \binom{10}{1}$
(D) $\binom{3}{3} + 2\binom{10}{1}$
(E) $\binom{3}{3}\binom{10}{1}2^9$
63. At how many points in the xy -plane do the graphs of $y = x^{12}$ and $y = 2^x$ intersect?
- (A) None
(B) One
(C) Two
(D) Three
(E) Four
64. Suppose that f is a continuous real-valued function defined on the closed interval $[0, 1]$. Which of the following must be true?
- I. There is a constant $C > 0$ such that $f(x) - f(y) \leq C$ for all x and y in $[0, 1]$.
 II. There is a constant $D > 0$ such that $f(x) - f(y) \leq D$ for all x and y in $[0, 1]$ that satisfy $x - y \leq D$.
 III. There is a constant $E > 0$ such that $f(x) - f(y) \leq E(x - y)$ for all x and y in $[0, 1]$.
- (A) I only
(B) III only
(C) I and II only
(D) II and III only
(E) I, II and III
65. Let $p(x)$ be the polynomial $x^3 + ax^2 + bx + c$, where a, b , and c are real constants. If $p(-3) = p(2) = 0$ and $p'(-3) < 0$, which of the following is a possible value of c ?
- (A) -27
(B) -18
(C) -6
(D) -3
(E) $-\frac{1}{2}$
66. In the xy -plane, if C is the circle $x^2 + y^2 = 9$, oriented counterclockwise, then $\oint_C -2y \, dx + x^2 \, dy =$
- (A) 0
(B) 6π
(C) 9π
(D) 12π
(E) 18π

Answer Key

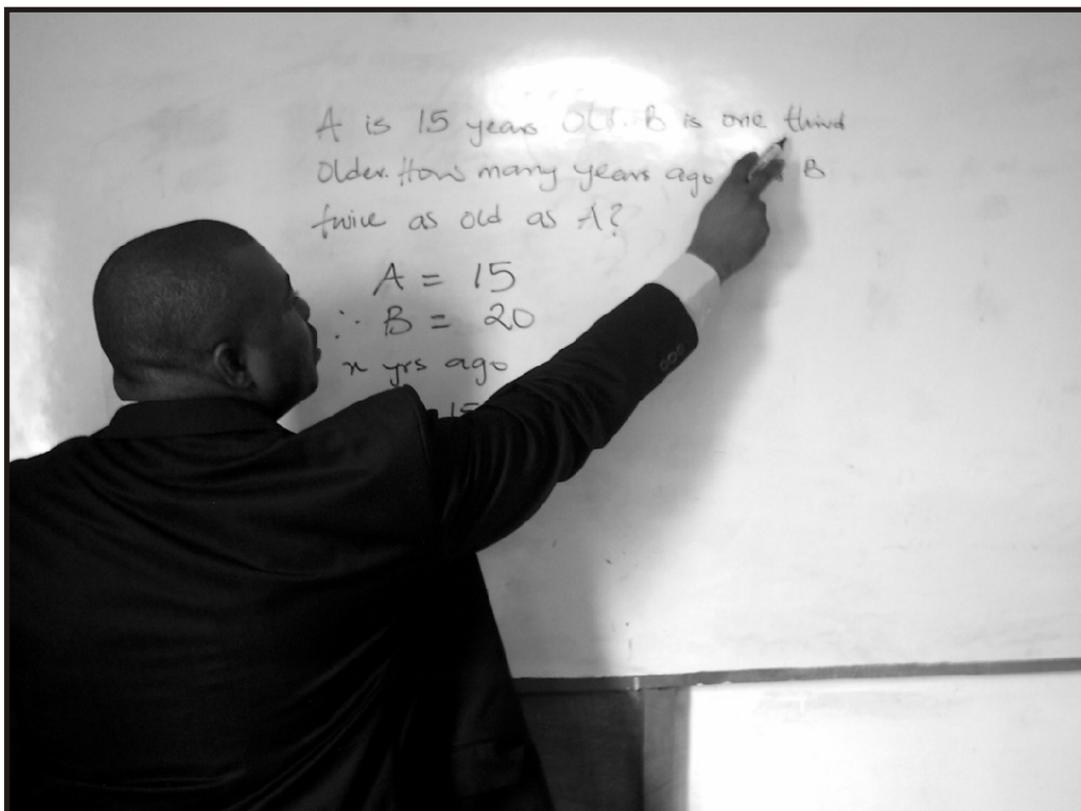
| | | | | | | | | | | | | | |
|-----|---|-----|---|-----|---|-----|---|-----|---|-----|---|-----|---|
| 1. | C | 11. | A | 21. | D | 31. | C | 41. | E | 51. | D | 61. | E |
| 2. | D | 12. | C | 22. | B | 32. | D | 42. | D | 52. | D | 62. | A |
| 3. | C | 13. | A | 23. | C | 33. | A | 43. | B | 53. | D | 63. | D |
| 4. | B | 14. | C | 24. | C | 34. | A | 44. | D | 54. | A | 64. | C |
| 5. | E | 15. | B | 25. | D | 35. | B | 45. | A | 55. | D | 65. | A |
| 6. | C | 16. | D | 26. | B | 36. | D | 46. | C | 56. | E | 66. | E |
| 7. | B | 17. | E | 27. | E | 37. | B | 47. | E | 57. | C | | |
| 8. | E | 18. | E | 28. | C | 38. | B | 48. | A | 58. | C | | |
| 9. | A | 19. | B | 29. | B | 39. | B | 49. | E | 59. | A | | |
| 10. | B | 20. | D | 30. | D | 40. | E | 50. | D | 60. | E | | |

PART SIX

ENGINEERING TESTS

For Oil Companies, Multinationals, Marketing Firms, Industries, Engineering Firms etc.

Note: Some Banks might use these tests also.



IEC MONTHLY SEMINAR

CHEMICAL ENGINEERING TEST

70 QUESTIONS

30 MINUTES

DIRECTIONS

Each of the questions or incomplete statements below is followed by five suggested answers or completions. In each case, select the one that is the best of the choices offered and then mark the corresponding space on the answer sheet.

- The inner surface of a plane brick wall is at 50° and the outer surface is at 25° C. Calculate the rate of heat transfer per m^2 of the surface area of the wall, which is 220 mm thick. The thermal conductivity of the bricks is 0.51 W/mK .

(A) 20.65 W/m^2
 (B) 32.75 W/m^2
 (C) 47.62 W/m^2
 (D) 57.95 W/m^2
- A mild steel tank of wall thickness 12 mm contains water at 100° C. Calculate the rate of heat loss per m^2 of tank surface area when the atmospheric temperature is 20° C. The thermal conductivity of mild steel is 50 W/m K , and the heat transfer coefficients for the inside and outside the tank are 2850 and $10 \text{ W/m}^2 \text{ K}$, respectively. Calculate also the temperature of the outside surface of the tank.

(A) $300.5 \text{ W/m}^2, 45.5^{\circ}$ C
 (B) $495.2 \text{ W/m}^2, 67.6^{\circ}$ C
 (C) $602.6 \text{ W/m}^2, 80.6^{\circ}$ C
 (D) $795.2 \text{ W/m}^2, 99.52^{\circ}$ C
- A spherical shaped vessel of 1.4 m diameter is 90 mm thick. Find the rate of heat leakage, if the temperature difference between the inner and outer surfaces is 220° C. Thermal conductivity of the material of the sphere is 0.083 W/mK .

(A) 0.2 kW
 (B) 0.5 kW
 (C) 1.0886 kW
 (D) 1.6 kW
- Liquid air at -147° C is stored in the space of two concentric spheres of 0.2 m and 0.3 m diameters. The surface emissivities are 0.028. Assume the outer surface temperature is 25° C. Considering only

(A) W/m-s-K
 (B) $\text{cal/m-s-}^{\circ}\text{C}$
- Choose the wrong statement about thermal diffusivity:

(A) it represents a physical property of the material
 (B) it is a dimensionless quantity
 (C) it is an important characteristic for unsteady heat conduction
 (D) it is the ratio of thermal conductivity to thermal storage capacity of a material.
- A body which partly absorbs and partly reflects but does not allow any radiation to pass through it ($a + r = 1$ and $t = 0$) is called

(A) diathermanous
 (B) opaque
 (C) gray
 (D) specular
- The heat flow equation through a cylinder of inner radius r_1 and other radius r_2 is desired to be written in the same form as that for heat flow through a plane wall. For wall thickness $(r_2 - r_1)$, the equivalent area A_m would be

(A) $\frac{A_1 + A_2}{2}$
 (B) $\frac{A_1 + A_2}{2 \log_e (A_2/A_1)}$
 (C) $\frac{A_2 - A_1}{\log_e (A_2/A_1)}$
 (D) $\frac{A_2 - A_1}{2 \log_e (A_2/A_1)}$

Where A_1 and A_2 are the inner and outer surface areas of the cylindrical tube.

8. A gas turbine blade (idealised as a flat plate of surface area A , thickness d and thermal conductivity k) has hot gases at temperature T_1 on one side and cooling air at temperature T_2 on the other side. If h_1 and h_2 are the corresponding surface coefficients of heat transfer, then the overall heat transfer coefficient U is given by
- $$\frac{1}{U} = \frac{1}{h_1} + \frac{\delta}{k} + \frac{1}{h_2}$$
- $$\frac{1}{U} = \frac{1}{h_1} + \frac{k}{\delta} + \frac{1}{h_2}$$
- $$U = h_1 + \frac{\delta}{k} + h_2$$
- $$\frac{1}{U} = \frac{1}{h_1} + \frac{\delta}{k} + \frac{1}{h_2}$$
9. Which of the following is the wrong value of characteristic length l which appears in the Biot number hl/k and the Fourier number at/l^2 ?
- (A) $l = R/3$ in case of a sphere of radius R
- (B) $l = R/2$ in case of a cylinder of radius R and length L
- (C) $l = R/6$ in case of a cube with each side of length L
- (D) $l = b/2$ for a flat plate of thickness d breadth b and height h .
10. A solid cement wall of a building having thermal conductivity k and thickness d is heated by convection on the inner side and cooled by convection on the outside. The heat flux through the wall can be expressed as
- (A) $\frac{(t_1 - t_2)}{1/h_1 + \delta/k + 1/h_2}$
- (B) $\frac{(t_1 - t_2)}{h_1 + \delta/k + h_2}$
- (C) $\frac{k(t_1 - t_2)(h_1 + h_2)}{8}$
- (D) None of the above
11. The heat dissipation from an infinitely long fin is given by
- (A) $\sqrt{PkhA_{cs}}(t_0 - t_a)$
- (B) $hPl(t_0 - t_a)$
- (C) $\sqrt{PkhA_{cs}}(t_0 - t_a) \tanh ml$
- (D) $\sqrt{PkhA_{cs}}(t_0 - t_a) \frac{\tanh ml + (h/k)m}{l + (h/k)m \tanh ml}$
12. The heat flow equation through a sphere of inner radius r_1 and outer radius r_2 is to be written in the same form as that for heat flow through a plane wall. For wall thickness $(r_2 - r_1)$, the equivalent means radius for the spherical shell is
- (A) $\frac{r_1 + r_2}{2}$
- (B) $r_1 r_2$
- (C) $\sqrt{r_1 r_2}$
- (D) $\frac{r_1 + r_2}{\log_e(r_2/r_1)}$
13. The variation in thermal conductivity of a wall material is stated to conform to the relation $k = k_0(1 + aT)$. In that case the temperature at the mid-plane of the heat conducting wall would be
- (A) average of the temperatures at the wall faces
- (B) more than the average of the temperatures at the wall faces
- (C) less than the average of the temperatures at the wall faces
- (D) depends upon the temperature difference between the wall faces.
14. The Fourier's conduction heat equation $Q = KA \frac{dt}{dx}$ presumes
- (A) steady state, one-dimensional heat flow
- (B) constant value of thermal conductivity
- (C) constant and uniform temperatures at the wall surfaces.
- (D) all of the above
15. A hollow sphere has inner and outer surface areas of 2 m^2 and 8 m^2 respectively. For a given temperature difference across the surfaces, it is desired to calculate heat flow by considering the material of the sphere as a plane wall of the same thickness. The equivalent mean area normal to the direction of heat flow should be
- (A) 6 m^2
- (B) 5 m^2
- (C) 4 m^2
- (D) 3 m^2
16. The relation $\nabla^2 t = 0$ is referred to as
- (A) Fourier heat conduction equation
- (B) Laplace equation
- (C) Poisson's equation
- (D) Lumped parameter solution for transient conduction

17. Heat is transferred from a hot fluid (temperature T_1 and heat transfer coefficient h_1) through a plane wall of thickness d , surface area A and thermal conductivity k . The thermal resistance for the set up is
- (A) $\frac{1}{A} \left(\frac{1}{h_1} + \frac{\delta}{k} + \frac{1}{h_2} \right)$
- (B) $A \left(\frac{1}{h_1} + \frac{\delta}{k} + \frac{1}{h_2} \right)$
- (C) $\frac{1}{A} \left(h_1 + \frac{k}{\delta} + h_2 \right)$
- (D) $A \left(h_1 + \frac{k}{\delta} + h_2 \right)$
18. Which of the following is *not a correct* statement?
- (A) The dimensions of thermal conductivity are $MLT^{-3} \theta^{-1}$
- (B) The thermal conductivity of glass wool varies from sample to sample because of variation in its structure, composition and porosity etc.
- (C) Metals and gases have a relatively small value of thermal conductivity where as this parameter is relatively large for non-metallic solids and liquids.
- (D) Thermal conductivity is the ability of solids to conduct heat, and thermal diffusivity is a measure of thermal inertia.
19. Considering a composite wall comprising two layers of thermal conductivities k and $2k$, and equal surface areas normal to the direction of heat flow. The outer surfaces of the composite wall are maintained at 1000°C and 200°C respectively. If surface temperature at the junction is desired to be 150°C and conduction is the only mode of heat transfer, then ratio of thickness should be
- (A) 1:1
- (B) 2:1
- (C) 1:2
- (D) 2:3
20. Most unsteady heat flow occurs
- (A) through the wall of a refrigerator
- (B) during annealing of castings
- (C) through the walls of a furnace
- (D) through lagged (insulated) pipes carrying steam.
21. A thin cylinder of radius r is lagged to an outer radius r_0 with an insulating layer of thermal conductivity k . If h_0 is the film coefficient at the outer surface of lagging, then minimum resistance and consequently maximum heat flow rate occurs when r_0 equals
- (A) $\sqrt{kh_0}$
- (B) $\frac{k}{h_0}$
- (C) $\frac{2k}{h_0}$
- (D) $\frac{h_0}{k}$
22. For a long cylinder of radius R with uniformly distributed heat sources, the temperature distribution in the dimensionless form is
- (A) $\frac{t - t_w}{t_{max} - t_w} = 1 = \frac{r}{R}$
- (B) $\frac{t - t_w}{t_{max} - t_w} = 1 = \left(\frac{r}{R} \right)^2$
- (C) $\frac{t - t_w}{t_{max} - t_w} = 1 = \left(\frac{r}{R} \right)^3$
- (D) $\frac{t - t_w}{t_{max} - t_w} = 1 = \left(\frac{r}{R} \right)^4$
- Where t_w is the temperature at the outer surface of the cylinder and t_{max} is the temperature along the cylinder axis.
23. The temperature distribution during transient heat conduction in a solid does not depend upon
- (A) location of point within the solid
- (B) Biot number hL/k
- (C) Prandtl number $\mu c_p/k$
- (D) Fourier number $\alpha t/l^2$
24. Two long parallel surfaces, each of emissivity 0.7, are maintained at different temperatures and accordingly have radiation heat exchange between them. It is desired to reduce 75% of this radiant heat transfer by inserting thin parallel shields of emissivity on both sides. The number of shields should be
- (A) one
- (B) two
- (C) three
- (D) four

25. For laminar conditions, the thickness of thermal boundary layer increases with its distance from the leading edge in proportion to
- x
 - $x^{1/2}$
 - $x^{1/3}$
 - $x^{1/4}$
26. The intensity of Solar radiation on earth is
- 1 kW/m²
 - 2 kW/m²
 - 4 kW/m²
 - 8 kW/m²
27. For a transport of diathermanous body
- absorptivity $\alpha = 1$ transmissivity $\tau = 0$ and reflectivity $\rho = 0$
 - $\rho = 1$ and $\alpha = \tau = 0$
 - $\tau = 1$ and $\alpha = \rho = 0$
 - $\alpha + \rho = 1$ and $\tau = 0$
28. Choose the false statement:
- the unit of heat transfer coefficient is kcal/m²-hr-°C
 - The overall heat transfer coefficient has units of w/m²-deg
 - In M-L-T- θ system, the dimensions of convective heat transfer coefficient and the overall heat transfer coefficient are $MT^{-3}\theta^{-1}$
 - The overall heat transfer coefficient is the reciprocal of overall thermal resistance to heat flow.
29. Three fins of equal length and diameter but made of aluminium, brass and cast iron are heated to 200°C at one end. If the fins dissipate heat to the surrounding air at 25°C, the temperature at the free end will be least in case of
- aluminium fin
 - brass fin
 - cast iron fin
 - each fin will have the same temperature at the free end
30. Which of the following heat flow situations pertains to free or natural convection?
- cooling of internal combustion engines
 - flow of water inside the condenser tubes
 - Cooling of billets in atmosphere
 - Air-conditioning installations and nuclear reactors.
31. The requirement of transfer of a large heat is usually met by
- increasing the length of tube
 - decreasing the diameter of tube
 - increasing the number of tubes
 - having multiple tube or shell passes.
32. Which of the following parameters does not appear in the formulation of Stefan- Boltzman law?
- Absorptivity
 - Emissivity
 - Radiating area
 - Radiation flux
33. Heisler charts are used to determine the transient heat flow rate and temperature distribution when
- solids posses infinitely large thermal conductivity
 - internal conduction resistance is small and the convective resistance is large
 - internal conduction resistance is large and the convective resistance is small
 - both conduction and convection resistance are almost of equal importance.
34. A body cooling from 80°C to 70°C takes 10 minutes when left exposed to environmental conditions. If the body is to cool further from 70°C to 60°C under the same external conditions, it will take
- same time of 10 minutes
 - more than 10 minutes
 - less than 10 minutes
 - time will depend upon the environmental conditions.
35. The dimensionless parameter $(b gr^2 \rho^3 D t)/m^2$ is referred to as
- Stanton number
 - Schmidt number
 - Grashoff number
 - Peclet number
36. For a plane wall of thickness l with uniformly distributed heat generation q_g per unit volume, the temperature t_0 at the mid-plane is given by
- $t_0 = \frac{q_g l^2}{2k} + t_w$
 - $t_0 = \frac{q_g l^2}{4k} + t_w$
 - $t_0 = \frac{q_g l^2}{8k} + t_w$
 - $t_0 = \frac{q_g l^2}{16k} + t_w$
37. The temperature distribution $(t - t_a)/(t_0 - t_a)$ for a fin with insulated tip is given by
- $\exp(-mx)$
 - $\frac{\exp(mx) + \exp(-mx)}{2}$
 - $\frac{\cosh m(l-x)}{\cosh ml}$
 - $\cosh m(l-x) + \cosh ml$

The symbols have their usual meanings.

38. The Nusselt number for convective heat transfer between a horizontal tube and water surrounding it is prescribed by the relation
- $$Nu = 0.52 (Gr.Pr)^{0.25}$$
- For a 4cm diameter tube, the heat transfer coefficient is stated to be 1412 kcal/m²-hr-deg. Subsequently the tube is replaced by one with 16 cm diameter tube. If temperature and surface of the fluid remains same, the heat transfer coefficient will change to
- (A) 706
(B) 1000
(C) 2824
(D) 5648 kcal/m²-hr-°C
39. Radiation heat transfer is characterized by
- (A) energy transport as a result of bulk fluid motion
(B) thermal energy transfer as vibrational energy in the lattice structure of the material
(C) movement of discrete packets of energy as electromagnetic waves
(D) circulation of fluid motion by bouyancy effects.
40. Choose the *false* statement:
- (A) Thermal conductivity is always higher in the purest form of metal
(B) Heat treatment causes considerable variation in thermal conductivity
(C) Thermal conductivity of a damp material is considerably higher than the thermal conductivity of the dry material and water taken individually
(D) Thermal conductivity decreases with increase in the density of the substance.
41. The emissive power is multiplied with the factor ... to obtain the intensity of normal radiation for a unit surface.
- (A) $\frac{1}{\sqrt{\pi}}$
(B) $\frac{1}{\pi}$
(C) $\frac{1}{2\pi}$
(D) $\sqrt{\pi}$
42. Thermal radiations occur in the portion of electromagnetic spectrum between the wavelengths.
- (A) 10⁻² to 10⁻⁴ micron
(B) 10⁻¹ to 10⁻² micron
(C) 0.1 to 10² micron
(D) 10² micron onwards
43. The thermal radiation propagates in the forum of discrete quanta; each quanta having an energy of E-hv where v is the frequency of quantum. The Planck's constant k has the dimensions.
- (A) MLT
(B) MLT⁻¹
(C) MLT⁻²
(D) ML²T⁻¹
44. Identify the *wrong* statement with respect to boiling heat transfer:
- (A) Boiling occurs when a heated surface is exposed to a liquid maintained at a temperature lower than the saturation temperature of the liquid
(B) The steam boilers employing natural convection have steam raised through pool boiling.
(C) The nucleation boiling is characterized by the formation of bubbles at the nucleation sites and the resulting liquid agitation.
(D) "Leidenfrost effect" refers to the phenomenon of stable film boiling.
(E) The boiling crisis or the burn out point on the boiling curve (surface heat flux as a function of excess temperatures) represents the maximum heat flux at which transition occurs from nucleate to film boiling.
45. Two walls of same thickness and cross-sectional area have thermal conductivities in the ration 1:2. If same temperature difference is maintained across the wall faces, the ratio of heat flow Q₁/Q₂ will be
- (A) 1/2
(B) 1
(C) 2
(D) 4

46. Consider development of laminar thermal boundary layer for a moving non-reacting fluid in contact with a flat plate of length l along the flow direction. The average value of heat transfer coefficient can be obtained by multiplying the local heat transfer coefficient at the trailing edge by the factor.
- (A) 0.75
(B) 1.0
(C) 1.5
(D) 2.0
47. Then emissivity and the absorptivity of a real surface are equal for radiation with identical temperature and wavelength. This law is referred to as
- (A) Lambert's law
(B) Kirchhoff's law
(C) Planck's law
(D) Wien's displacement law
48. The unit of thermal diffusivity is
- (A) $\text{m}^2/\text{hr}^\circ\text{C}$
(B) $\text{kcal}/\text{m}^2\text{-hr}$
(C) $\text{m}/\text{hr}^\circ\text{C}$
(D) m^2/hr
49. Choose the *wrong statement* with respect to Nusselt number and convective heat transfer coefficient:
- (A) Nusselt number represent the ratio of temperature gradient at the surface to an overall or reference temperature gradient.
(B) Nusselt number represents the dimensionless slope of the temperature distribution curve at the surface.
(C) The convective coefficient can be evaluated from a knowledge of fluid temperature, distribution in the neighbourhood of the surface.
(D) for a given Nusselt number, the convective coefficient is inversely proportional to thermal conductivity of the fluid.
50. The law governing the distribution of radiant energy over wavelength for a black body at fixed temperature is referred to as
- (A) Planck's law
(B) Wien's formula
(C) Kirchhoff's law
(D) Lambert's law
51. The convective coefficients for boiling and condensation usually lie in the range
- (A) 30-300
(B) 60-3000
(C) 300-10000
(D) 2500-10000 $\text{W}/\text{m}^2\text{K}$
52. In $M-L-T-q$ system, the dimensions of thermal diffusivity are
- (A) L^2T^{-1}
(B) $LT^{-1}q^{-1}$
(C) ML^2T^{-1}
(D) $L^2T^{-1}q^{-1}$
53. Choose the *false* statements:
- (A) the monochromatic emissive power is the rate of energy radiated per unit area of the surface per unit wavelength.
(B) The distribution of monochromatic emissive power across the wavelength is continuous but non-uniform
(C) at elevated temperatures, much of the energy is emitted in shorter wavelengths.
(D) The area under the monochromatic emissive power versus wavelength curve represents the total emissive power per unit area radiated from the surface.
(E) None of the above
54. A thermally transparent surface of transmissivity 0.15 receives 500 kcal/min of radiation and reflects back 200 kcal/min out of it. The emissivity of the surface is then
- (A) 0.15
(B) 0.4
(C) 0.45
(D) 0.55
55. Peclet number is defined as
- (A) $\frac{\text{kinematic viscosity}}{\text{thermal diffusivity}}$
(B) $\frac{\text{convective heat transfer viscosity}}{\text{conduction heat transfer}}$
(C) $\frac{\text{bouyancy force} \times \text{inertia force}}{\text{viscous force}}$
(D) $\frac{\text{wall heat transfer rate}}{\text{convection heat transfer}}$

56. A plane wall of thickness $2L$ has a uniform volumetric heat source q^* (W/m^3). It is exposed to local ambient temperature T_∞ at both the ends ($x = \pm L$). The surface temperature T_s of the wall under steady state condition (where h and k have their usual meanings) is given by

(A) $T_s = T_\infty + \frac{q^* L}{h}$

(B) $T_s = T_\infty + \frac{q^* L^2}{2k}$

(C) $T_s = T_\infty + \frac{q^* L^2}{h}$

(D) $T_s = T_\infty + \frac{q^* L^3}{2k}$

57. A flat plate has thickness 5cm, thermal conductivity 1 W/(mK), convective heat transfer coefficients on its two flat faces of 10 W/(m²K) and 20 W/(m²K). The overall heat transfer coefficient for such a flat plate is

(A) 5 W/(m²K)

(B) 6.33 W/(m²K)

(C) 20 W/(m²K)

(D) 30 W/(m²K)

58. The efficiency of a pin fin with insulated tip is

(A) $\frac{\tan h mL}{(hA/kP)^{0.5}}$

(B) $\frac{\tan h mL}{ml}$

(C) $\frac{mL}{\tan h ml}$

(D) $\frac{(hA/kP)^{0.5}}{\tan h ml}$

59. A cylinder made of a metal of conductivity 40 W/(mK) is to be insulated with a material of conductivity 0.1 W/(mK). If the convective heat transfer coefficient with the ambient atmosphere is 5W/(m²K), the critical radius of insulation is

(A) 2cm

(B) 4cm

(C) 8cm

(D) 50cm

60. Nusselt number for fully developed turbulent flow in a pipe is given by $Nu = CRe^a Pr^b$. The values of a and b are

(A) $a = 0.5$ and $b = 0.33$ for heating and cooling both

(B) $a = 0.5$ and $b = 0.4$ for heating and $b=0.3$ for cooling

(C) $a = 0.8$ and $b = 0.4$ for heating and $b=0.3$ for cooling

(D) $a = 0.8$ and $b = 0.3$ for heating and $b=0.4$ for cooling

61. For natural convective flow over a vertical flat plate as shown in the given figure, the governing differential equation of momentum is

$$\left(u \frac{\partial u}{\partial x} + v \frac{\partial u}{\partial y} \right) = g\beta (T - T_\infty) + \gamma \frac{\partial^2 u}{\partial y^2}$$

If equation is nondimensionalized by $U = \frac{u}{U_\infty}$

$$V = \frac{v}{U} \quad X = \frac{x}{L} \quad Y = \frac{y}{L} \quad \text{and} \quad \theta = \frac{T - T_\infty}{T_s - T_\infty}$$

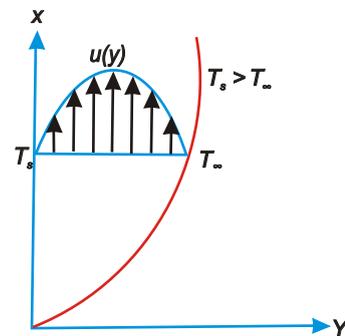
The term $(T - T_\infty)$ is equal to

(A) Grashoff number

(B) Prandtl number

(C) Rayleigh number

(D) $\frac{\text{Grashof number}}{(\text{Reynolds number})^2}$



62. The shaped factor of a hemispherical body placed on a flat surface with respect to itself is

(A) zero

(B) 0.25

(C) 0.5

(D) 1.0

63. Which one of the following heat exchange gives parallel straight line pattern of temperature distribution for both cold and hot fluids?
(A) Parallel-flow with unequal heat capacities
(B) Counter-flow with equal heat capacities
(C) Parallel-flow with equal heat capacities
(D) Counter-flow with unequal heat capacities.
64. In a counter-flow heat exchanger, the hot fluid is cooled from 110°C to 80°C by a cold fluid which gets heated from 30°C to 60°C . LMTD for the heat exchanger is
(A) 20°C
(B) 30°C
(C) 50°C
(D) 80°C
65. In a counter-flow heat exchanger, the product of specific heat and mass flow rate is same for the hot and cold fluids. If NTU is equal to 0.5, then the effectiveness of the heat exchanger is
(A) 1.0
(B) 0.5
(C) 0.33
(D) 0.2
66. For flow over a flat plate the hydrodynamic boundary layer thickness is 0.5mm. The dynamic viscosity is 25×10^{-6} Pa s, specific heat is $2.0\text{kJ}/(\text{kg K})$ and thermal conductivity is $0.05\text{W}/(\text{m}\cdot\text{K})$. The thermal boundary layer thickness would be
(A) 0.1mm
(B) 0.5mm
(C) 1mm
(D) 2mm
67. An enclosure consists of four surfaces 1, 2, 3 and 4. The view factors for radiation heat transfer (where the subscripts 1, 2, 3, 4 refer to the respective surfaces) are $F_{11} = 0.1$, $F_{12} = 0.4$ and $F_{13} = 0.25$. The surface areas A_1 and A_4 are 4m^2 and 2m^2 respectively. The view factor F_{41} is
(A) 0.75
(B) 0.50
(C) 0.25
(D) 0.10
68. A 0.5m thick plane wall has its two surfaces kept at 300°C and 200°C . Thermal conductivity of the wall varies linearly with temperature and its values at 300°C and 200°C are $25\text{W}/\text{mK}$ and $15\text{W}/\text{mK}$, respectively. Then the steady heat flux through the wall is
(A) $8\text{kW}/\text{m}^2$
(B) $5\text{kW}/\text{m}^2$
(C) $4\text{kW}/\text{m}^2$
(D) $3\text{kW}/\text{m}^2$
69. A 320 cm high vertical pipe at 150°C wall temperature is in a room with still air at 10°C . This pipe supplies heat at the rate of 8kW into the room air by natural convection. Assuming laminar flow, the height of the pipe needed to supply 1kW only is
(A) 10cm
(B) 20cm
(C) 40cm
(D) 80cm
70. The average Nusselt number in laminar natural convection from a vertical wall at 180°C with still air at 20°C is found to be 48. If the wall temperature becomes 30°C , all other parameters remaining same, the average Nusselt number will be
(A) 8
(B) 16
(C) 24
(D) 32
71. A fluid of thermal conductivity $1.0\text{W}/\text{m}\cdot\text{K}$ flows in fully developed flow with Reynolds number of 15000 through a pipe of diameter 10cm. The heat transfer coefficient for uniform heat flux and uniform wall temperature boundary conditions are, respectively.
(A) 36.57 and $43.64 \frac{\text{W}}{\text{m}^2\text{K}}$
(B) 43.64 and $36.57 \frac{\text{W}}{\text{m}^2\text{K}}$
(C) $43.64 \frac{\text{W}}{\text{m}^2\text{K}}$ for both the cases
(D) $36.57 \frac{\text{W}}{\text{m}^2\text{K}}$ for both the cases

72. Two large parallel grey plates with a small gap, exchange radiation at the rate of 1000 W/m^2 when their emissivities are 0.5 each. By coating one plate, its emissivity is reduced to 0.25. Temperatures remain unchanged. The new rate of heat exchange shall be come
- (A) 500 W/m^2
 - (B) 600 W/m^2
 - (C) 700 W/m^2
 - (D) 800 W/m^2

73. Two long parallel plates of same emissivity 0.5 are maintained at different temperatures and have radiations heat exchange between them. The radiation shield of emissivity 0.25 placed in the middle will reduce radiation heat exchange to
- (A) $\frac{1}{2}$
 - (B) $\frac{1}{4}$
 - (C) $\frac{3}{10}$
 - (D) $\frac{3}{5}$

Answer Key

- | | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|
| 1. D | 11. C | 21. B | 31. A | 41. C | 51. A | 61. D | 71. B |
| 2. D | 12. B | 22. C | 32. D | 42. D | 52. E | 62. B | 72. C |
| 3. C | 13. D | 23. C | 33. B | 43. A | 53. C | 63. B | 73. C |
| 4. B | 14. C | 24. B | 34. C | 44. A | 54. B | 64. D | |
| 5. B | 15. B | 25. A | 35. C | 45. D | 55. A | 65. D | |
| 6. C | 16. A | 26. C | 36. C | 46. B | 56. A | 66. C | |
| 7. A | 17. C | 27. D | 37. B | 47. D | 57. B | 67. C | |
| 8. D | 18. C | 28. A | 38. C | 48. D | 58. A | 68. B | |
| 9. A | 19. B | 29. C | 39. D | 49. A | 59. D | 69. C | |
| 10. A | 20. B | 30. D | 40. B | 50. D | 60. C | 70. B | |

MECHANICAL ENGINEERING TEST

70 QUESTIONS

30 MINUTES

DIRECTIONS

Each of the questions or incomplete statements below is followed by five suggested answers or completions. In each case, select the one that is the best of the choices offered and then mark the corresponding space on the answer sheet.

1. In a framed structure, as shown in Fig. 1.47, the force in the member BC is

- (A) $W/\sqrt{3}$ (compression)
- (B) $W/\sqrt{3}$ (tension)
- (C) $2W/\sqrt{3}$ (compression)
- (D) $2W/\sqrt{3}$ (tension)

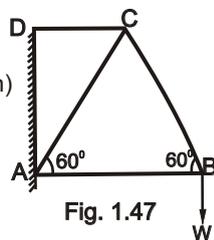


Fig. 1.47

2. In a framed structure, as shown in Fig. 1.47, the force in the member AB is The force in member AC

- (A) $\sqrt{3}W$ (tensile) and $2W$ (compressive)
- (B) $2W$ (tensile) and $\sqrt{3}W$ (compressive)
- (C) $2\sqrt{3}W$ (tensile) and $2\sqrt{3}W$ (compressive)
- (D) none of the above

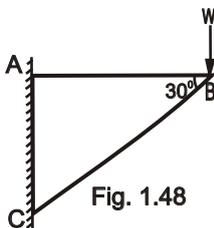


Fig. 1.48

3. Two bodies of masses m_1 and m_2 are hung from the ends of a rope, passing over a frictionless pulley as shown in Fig. 1.49. The acceleration of the string will be

- (A) $\frac{g(m_1 - m_2)}{m_1 + m_2}$
- (B) $\frac{2g(m_1 - m_2)}{m_1 + m_2}$
- (C) $\frac{g(m_1 + m_2)}{m_1 - m_2}$
- (D) $\frac{2g(m_1 + m_2)}{m_1 - m_2}$

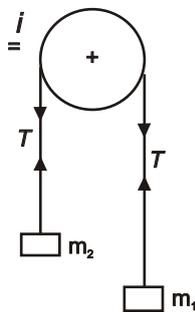


Fig. 1.49

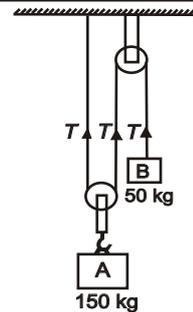


Fig. 1.50

4. Two blocks a and B of masses 150 kg and 50kg respectively are connected by means of a string as shown in Fig. 1.50. The tension in all the three strings....be same

- (A) will
- (B) will not

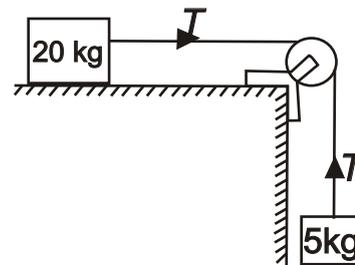


Fig. 1.51

5. A block of mass 20kg lying on a rough horizontal plane is connected by light string passing over a smooth pulley to another mass 5kg, which can move freely in the vertical direction, as shown in Fig. 1.51. The tension in the string will....with the increase in coefficient of friction.

- (A) increase
- (B) decrease
- (C) not be effected

6. A block of mass m_1 placed on an inclined smooth plane is connected by a light string passing over a smooth pulley to mass m_2 , which moves vertically downwards as shown in Fig. 1.52. The tension in the string is
- (A) m_1 / m_2
 (B) $m_1 g \sin$
 (C) $m_1 m_2 / m_1 + m_2$
 (D) $\frac{m_1 m_2 g (1 + \sin)}{m_1 + m_2}$

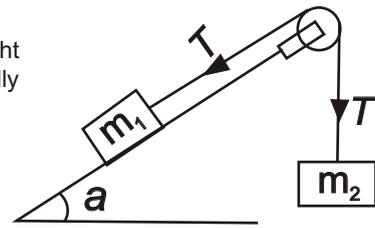


Fig. 1.52

7. Match the correct answer from Group B for the given statements in Group A.

| Group A | Group B |
|---|---|
| (A) The cartesian equation of trajectory is | (A) $\frac{2u \sin}{g}$ |
| (B) The time of flight of a projectile on a horizontal plane is | (B) $\frac{2u \sin (-)}{g \cos}$ |
| (C) The horizontal range of projectile is | (C) $\frac{u^2 \sin 2}{g}$ |
| (D) The maximum height of a projectile on a horizontal plane is | (D) $x \tan - \frac{gx^2}{2u^2 \cos^2}$ |
| (E) The time of flight of a projectile on an upward inclined plane is | (E) $\frac{u^2 \sin^2}{2g}$ |

8. One end of a helical spring is fixed while the other end carries the load W which moves with simple harmonic motion. The frequency of motion is given by
- (A) $2 \sqrt{\frac{g}{\delta}}$
 (B) $2 \sqrt{\frac{g}{\delta}}$
 (C) $2 \sqrt{\frac{\delta}{g}}$
 (D) $2 \sqrt{\frac{\delta}{g}}$

9. Match the correct answer from Group B for the given statements in Group A, in connection with simple harmonic motion.

| Group A | Group B |
|--|------------------------|
| (A) The maximum displacement of a body from its mean position is | (A) frequency |
| (B) The number of cycles per second is | (B) end of extremities |
| (C) The velocity of the particle is zero at the | (C) mean position |
| (D) The acceleration of the particle is zero at the | (D) amplitude |

10. The loss of kinetic energy during inelastic impact, is given by

$$\frac{m_1 m_2}{2(m_1 + m_2)} (u_1 - u_2)^2$$

$$\frac{2(m_1 + m_2)}{m_1 m_2} (u_1 - u_2)^2$$

$$\frac{m_1 m_2}{2(m_1 + m_2)} (u_1^2 - u_2^2)$$

$$\frac{2(m_1 + m_2)}{m_1 m_2} (u_1^2 - u_2^2)$$

Where m_1 = Mass of the first body,
 m_2 = Mass of the second body, and
 u_1 and u_2 = Velocities of the first and second bodies respectively.

11. A lead ball with a certain velocity is made to strike a wall, it falls down, but rubber ball of same mass and with same velocity strikes the same wall, it rebounds. Select the correct reason from the following:

- (A) both the balls undergo an equal change in momentum
- (B) the change in momentum suffered by rubber ball is more than the lead ball
- (C) the change in momentum suffered by rubber ball is less than the lead ball
- (D) none of the above

12. If u_1 and u_2 are the velocities of two moving bodies in the same direction before impact and v_1 and v_2 are their velocities after impact, then coefficient of restitution is given by

$$\frac{v_1 - v_2}{u_1 - u_2}$$

$$\frac{v_2 - v_1}{u_1 - u_2}$$

$$\frac{u_1 - u_2}{v_1 - v_2}$$

$$\frac{u_2 + u_1}{v_2 + v_1}$$

13. When a body of mass moment of inertia I (about a given axis) is rotated about that axis with an angular velocity w , then the kinetic energy of rotation is

- (A) Iw
- (B) Iw^2
- (C) $0.5Iw$
- (D) $0.5Iw^2$

14. The total energy possessed by a system of moving bodies

- (A) is constant at every instant
- (B) varies from point to point
- (C) is maximum in the start and minimum at the end
- (D) is minimum in the start and maximum at the end

15. When a body is subjected to two equal and opposite pulls, as a result of which the body tends to extend its length, the stress and strain induced is

- (A) compressive stress, tensile strain
- (B) compressive stress, compressive strain
- (C) shear stress, tensile strain
- (D) shear stress, shear strain

16. The ratio of linear stress to the linear strain is called
 (A) modulus of rigidity
 (B) modulus of elasticity
 (C) bulk modulus
 (D) poisson's ratio
17. When a bar of length l and diameter d is rigidly fixed at the upper end and hanging freely, then the total elongation produced in the bar due to its own weight is
 (A) $\frac{wl}{2E}$
 (B) $\frac{wl^2}{2E}$
 (C) $\frac{wl^3}{2E}$
 (D) $\frac{wl^4}{2E}$
18. The extension of a circular bar tapering uniformly from diameter d_1 at one end to diameter d_2 at the other end, and subjected to an axial pull of P is.....the extension of a circular bar of diameter $\sqrt{d_1 d_2}$ subjected to the same load P .
 (A) equal to
 (B) less than
 (C) greater than
19. The shear modulus of most materials with respect to the modulus of elasticity is
 (A) equal to half
 (B) less than half
 (C) more than half
 (D) none of these
20. A bolt is made to pass through a tube and both of them are tightly fitted with the help of washers and nuts. If the nut is tightened, then
 (A) bolt and tube are under tension
 (B) bolt and tube are under compression
 (C) bolt is under compression and tube is under tension
 (D) bolt is under tension and tube is under compression.
21. When a bar is cooled to -50°C , it will develop
 (A) no stress
 (B) shear stress
 (C) tensile stress
 (D) compressive stress
22. Every direct stress is always accompanied by a strain in every direction, at right angles to it. Such a strain is known as
 (A) linear strain
 (B) lateral strain
 (C) volumetric strain
 (D) shear strain

23. Resilience is the
 (A) energy stored in a body when strained within elastic limits
 (B) energy stored in a body when strained up to the breaking of the specimen
 (C) maximum strain energy which can be stored in a body
 (D) none of the above
24. The capacity of a strained body for doing work on the removal of the straining force, is called
 (A) strain energy
 (B) resilience
 (C) proof resilience
 (D) impact energy
25. A cantilever beam is one which is
 (A) fixed at both ends
 (B) fixed at one end and free at the other end
 (C) supported at its ends
 (D) supported on more than two supports
26. A continuous beam is one which is
 (A) fixed at both ends
 (B) fixed at one end and free at the other end
 (C) supported on more than two supports
 (D) extending beyond the supports

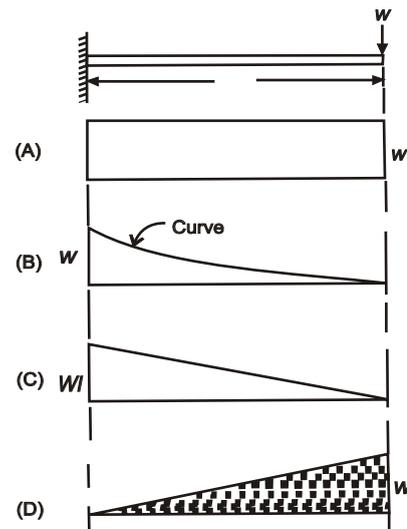


Fig. 2.41

27. A cantilever beam of length l and carrying a point load W at the free end is shown in Fig. 2.41. Which of the following is correct?
 (A) A is the bending moment diagram and C is the shear force diagram
 (B) A is the shear force diagram and C is the bending moment diagram
 (C) B is the bending moment diagram and D is the shear force diagram
 (D) B is the shear force diagram and D is the bending moment diagram

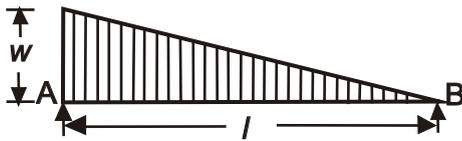


Fig. 2.43

28. A simply supported beam with a gradually varying load from zero to B and w per unit length at A is shown in Fig. 2.43. The shear force at B is equal to
- $wl/6$
 - $wl/3$
 - wl
 - $2wl/3$
29. Which of the following statement is correct?
- a continuous beam has only two supports at the ends.
 - a uniformly distributed load spreads uniformly over the whole length of a beam
 - The bending moment is maximum where shear force is maximum.
 - The maximum bending moment of a simply supported beam of length l with a central point load W is $Wl/8$.
30. In a simple bending theory, one of the assumption is that the material of the beam is isotropic. This assumption means that the
- normal stress remains constant in all directions
 - normal stress varies linearly in the material
 - elastic constants are same in all the directions
 - elastic constants varies linearly in the material
31. The line of intersection of the neutral layer with any normal cross-section of the beam is called neutral axis.
- True
 - False
32. A beam of uniform strength may be obtained by
- keeping the width uniform and varying the dept
 - keeping the depth uniform and varying the width
 - varying the width and depth both
 - any one of the above
33. At the neutral axis of a beam
- the layers are subjected to maximum bending stress
 - the layers are subjected to minimum bending stress
 - the layers are subjected to compression
 - the layers do not undergo any strain

34. The rectangular beam 'A' has length l , width b and depth d . Another beam 'B' has the same length and width but depth is double that of 'A'. The elastic strength of beam B will be.....as compared to beam A.
- same
 - double
 - four times
 - six times

35. Which of the following statement is wrong?
- in the theory of simple bending, the assumption is that the plane sections before bending remains plane after bending.
 - in a beam subjected to bending moment, the strain is directly proportional to the distance from the neutral axis.
 - At the neutral axis of a beam, the bending stress is maximum.
 - The bending stress in a beam, the bending stress is maximum.

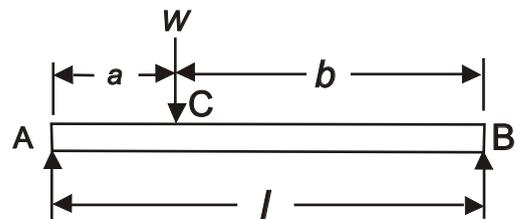


Fig. 2.45

36. A simply supported beam of length l carries a point load W at a point C as shown in Fig. 2.45. The maximum deflection lies at
- point A
 - point B
 - point C
 - between points B and C

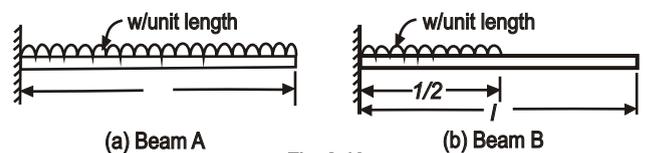


Fig. 2.46

37. Two cantilever beams A and B are shown in Fig. 2.46. The ratio of maximum deflection of beam A to the beam B is
- $8/7$
 - $16/7$
 - $32/7$
 - $48/7$

38. The torsional rigidity of a shaft is expressed by the torque required to produce a twist of one radian per unit length of a shaft.
 (A) True
 (B) False
39. The strength of the shaft is judged by the torque transmitted by the shaft.
 (A) Yes
 (B) No
40. The load required to produce a unit deflection in a spring is called
 (A) flexural rigidity
 (B) torsional rigidity
 (C) spring stiffness
 (D) young's modulus
41. Two closely-coiled helical spring 'A' and 'B' of the same material, same number of turns and made from same wire are subjected to an axial load W . The mean diameter of spring 'A' is double the mean diameter of spring 'B'. The ratio of deflections in spring 'B' to spring 'A' will be
 (A) $1/8$
 (B) $1/4$
 (C) 2
 (D) 4
42. Two closely coiled helical springs 'A' and 'B' are equal in all respects but the diameters of wire of spring 'A' is double that of spring 'B'. The stiffness of spring 'A' will be.....that of spring 'B'
 (A) one-sixteenth
 (B) one-eighth
 (C) one-fourth
 (D) one-half
43. When one plate overlaps the other and the two plates are riveted together with two rows of rivets, the joint is known as
 (A) single riveted lap joint
 (B) double riveted lap joint
 (C) double riveted single cover butt joint
 (D) double riveted double cover butt joint
44. When a thin cylindrical shell is subjected to an internal pressure, there will be
 (A) a decrease in diameter and length of the shell
 (B) an increase in diameter and decrease in length of the shell
 (C) a decrease in diameter and increase in length of the shell
 (D) an increase in diameter and length of the shell
45. The assumption made in Euler's column theory is that
 (A) the failure of column occurs due to buckling alone
 (B) the length of column is very large as compared to its cross-sectional dimensions
 (C) the column material obeys Hooke's law
 (D) all of the above
46. The slenderness ratio is the ratio of
 (A) area of column to least radius of gyration
 (B) length of column to least radius of gyration
 (C) least radius of gyration to area of column
 (D) least radius of gyration to length of column
47. The Rankine's formula holds good for
 (A) short column
 (B) long column
 (C) both short and long column
 (D) weak column
48. A reinforced cement concrete beam is considered to be made of
 (A) homogeneous material
 (B) heterogeneous material
 (C) composite material
 (D) isotropic material
49. The assumption made in the theory of the reinforced cement concrete beam is that
 (A) all the tensile stresses are taken up by the steel reinforcement only
 (B) there is a sufficient bond between steel and concrete
 (C) the steel and concrete are stressed within its elastic limit
 (D) all of the above

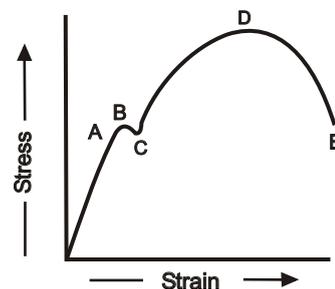


Fig. 2.52

50. In a stress-strain diagram for mild steel, as shown, the point A represents
 (A) elastic limit
 (B) upper yield
 (C) lower yield
 (D) breaking point

51. If percentage reduction in area of a certain specimen made of material 'A' under tensile test is 60% and the percentage reduction in area of same dimensions made of material 'B' is 40%, then
- the material A is more ductile than material B
 - the material B is more ductile than material A
 - the ductility of material A and B is equal
 - the material A is brittle and material B is ductile
52. The ductility of a material.....with the increase in percentage reduction in area of a specimen under tensile test.
- increases
 - decreases
 - remains same
53. The ductility of the material.....with the decrease in percentage elongation of a specimen under tensile test.
- increases
 - decreases
 - remains same
54. Factor of safety is defined as the ratio of
- ultimate stress to working stress
 - working stress to ultimate stress
 - breaking stress to ultimate stress
 - ultimate stress to breaking stress
55. Fatigue test is carried out for
- stresses varying between two limits of equal value, but of opposite sign
 - stresses varying two limits of unequal value, but of opposite sign
 - stresses varying two limits of unequal value, but of same sign
 - all of the above
56. A vessel of 4 m³ contains an oil which weighs 30kN. The specific weight of the oil is
- 4.5 kN / m³
 - 6 kN / m³
 - 7.5 kN / m³
 - 10 kN / m³
57. Falling drops of water become spheres due to the property of
- surface tension of water
 - compressibility of water
 - capillarity of water
 - viscosity of water
58. A vertically immersed surface is shown. The distance of its centre of pressure from the water surface is
- $\frac{bd^2}{12} + \bar{x}$
 - $\frac{d^2}{12\bar{x}} + \bar{x}$
 - $\frac{b^2}{12} + \bar{x}$
 - $\frac{d^2}{12} + \bar{x}$

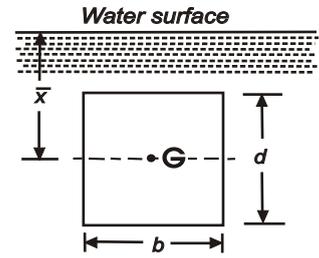


Fig. 3.8

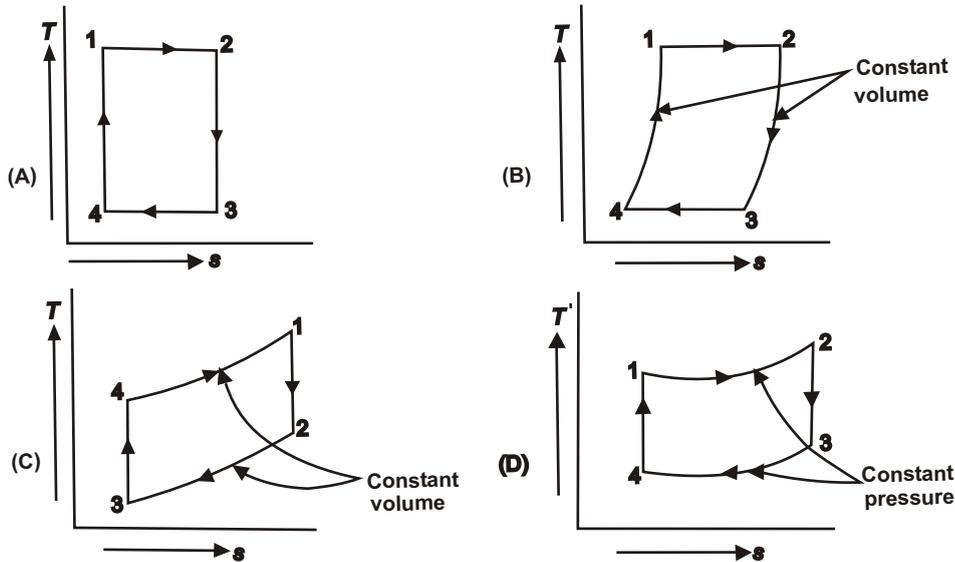
59. A water tank contains 1.3m deep water. The pressure exerted by the water per metre length of the tank is
- 2.89 kN
 - 8.29 kN
 - 9.28 kN
 - 28.9 kN
60. A uniform body 3m long, 2m wide and 1m deep floats in water. If the dept of immersion is 0.6m, then the weight of the body is
- 3.53 kN
 - 33.5 kN
 - 35.3 kN
 - none of the above
61. When a body, floating in a liquid, is given a small angular displacement, it starts oscillating about a point known as
- centre of pressure
 - centre of gravity
 - centre of buoyancy
 - metacentre
62. The imaginary line drawn in the field in such a way that the tangent to any point gives the direction of motion at that point, is known as
- path line
 - stream line
 - steak line
 - potential line
63. For a perfect incompressible liquid, flowing in a continuous stream, the total energy of a particle remains the same, while the particle moves from one point to another. This statement is called
- continuity equation
 - Bernoulli's equation
 - Pascal's law
 - Archimede's principle

64. Euler's equation in the differential form for the motion of fluid is given by
- (A) $\frac{dp}{\rho} + g \cdot dz + v \cdot dv = 0$
- (B) $\frac{dp}{\rho} - g \cdot dz + v \cdot dv = 0$
- (C) $p \cdot dp + g \cdot dz + v \cdot dv = 0$
- (D) $p \cdot dp - g \cdot dz + v \cdot dv = 0$
65. The Bernoulli's equation is based on the assumption that
- (A) there is no loss of energy of the liquid flowing
- (B) the velocity of flow is uniform across any cross-section of the pipe
- (C) no force except gravity acts on the fluid
- (D) all of the above
66. Venturi meter is used to
- (A) measure the velocity of a flowing liquid
- (B) measure the pressure of a flowing liquid
- (C) measure the discharge of liquid flowing in a pipe
- (D) measure the pressure difference of liquid flowing between two points in a pipe line
67. A jet of water discharging from a 40mm diameter orifice has a diameter of 32mm at its vena contracta. The coefficient of contraction is
- (A) 0.46
- (B) 0.64
- (C) 0.78
- (D) 0.87
68. Which of the following statement is wrong?
- (A) A flow whose statement is represented by a curve, is called two dimensional flow
- (B) The total energy of a liquid particle is the sum of potential energy, kinetic energy and pressure energy.
- (C) The length of divergent portion in a venturi meter is equal to the convergent portion.
- (D) A pitot tube is used to measure the velocity of flow at the required point in a pipeline
69. An orifice is said to be large, if
- (A) the size of orifice is large
- (B) the velocity of flow is large
- (C) the available head of liquid is more than 5 times the height of orifice
- (D) the available head of liquid is less than 5 times the height of orifice
70. The length AB of a pipe ABC in which the liquid is flowing has diameter (d_1) and is suddenly contracted to diameter (d_2) at B is constant for the length BC . The loss of head due to sudden contraction, assuming coefficient of contraction as 0.62, is
- (A) $\frac{V_1^2}{2g}$
- (B) $\frac{V_2^2}{2g}$
- (C) $\frac{0.5V_1^2}{2g}$
- (D) $\frac{0.375V_1^2}{2g}$
71. An error of 1% in measuring head over the crest of the notch (H) will produce an error of.....in discharge over a triangular notch,
- (A) 1%
- (B) 1.5%
- (C) 2%
- (D) 2.5%
72. The hydraulic mean dept or the hydraulic radius is the ratio of
- (A) area of flow and wetted perimeter
- (B) wetted perimeter and diameter of pipe
- (C) velocity of flow and area of flow
- (D) none of these
73. In case of flow through parallel pipes,
- (A) the head loss for all the pipes is same
- (B) the total discharge is equal to the sum of discharges in the various pipes
- (C) the total head loss is the sum of head losses in the various pipes
- (D) all of the above
74. The siphon will work satisfactorily, if the minimum pressure in the pipevapour pressure of liquid.
- (A) equal to
- (B) less than
- (C) more than
75. The hammer blow in pipes occurs when
- (A) there is excessive leakage in the pipe
- (B) the pipe burst under high pressure of fluid
- (C) the flow of fluid through the pipe is suddenly brought to rest by closing of the valve
- (D) the flow of fluid through the pipe is gradually brought to rest by closing of the valve

76. The purpose of a surge tank is
(A) to control the pressure variations due to rapid changes in the pipeline flow
(B) to eliminate water hammer possibilities
(C) to regulate flow of water to turbines by providing necessary retarding head of water
(D) all of the above
77. The discharge through a channel of trapezoidal section is maximum when
(A) width of channel at the top is equal to twice the width at the bottom
(B) dept of channel is equal to the width at the bottom
(C) the sloping side is equal to half the width at the top
(D) the sloping side is equal to the width at the bottom
78. The flow of water through the hole in the bottom of a wash basin is an example of
(A) steady flow
(B) uniform flow
(C) free vortex
(D) forced vortex
79. The kinematic viscosity of an oil (in stokes) whose specific gravity is 0.95 and viscosity 0.011, poise is
(A) 0.0116 stoke
(B) 0.116 stoke
(C) 0.0611 stoke
(D) 0.611 stoke
80. The flow in a pipe is turbulent when Reynold number is
(A) less than 2000
(B) between 2000 and 2800
(C) more than 2800
(D) none of these
81. The flow in a pipe is neither laminar nor turbulent when Reynold number is
(A) less than 2000
(B) between 2000 and 2800
(C) more than 2800
(D) none of these
82. Bulk modulus of fluid is the ratio of
(A) shear stress to shear strain
(B) increase in volume to the viscosity of fluid
(C) increase in pressure to the volumetric Strain
(D) critical velocity to the viscosity of fluid
83. A point in a compressible flow where the velocity of fluid is zero, is called
(A) critical point
(B) vena contracta
(C) stagnation point
(D) none of these
84. The value of bulk modulus of a fluid is required to determine
(A) Reynold's number
(B) Froude's number
(C) stagnation point
(D) none of these
85. A jet of water is striking at the centre of a curved vane moving with a uniform velocity in the direction of jet. For the maximum efficiency, the vane velocity isof the jet velocity.
(A) one-half
(B) one-third
(C) two-third
(D) three-fourth
86. Braking jet in an import turbine is used
(A) to break the jet of water
(B) to bring the runner to rest in a short time
(C) to change the direction of water
(D) none of these
87. The function of guide vanes in a reaction turbine is to
(A) allow the water to enter the runner without shock
(B) allow the water to flow over them, without Forming eddies
(C) allow the required quantity of water to enter the turbine
(D) all of the above
88. A pelton wheel develops 1750 kW under a head of 100metres while running at 200 r.p.m and discharging 2500 litres of water per second. The unit power of the wheel is
(A) 0.25 kW
(B) 0.75 kW
(C) 1.75 kW
(D) 3.75 kW
89. A turbine is required to develop 1500 kW at 300 r.p.m. Under a head of 150m. Which of the following turbine should be used
(A) Pelton wheel with one nozzle
(B) Pelton wheel with two or more nozzles
(C) Kaplan turbine
(D) Francis turbine
90. The specific speed of a centrifugal pump, delivering 750 litres of water per second against a head os 15 metres aaa 725 r.p.m., Is
(A) 24.8 r.p.m.
(B) 48.2 r.p.m.
(C) 82.4 r.p.m.
(D) 248 r.p.m.
91. Which of the following pump is suitable for small discharge and high heads
(A) Centrifugal pump
(B) Axial flow pump
(C) Mixed flow pump
(D) Reciprocating pump

92. In order to avoid cavitation in centrifugal pumps
 (A) the suction pressure should be high
 (B) the delivery pressure should be high
 (C) the suction pressure should be low
 (D) the delivery pressure should be low
93. Which of the following pump is successfully used for lifting water to the boiler?
 (A) Centrifugal pump
 (B) Reciprocating pump
 (C) Jet pump
 (D) Air-lift pump
94. Which of the following hydraulic unit is used for transmitting increased or decreased torque to the driven shaft?
 (A) Hydraulic ram
 (B) Hydraulic intensifier
 (C) Hydraulic torque converter
 (D) Hydraulic accumulator
95. An open system is one in which
 (A) heat and work crosses the boundary of the system, but the mass of the working substance does not cross the boundary of the system
 (B) mass of the working substance crosses the boundary of the system, but the heat and work does not cross the boundary of the system
 (C) both the heat and work as well as the mass of the working substance crosses the boundary of the system
 (D) neither the heat and work nor the mass of the working substance crosses the boundary of the system
96. The reading of the pressure gauge fitted on a vessel is 25 bar. The atmospheric pressure is 1.03 bar and the value of 'g' is 9.81 m/s^2 . The absolute pressure in the vessel is
 (A) 23.97 bar
 (B) 25 bar
 (C) 26.03 bar
 (D) 34.81 bar
97. A path 1-2-3 is given. A system absorbs 100 kJ as heat and does 60 kJ of work while along the path 1-4-3, it does 20 kJ of work. The heat absorbed during the cycle 1-4-3 is
 (A) -140 kJ
 (B) -80 kJ
 (C) -40 kJ
 (D) +60 kJ
-
98. A person in which the gas is heated or expanded in such a way that the product of its pressure and volume remains constant, is called
 (A) isothermal process
 (B) hyperbolic process
 (C) adiabatic process
 (D) polytropic process
99. A series of operations, which takes place in a certain order and restore the initial conditions at the end, is known as
 (A) reversible cycle
 (B) irreversible cycle
 (C) thermodynamic cycle
 (D) none of these
100. Carnot cycle consists of
 (A) two constant volume and two isentropic processes
 (B) two isothermal two isentropic processes
 (C) two constant pressure two isentropic processes
 (D) one constant volume, one constant pressure and two isentropic processes
101. Stirling cycle consists of
 (A) two constant volume and two isentropic processes
 (B) two constant two isothermal processes
 (C) two constant pressure two isothermal processes
 (D) one constant volume, one constant pressure and two isentropic processes
102. Otto cycle consists of
 (A) two constant volume and two isentropic processes
 (B) two constant pressure two isentropic processes
 (C) two constant volume two isothermal processes
 (D) one constant pressure, one constant volume and two isentropic processes
103. Otto cycle efficiency is higher than Diesel cycle efficiency for the same compression ratio and heat input because in Otto cycle
 (A) combustion is at constant volume
 (B) expansion and compression are isentropic
 (C) maximum temperature is higher
 (D) heat rejection is lower

104. Which of the following represents Otto cycle on temperature (T - s) diagram?



105. Select the wrong statement
- (A) A Joule cycle consists of two constant volume and two isentropic processes.
 - (B) An Otto cycle consists of two constant volume and two isentropic processes.
 - (C) An Ericsson cycle consists of two constant pressure and two isothermal processes.
 - (D) all of the above

106. Which of the following is the correct statement?
- (A) For a given compression ratio, both Otto and Diesel cycles have the same efficiency
 - (B) For a given compression ratio, Otto cycle is more efficient than Diesel cycle
 - (C) For a given compression ratio, Diesel cycle is more efficient than Otto ratio
 - (D) The efficiency of Otto and Diesel cycle has nothing to do with compression ratio.

107. Which of the following is the correct statement?
- (A) All the reversible engines have the same efficiency
 - (B) All the reversible and irreversible engines have the same efficiency
 - (C) irreversible engines have maximum efficiency.
 - (D) All engines are designed as reversible in order to obtain maximum efficiency

108. The work ratio of a gas turbine plant is given by
- (A)
$$\frac{\text{Net work Output}}{\text{Workdone by the turbine}}$$

(B)
$$\frac{\text{Net work Output}}{\text{Heat supplied}}$$

(C)
$$\frac{\text{Actual temperature drop}}{\text{Isentropic temperature drop}}$$

(D)
$$\frac{\text{Isentropic increase in temperature}}{\text{Actual increase in temperature}}$$

109. Coke is produced
- (A) when coal is first dried and then crushed to a fine powder by pulverizing machine
 - (B) from the finely grind coal by moulding under pressure with or without a binding material
 - (C) when coal is strongly heated for continuously 42 to 48 hours in the absence of air in a closed vessel
 - (D) by heating wood with a limited supply of air to a temperature not less than 280°C

110. The distillation carried out in such a way that the liquid with the lowest boiling point is first evaporated and recondensed, then the liquid with the next higher boiling point is then evaporated and recondensed, and so until all the available liquid fuels are separately recovered in the sequence of their boiling points. Such a process is called
(A) cracking
(B) carbonisation
(C) fractional distillation
(D) full distillation
111. A process of heating crude oil to a high temperature under a very high pressure to increase the yield of lighter distillates, is known as
(A) cracking
(B) carbonisation
(C) fractional distillation
(D) full distillation
112. Petrol is distilled at
(A) 65° to 220°C
(B) 220° to 345°C
(C) 345° to 470°C
(D) 470° to 550°C
113. Which of the following gas has the highest calorific value?
(A) Coal gas
(B) Producer gas
(C) Mond gas
(D) Blast Furnace gas
114. Producer gas is obtained by
(A) partial combustion of coal, coke, anthracite coal or charcoal in a mixed air system blast
(B) carbonisation of bituminous coal
(C) passing steam over incandescent coke
(D) passing air and a large amount of steam over waste coal at about 650°C

ANSWER KEY

- | | | | | | | | | | | | |
|-----|---------------|-----|---|-----|---|-----|------|------|---|------|---|
| 1. | D | 21. | C | 41. | A | 61. | D | 81. | B | 101. | B |
| 2. | A | 22. | B | 42. | A | 62. | B | 82. | C | 102. | A |
| 3. | A | 23. | D | 43. | B | 63. | B | 83. | C | 103. | D |
| 4. | A | 24. | B | 44. | D | 64. | A | 84. | C | 104. | C |
| 5. | A | 25. | B | 45. | D | 65. | D | 85. | B | 105. | A |
| 6. | D | 26. | C | 46. | B | 66. | C | 86. | B | 106. | B |
| 7. | D, A, C, E, B | 27. | B | 47. | C | 67. | B | 87. | D | 107. | C |
| 8. | B | 28. | A | 48. | B | 68. | C | 88. | C | 108. | A |
| 9. | D, A, B, C | 29. | B | 49. | D | 69. | D | 89. | A | 109. | C |
| 10. | A | 30. | C | 50. | A | 70. | D | 90. | C | 110. | C |
| 11. | B | 31. | A | 51. | A | 71. | B | 91. | D | 111. | A |
| 12. | B | 32. | D | 52. | A | 72. | A | 92. | A | 112. | A |
| 13. | D | 33. | D | 53. | B | 73. | A, B | 93. | C | 113. | A |
| 14. | A | 34. | C | 54. | A | 74. | C | 94. | C | 114. | A |
| 15. | D | 35. | C | 55. | D | 75. | C | 95. | C | | |
| 16. | B | 36. | D | 56. | C | 76. | D | 96. | C | | |
| 17. | B | 37. | D | 57. | A | 77. | C | 97. | D | | |
| 18. | A | 38. | A | 58. | B | 78. | C | 98. | B | | |
| 19. | B | 39. | A | 59. | B | 79. | A | 99. | C | | |
| 20. | D | 40. | C | 60. | C | 80. | C | 100. | B | | |

MARKETING TEST

70 QUESTIONS

30 MINUTES

DIRECTIONS

Each of the questions or incomplete statements below is followed by five suggested answers or completions. In each case, select the one that is the best of the choices offered and then mark the corresponding space on the answer sheet.

1. A carpet manufacturer wants to expand the business and decides to export to Europe. In what way will the business grow? Is it through:
(A) new markets
(B) new clients in the home market
(C) increased home market share
(D) retained clients
2. An entrepreneur thinks that there is a gap in the market for a particular product. She decides to import the product for resale in this country. Which marketing principle is she applying?
(A) generating income
(B) satisfying customer expectations
(C) anticipating market needs
(D) enhancing customers perception of the business
3. Say whether each of the following statement is true (T) or false (F)
i. Marketing is about being product oriented
ii. One of the principles of marketing is anticipating customer needs.
(A) (i) T (ii) T
(B) (i) T (ii) F
(C) (i) F (ii) T
(D) (i) F (ii) F
4. A company has launched a new product on the market and after three months it wants to know what people think about it. Which method is likely to produce the lowest response?
(A) interview in person
(B) interview over the phone
(C) postal questionnaire
(D) panel discussion

Question 5 to 7 relate to the following
A door-to-door leaflets in a neighbourhood
B posters on hoardings nationally
C specialist journal
D local TV advertisement
5. To announce the opening of a corner shop
(A) a
(B) b
(C) c
(D) d
6. The development of new type of hard disk for computers
(A) a
(B) b
(C) c
(D) d
7. To raise general public awareness over a period of time about a forthcoming product, cost effectively.
(A) independent television commission
(B) advertising standards authority
(C) trade descriptions act
(D) broadcasting standards council
8. A company launches a new handcream for women. How might they most effectively encourage women to try this product?
(A) sell at half price
(B) money off next purchase
(C) free samples
(D) a competition
9. Which of the following is not an example of direct selling
(A) telesales
(B) mail order
(C) house parties
(D) dealerships
10. Which of the following is not an example of indirect selling?
(A) factory sales
(B) retail co-operatives
(C) franchised outlets
(D) agencies

11. A large manufacturer produces a wide range of goods for public consumption. How would it distribute its products, cost effectively, to a large number of small shops?
(A) directly to each shop
(B) employ agents to get orders
(C) through wholesalers
(D) through catalogues
12. Which one of the following could be described as a function of sales administration?
(A) product development
(B) credit control
(C) packaging policy
(D) procurement of raw materials
13. Which term would describe a person or organisation that is sent goods from abroad to be sold to shopkeepers and then to consumers?
(A) a retailer
(B) a distributor
(C) a sales representative
(D) a dealer
14. An insurance company is most likely to use which of the following methods to sell policies?
(A) pyramid selling
(B) catalogues
(C) agents
(D) a wholesaler
15. A double glazing company wants to 'cold call' a large number of people in a wide geographical area and is constrained by a time limit. Which of the following methods would be advisable in this situation?
(A) a distributor
(B) sales representatives
(C) telesales
(D) door-to-door leaflets
16. Say whether each of the following statements is true (T) or false (F).
i. One of the aims of marketing is to generate income and make the business profitable.
ii. Marketing should test the product concept for production suitability.
(A) (i) T (ii) T
(B) (i) T (ii) F
(C) (i) F (ii) T
(D) (i) F (ii) F
17. Which of the following is not part of the marketing principles?
(A) meeting customer needs
(B) meeting organisational needs
(C) product research and development
(D) managing change in the marketplace
18. Marketing involves promoting products using various methods. Which of the following would be least likely to be used for a product that is sold in a particular geographical location?
(A) poster in shops
(B) local newspapers
(C) national television
(D) billboards
19. Which of the following stages would come first in the product life cycle?
(A) growth
(B) maturity
(C) launch
(D) decline
20. The SWOT analysis is a planning technique used in forming a marketing plan. What does SWOT stand for?
(A) strengths working open threats
(B) strengths weaknesses open threats
(C) strengths weaknesses opportunities tackled
(D) strengths weaknesses opportunities threats.
21. A soft drinks manufacturer is interested in finding out which of its range of drinks are preferred by people over the age of 40. Which of the following methods would be most suitable?
(A) use government publications
(B) conduct primary research
(C) consult secondary market research
(D) use the electoral register
22. A person conducting desk research would do all of the following except:
(A) gather existing sales figures
(B) gather fresh data
(C) use governmental statistics
(D) use secondary research figures
23. Which of the following is likely to provide primary research data for an organisation?
(A) government trade figures
(B) surveys
(C) internal sales figures
(D) marketing journal
24. Where a researcher chooses people from different social classes, age groups, income etc for research, which sampling method is being used?
(A) random sampling
(B) stratified sampling
(C) quota sampling
(D) cluster sampling

25. Say whether each of the following statements is true (T) or false (F)
- A perfectly random sampling technique means that every person has an equal chance of appearing in the sample
 - A random sampling technique means that older people are more likely to be selected compared with younger people
- (A) (i)T (ii)T
(B) (i)T (ii)F
(C) (i)F (ii)T
(D) (i)F (ii)F
26. Which research method is most likely to be used to find out how people react to a display in a supermarket?
- (A) telephone research
(B) observation
(C) postal questionnaire
(D) panel research
27. A company has launched a new product on the market and after three months it wants to know what people think about it. Which method is likely to be used to cover the widest geographical area in the shortest possible time?
- (A) interview in person
(B) interview over the phone
(C) postal questionnaire
(D) panel discussion
28. Many companies get their name or product advertised by having sports stars wear the company logo. How do they get the stars to wear it?
- (A) by lobbying them
(B) by sponsoring them
(C) by issuing press releases
(D) by improving community relations
29. Many companies make substantial donations to charities and other good causes. What benefit might they derive from this?
- (A) increased sponsorship
(B) improved public image
(C) increased investment
(D) improved lobbying
30. Which of the following would be considered to be publicity?
- (A) money-off coupons
(B) special offers
(C) product review
(D) an advert in a magazine
31. Where consumers react to an advertisement on television and other the product by phone, which direct marketing technique is being employed?
- (A) direct mail
(B) off-page selling
(C) off-screen selling
(D) telesales
32. Which direct selling method involves a salesperson recruiting other salespeople, who in turn recruit even more salespeople?
- (A) party selling
(B) telesales
(C) network selling
(D) catalogue selling
33. A manufacturer finds that it has a number of items which have minor defects and hence cannot be sold through the usual retailers. Which of the following would be suitable for selling these 'seconds' quality goods?
- (A) telesales
(B) pyramid selling
(C) factory shop
(D) 'cold calling'
34. A double glazing company sells its products mainly through cold calls. Which of the following would be the most cost effective in terms of covering a wide geographical area in a short space of time?
- (A) telesales
(B) pyramid selling
(C) factory shop
(D) catalogues
35. Say whether each of the following statements is true (T) or false (F).
- The purpose of credit control is to ensure that all transactions are on a cash-only basis.
 - The purpose of delivery schedules is to ensure that the right goods are sent to the right person at the right time.
- (A) (i)T (ii)T
(B) (i)T (ii)F
(C) (i)F (ii)T
(D) (i)F (ii)F
36. A business person is visiting another country and sees a craze for new product. He decides to import the product for resale in this country. Which marketing principle is he using?
- (A) generating income
(B) satisfying customer expectations
(C) anticipating market needs
(D) enhancing customer perception of the business
37. Marketing involves promoting products using various methods. Which of the following would be least likely to be used for a product that is sold nationally?
- (A) posters in shops
(B) local newspapers
(C) national television
(D) shop window postcard

38. A company is conducting research into the spending habits of pensioners by postal questionnaires. Which type of research is this?
- (A) primary research
 - (B) secondary research
 - (C) desk research
 - (D) using government statistics
39. Which of the following is most likely to give publicity to an organisation?
- (A) money-off coupons
 - (B) charitable donation
 - (C) advert in a magazine
 - (D) loyalty incentives
40. A company launches a new shampoo. Which of the following methods will be the most effective in getting people to try it?
- (A) give a 50 per cent discount
 - (B) money-off coupons in magazines
 - (C) free trial size sachets
 - (D) poster adverts
41. Which direct marketing technique is being employed when consumers tear out coupons from newspapers and magazines?
- (A) direct mail
 - (B) off-page selling
 - (C) off-screen selling
 - (D) telesales
42. Which of the following is an example of direct selling?
- (A) factory sales
 - (B) retail co-operatives
 - (C) franchised outlets
 - (D) agencies
43. Which sales administration function is concerned with chasing clients who have not brought their accounts up to date within a specified period.
- (A) credit clearance
 - (B) credit control
 - (C) order processing
 - (D) security
44. A waiter in a restaurant is presented with a credit card by a customer, to pay for the meal. Which of the following functions will the waiter carry out
- (A) issue a credit note
 - (B) credit rating
 - (C) credit clearance
 - (D) credit customer's account
45. Raheel owns a clothes shop, selling both ladies' and gents' fashion wear. During the autumn he purchased a large amount of winter stock which did not sell too well. So in the spring he decides to have a sale. Which marketing principle is he using by having a sale?
- (A) generating cashflow
 - (B) anticipating market needs
 - (C) a SWOT analysis
 - (D) utilizing technological development
46. To avoid being stuck with unwanted stock again, what should Raheel do when buying new stock?
- (A) anticipate future needs
 - (B) improve customer perceptions
 - (C) meet customer needs
 - (D) improve his cash flow
47. Raheel wants to ensure the continued growth of his business; how best could he do this?
- (A) by reducing staff
 - (B) by reducing product range
 - (C) by reducing customer service
 - (D) by reducing wastage
48. How can Raheel make sure that his business is profitable and keep tabs on stock levels?
- (A) sales monitoring
 - (B) marketing research
 - (C) credit clearance
 - (D) security
49. Raheel wants to diversify by opening a new type of shop, specializing in selling toys. Which marketing principle should he carry out first?
- (A) sales monitoring
 - (B) marketing research
 - (C) implement marketing mix
 - (D) satisfy customer requirements
50. A company is researching export trends over the last ten years using published statistics. Which type of research is it?
- (A) primary research
 - (B) secondary research
 - (C) field research
 - (D) panel research
51. A company launches a new body spray for men. What incentive can they give to encourage men to buy this product again?
- (A) advertise nationally on TV
 - (B) money off next purchase
 - (C) advertise in the national press
 - (D) set up a competition

52. Direct marketing has increased considerably over the last 10 to 15 years. What can we attribute this to?
- (A) rise in disposable incomes
 - (B) use of information technology
 - (C) fall in disposable incomes
 - (D) ageing of the population
53. Which of the following would you use to ascertain whether a potential client is creditworthy prior to supplying goods?
- (A) credit control
 - (B) credit clearance
 - (C) customer accounts
 - (D) security
54. Which sales administration function is concerned with preventing overdue accounts becoming bad debts?
- (A) credit control
 - (B) credit clearance
 - (C) customer accounts
 - (D) security
55. Which sales administration function is concerned with preventing pilfering of merchandise during transit?
- (A) credit control
 - (B) credit clearance
 - (C) customer accounts
 - (D) security
56. Which direct selling method involves using a photographic display of goods?
- (A) party selling
 - (B) telesales
 - (C) network selling
 - (D) catalogue selling
57. A manufacturing company which sells in bulk only is most likely to use which of the following methods to eventually get their goods to consumers?
- (A) pyramid selling
 - (B) catalogues
 - (C) agents
 - (D) wholesalers
58. Which of the following would be used to decide whether the product needs replacing?
- (A) market research
 - (B) product launch
 - (C) distribution
 - (D) monitoring sales
59. One of the activities of marketing is product launch. Within this the following will take place except:
- (A) branding
 - (B) pricing
 - (C) testing
 - (D) revamping
60. Identify which of the following is not a marketing activity.
- (A) optimise customer perception
 - (B) sales monitoring
 - (C) product R&D
 - (D) assess market needs
61. A company makes luxury products. Which type of customers is most likely to be targeted?
- (A) affluent customers
 - (B) low disposable income groups
 - (C) affluent customers
 - (D) teenagers
62. Which of the following is not part of the marketing principles?
- (A) manage change in the marketplace
 - (B) meet organisational needs
 - (C) meet production target
 - (D) meet customer needs
63. A company is researching demographic changes and consumption habits during the last ten years or so. Where is the company most likely to find this information?
- (A) internal sales figures
 - (B) census data
 - (C) primary research
 - (D) field research
64. A company wants to find out the opinions of people who have used the company's products. Which type of questioning will they use?
- (A) closed
 - (B) open
 - (C) biased
 - (D) yes/no type
65. A toy manufacturer is interested in finding out which types of toy, of the ones that it makes, are preferred by children under ten years of age. Which of the following methods would be most suitable?
- (A) use government publications
 - (B) use the electoral register
 - (C) consult trade journals
 - (D) conduct primary research
66. Which types of question would you use if you wanted the responses to be the least difficult to quantify?
- (A) open
 - (B) closed
 - (C) opinionated
 - (D) biased

67. A company has decided to target its advertisements at women. They want to encourage them to remove coupons, fill them in and order the goods. How is the company aiming to sell their goods?
(A) on screen
(B) on page
(C) off screen
(D) off page
68. Say whether each of the following statements is true (T) or false (F).
- i. The launch of a new type of car is best announced by advertising nationally.
- ii. The launch of a new type of manufacturing machine is best announced by advertising nationally on TV.
- (A) (i) T (ii) T
(B) (i) T (ii) F
(C) (i) F (ii) T
(D) (i) F (ii) F
69. Which one of the following could be described as a function of sales administration?
(A) product development
(B) delivery schedules
(C) packaging policy
(D) procurement of raw materials
70. Which one of the following functions should a company carry out to ensure that it is likely to be paid for goods supplied to a customer?
(A) security
(B) credit control
(C) networking
(D) credit clearance

Answer Key

| | | | | | | | | | | | | | |
|-----|---|-----|---|-----|---|-----|---|-----|---|-----|---|-----|---|
| 1. | A | 11. | C | 21. | B | 31. | C | 41. | B | 51. | B | 61. | C |
| 2. | C | 12. | B | 22. | B | 32. | C | 42. | A | 52. | B | 62. | C |
| 3. | C | 13. | B | 23. | B | 33. | C | 43. | B | 53. | B | 63. | B |
| 4. | C | 14. | C | 24. | B | 34. | A | 44. | C | 54. | A | 64. | B |
| 5. | A | 15. | C | 25. | B | 35. | C | 45. | A | 55. | D | 65. | D |
| 6. | C | 16. | B | 26. | B | 36. | C | 46. | A | 56. | D | 66. | B |
| 7. | B | 17. | C | 27. | B | 37. | D | 47. | D | 57. | D | 67. | D |
| 8. | C | 18. | C | 28. | B | 38. | A | 48. | A | 58. | D | 68. | B |
| 9. | D | 19. | C | 29. | B | 39. | B | 49. | B | 59. | D | 69. | B |
| 10. | A | 20. | D | 30. | C | 40. | C | 50. | B | 60. | C | 70. | D |

HUMAN RESOURCES TEST

70 QUESTIONS

30 MINUTES

DIRECTIONS

Each of the questions or incomplete statements below is followed by five suggested answers or completions. In each case, select the one that is the best of the choices offered and then mark the corresponding space on the answer sheet.

1. The managing director of a company recognises the importance of employee co-operation and participation in running the firm. Which of the following is not a participative management technique?
(A) joint consultation
(B) quality circles
(C) team meetings
(D) a management directive
2. Employers and employees have certain expectations of each other. Which of the following would an employer find not acceptable in an employee?
(A) not to discriminate
(B) not to be honest
(C) not to be abusive
(D) not to be disobedient
3. Below are reasons why an employer may dismiss an employee. Which one would be unfair?
(A) sexual harassment
(B) racial harassment
(C) joining a union
(D) physical violence
4. Employers can gain the co-operation of employees in a number of ways. Which of the following is not a participative management technique?
(A) joint consultation
(B) quality circles
(C) team meetings
(D) a management directive
5. A managing director will be mainly concerned with which of the following?
(A) implementing policy decision
(B) day-to-day running of the company
(C) formulating policies
(D) hiring and firing of workers
6. Which of the following would provide the details of a job role?
(A) job analysis
(B) job evaluation
(C) job description
(D) recruitment and selection
7. The employees working within a personnel function in an organisation would deal with all of the following except:
(A) manpower planning
(B) staff welfare
(C) product innovation
(D) recruitment and selection
8. A press release would normally be issued by someone working in one of the following departments
(A) personnel
(B) Accounts
(C) Public Relations
(D) Customer Relations
9. Beds Ltd is a company making beds. Whose responsibility will it be to look after the shop-floor work?
(A) an operative
(B) a supervisor
(C) a manager
(D) a director
10. A curriculum vitae would not include one of the following. Which?
(A) personal details
(B) career history
(C) detailed reference
(D) educational background
11. A job description includes all except:
(A) an individual's attributes
(B) an outline of the main purpose involved
(C) a detailed list of the main duties and responsibilities
(D) the title of the job concerned

12. The employer would provide two of the following to a job applicant. Which two?
- i job analysis (A) i & ii
 - ii job evaluation (B) ii & iii
 - iii job description (C) iii & iv
 - iv person specification (D) ii & iv
13. The recruitment process could involve all of the following except:
- (A) application form
 - (B) shortlisting
 - (C) letter of application
 - (D) appraisal interview
14. An ethnic restaurant owner advertises for a waiter/waitress and specifies that the waiter/waitress must be from the same cultural background as the restaurant.
- (A) this is legally allowed
 - (B) this is not legally allowed
 - (C) it is allowed if no one from another culture applies
 - (D) it is allowed if no one objects
15. Which of the following would give an interviewer a 'picture' of the type of individual that would be suitable for the job?
- (A) job design
 - (B) person specification
 - (C) job description
 - (D) curriculum vitae
16. A manufacturing company decides to utilize its machinery more efficiently. To this end it wants to introduce a night shift, thus changing the terms and conditions of work. What is the best way forward to gain the co-operation of staff?
- (A) write a letter to each worker telling them of the change
 - (B) arrange a meeting of all workers and tell them of the change
 - (C) meet with worker representatives to discuss the change
 - (D) issue a directive of the changes that will take place.
17. Many employers choose to train and develop their employees. Which of the following is not an employee development technique?
- (A) job enrichment
 - (B) job rotation
 - (C) job design
 - (D) job enlargement
18. An employer would be well within his rights to sack an employee without warning for one of the following reasons.
- (A) joining a trade union
 - (B) becoming a shop steward
 - (C) being late
 - (D) gross misconduct
19. The employees working within a personnel function in an organization would deal with all the following except:
- (A) manpower planning
 - (B) staff welfare
 - (C) recruitment and selection
 - (D) product promotion
20. A chief executive of a large business organisation would, on the whole, be concerned with which of the following levels of business operation?
- (A) operational
 - (B) tactical
 - (C) strategic
 - (D) shop-floor activities
21. Adeel and Uzair work for a large publishing company and do the same job. Adeel works in the afternoon and Uzair works in the morning. This type of arrangement is called what?
- (A) flexi - time
 - (B) part time
 - (C) fixed term
 - (D) job sharing
22. Neha, a clerical assistant, is called into the manager's office to be warned about her time keeping. Which of the following issues is the manager dealing with?
- (A) training
 - (B) grievance
 - (C) discipline
 - (D) advising
23. Many large organizations these days want employees who can do more than one job. Which of the following terms describe the type of employees that employers want?
- (A) semi-skilled
 - (B) de-skilled
 - (C) multi-skilled
 - (D) unskilled
24. A curriculum vitae is
- (A) brief history of the individual
 - (B) list of the school curriculum studied
 - (C) list of extra-curricular activities
 - (D) a university degree
25. All employers are obliged to issue a contract or a statement of terms and conditions of employment. Which of the following would not form a part of the contract of employment?
- (A) level of pay
 - (B) length of lunch break
 - (C) named supervisor
 - (D) days and hours of work

26. A company which employs 500 people is required by law to have a certain type of insurance. What type of insurance must it have?
- (A) private medical insurance
 - (B) employers' liability insurance
 - (C) employees' liability insurance
 - (D) life insurance for all employees
27. An employee has been warned on two occasions about his behaviour at work. Which of the following will the employer use if the behaviour does not improve?
- (A) grievance procedure
 - (B) professional development
 - (C) disciplinary procedure
 - (D) negotiate conditions of service
28. Where management do not consult with employees on major changes to the conditions of services, which of the following is likely to be most affected?
- (A) employee skill levels
 - (B) equal opportunities
 - (C) industrial relations
 - (D) de-skilling
29. Many large employers tend to provide training for their staff. What is the reason for this?
- (A) increase staff turnover
 - (B) decrease staff turnover
 - (C) improve relations with staff
 - (D) provide appropriate skills
30. An employee has been ridiculed by a manager in front of other people and feels humiliated. What is the most appropriate action to take in this situation?
- (A) sue the manager in a court of law
 - (B) use the grievance procedure
 - (C) try to humiliate the manager
 - (D) use physical violence
31. Which of the following methods would an organisation use to find out the strengths and weakness of employees as well as what development needs the employees may have?
- (A) induction
 - (B) selection interview
 - (C) appraisal interview
 - (D) outplacement interview
32. A supervisor in a large manufacturing company would, on the whole, be concerned with which of the following levels of business operation?
- (A) making policy decisions
 - (B) tactical
 - (C) strategic
 - (D) shop-floor activities
33. Neha works full time in the administration department of a large insurance company. As she has children and needs to take them to school in the morning, she prefers to start work late. She then makes up the hours by finishing late. She can do this because the company allows:
- (A) job sharing
 - (B) flexi-time
 - (C) part-time
 - (D) overtime
34. A company has decided to alter the way in which their employees currently work. They have decided to set up project teams. They have done this because:
- (A) it gives management more control
 - (B) employees can keep a check on each other
 - (C) it can increase the consultation between employees
 - (D) it may give job security
35. A company is looking to recruit a person for a one-off project for a specified period. Which of the following types of contract would it offer?
- (A) permanent contract
 - (B) flexi-time contract
 - (C) part-time contract
 - (D) fixed term contract
36. Organisations use a range of techniques when selecting new employees. Apart from a formal interview they may also use tests. Which of the following is most likely to be of benefit to a commercial organisation when recruiting a junior finance clerk?
- (A) aptitude test
 - (B) keyboard skills test
 - (C) manual dexterity test
 - (D) spelling test
37. A company makes electrical items and needs to increase productivity levels. Which of the following methods is most likely to achieve the above objective?
- (A) a management directive
 - (B) a bonus system
 - (C) a reduction in remuneration
 - (D) setting up a staff association
38. A company has a very high staff turnover. It decides to look at ways to improve the situation. Which of the following is likely to help the company?
- (A) increased use of disciplinary procedures
 - (B) taking a more authoritarian approach
 - (C) a better remuneration package
 - (D) offering fixed-term contracts

39. The increased use of consultation between employer and employees can be beneficial. The employees are more likely to feel:
- (A) equal
 - (B) skilled
 - (C) motivated
 - (D) threatened
40. A company secretary's role would include one of the following
- (A) take minutes at departmental meetings
 - (B) deal with shareholders' correspondence
 - (C) book meetings for a departmental manager
 - (D) type letters for a departmental manager
41. During a recruitment process an applicant may provide a non-confidential statement about his/her character and abilities. What is this statement called?
- (A) reference
 - (B) curriculum vitae
 - (C) testimonial
 - (D) qualification certificate
42. A medium-sized organisation has decided to train the majority of its staff so that they become multi-skilled. What is the reasoning behind this?
- (A) to improve industrial relations
 - (B) to improve staff consultation
 - (C) to offer job security
 - (D) to improve staff productivity
43. An employee has worked for a manufacturing firm for ten years as a manual worker. The manager of the firm tells the employee on a Friday that he is now redundant and should not turn up for work on Monday morning. Which body is most likely to deal with this case?
- (A) a staff association
 - (B) Equal Opportunities Commission
 - (C) industrial tribunal
 - (D) European Court of Human Rights
44. A company decides to change the terms and conditions of work. What is the best way forward to gain the co-operation of staff?
- (A) inform each worker by letter of the change
 - (B) arrange a meeting of all workers and tell them of the change
 - (C) meet with worker representatives to discuss the change
 - (D) issue a directive of the changes that will take place
45. A company decides to survey its workforce about job satisfaction. It wants to increase job satisfaction if possible. Why?
- (A) to increase stress levels
 - (B) to increase staff turnover
 - (C) to decrease wages
 - (D) to decrease absenteeism
46. Which of the following would a production manager be most concerned with?
- (A) day-to-day functioning of the company
 - (B) the grievances currently outstanding
 - (C) strategic planning
 - (D) the production targets for the next two months.
47. Which of the following job advertisements would be contrary to the equal opportunities legislation?
- (A) required one bar person, to work in a busy pub
 - (B) required one bar person, must be fit and healthy
 - (C) required one bar person, must be over 21
 - (D) required one bar person, will need to wear mini-skirt
48. An organization wants to hire a person from within the company. Where should it advertise the job?
- (A) local paper
 - (B) internally
 - (C) national paper
 - (D) specialist press

Answer Key

| | | | | | | | | | |
|-----|---|-----|---|-----|---|-----|---|-----|---|
| 1. | D | 11. | A | 21. | D | 31. | C | 41. | C |
| 2. | B | 12. | C | 22. | C | 32. | D | 42. | D |
| 3. | C | 13. | D | 23. | C | 33. | A | 43. | C |
| 4. | D | 14. | A | 24. | A | 34. | C | 44. | C |
| 5. | C | 15. | B | 25. | C | 35. | D | 45. | D |
| 6. | C | 16. | C | 26. | B | 36. | A | 46. | D |
| 7. | C | 17. | C | 27. | C | 37. | B | 47. | D |
| 8. | C | 18. | D | 28. | C | 38. | C | 48. | B |
| 9. | B | 19. | D | 29. | D | 39. | C | | |
| 10. | C | 20. | C | 30. | B | 40. | B | | |

PART FOUR

DIAGRAMMATIC REASONING TESTS

**For Oil Companies, Multinationals, Marketing Firms,
Industries, Engineering Firms etc.**

Note: Some Banks might use these tests also.



IEC MONTHLY SEMINAR

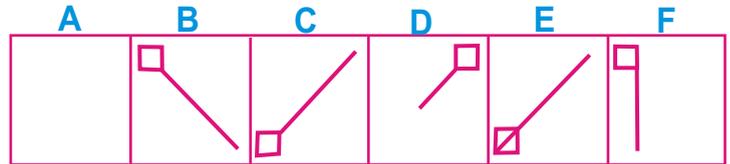
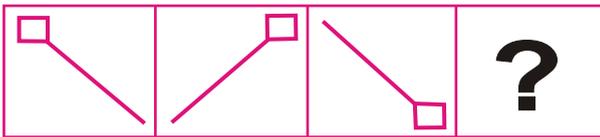
DIAGRAMMATIC SERIES TEST 1

42 QUESTIONS
20 MINUTES

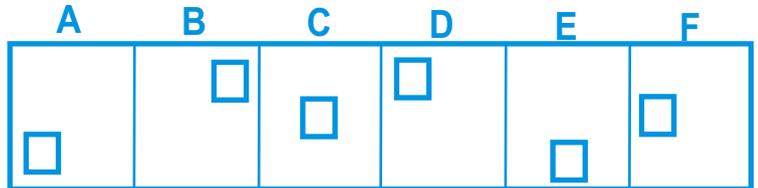
INSTRUCTION

Symbols Series questions test your ability to spot the relationship governing a group of symbols so that you are able to choose the next term in the series. Each question consists of a series of five symbols of the left half of the page. Next to these are five other symbols labelled (A), (B), (C), (D) and (E). Study the first five symbols to determine what is happening in the series. Then select the one lettered symbol that best continues the series.

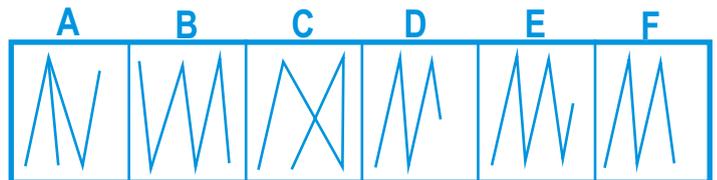
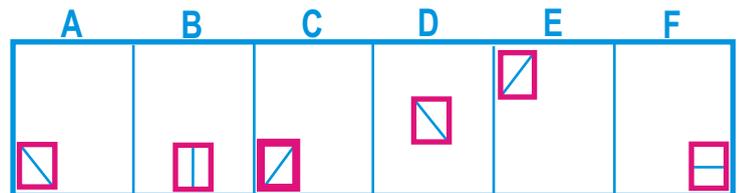
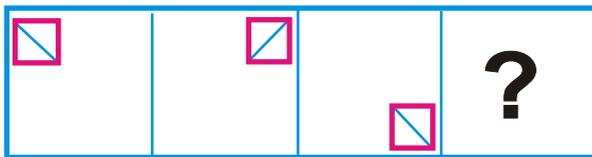
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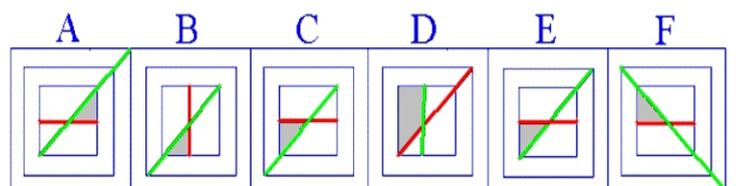
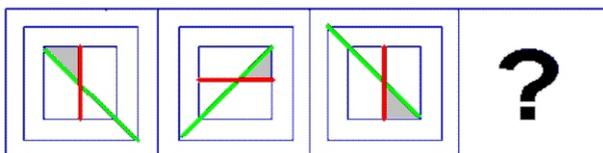
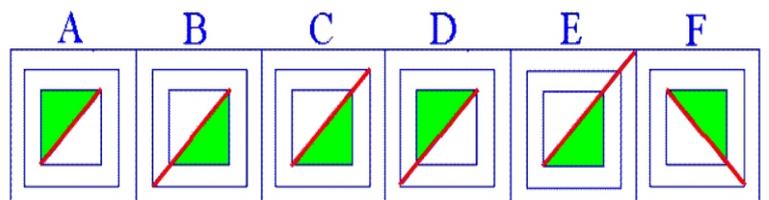
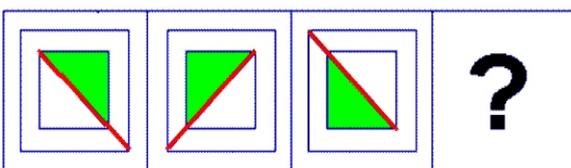
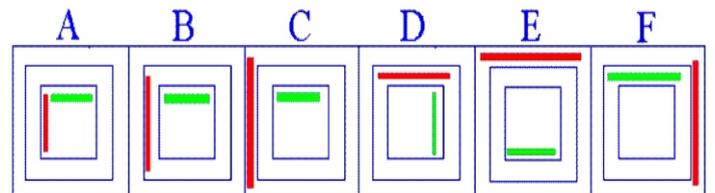
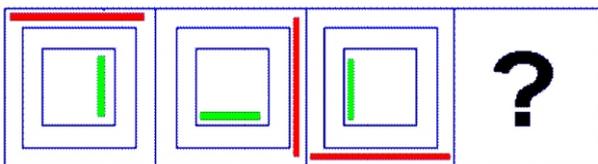
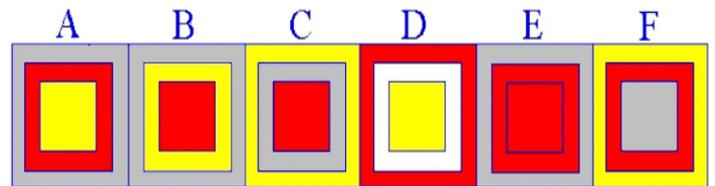
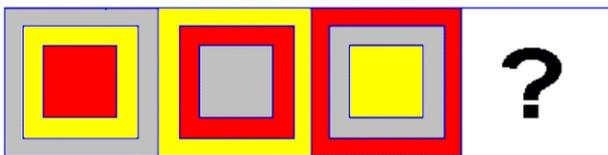
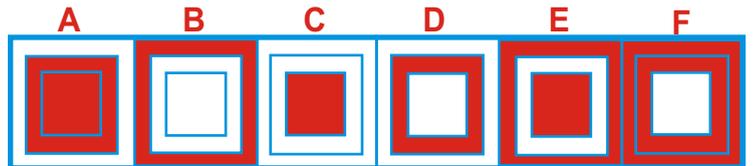
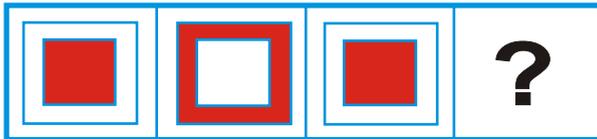
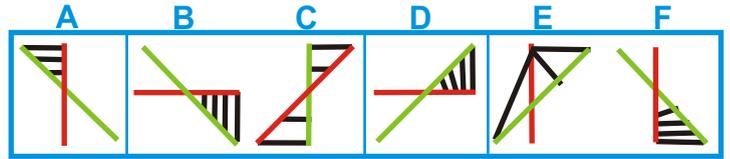
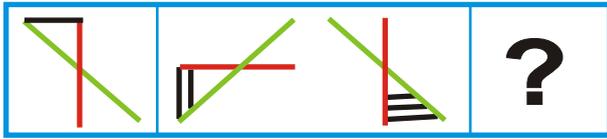


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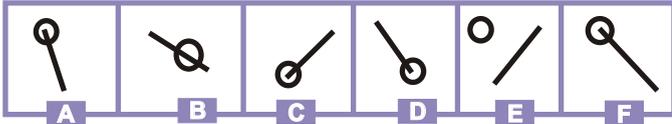


Master Job Aptitude Test

Diagrammatic Series Test 1

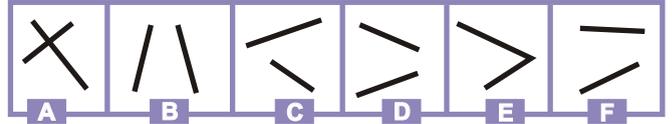


Example 1



The second and the fifth are different from the other. They should be checked

Example 2



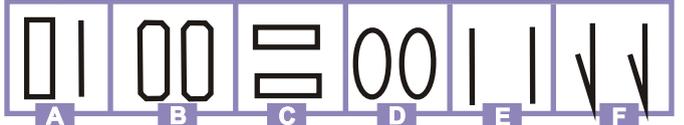
The first the figures are not two separated lines. These are the odd-one-out

Example 3

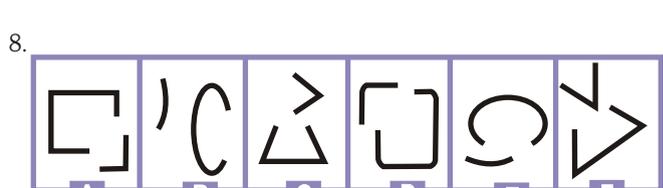
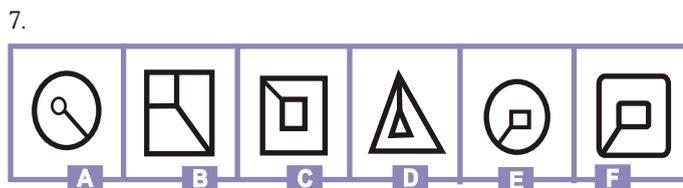
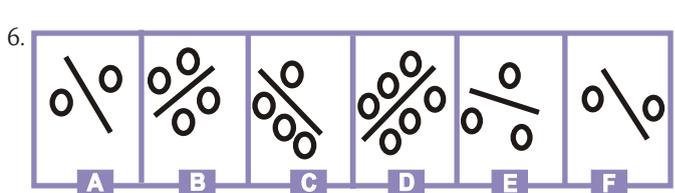
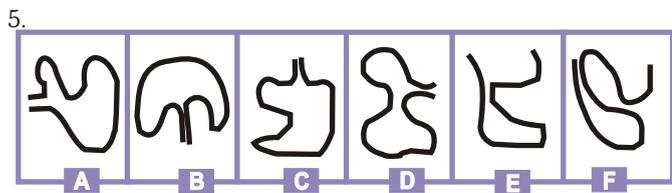
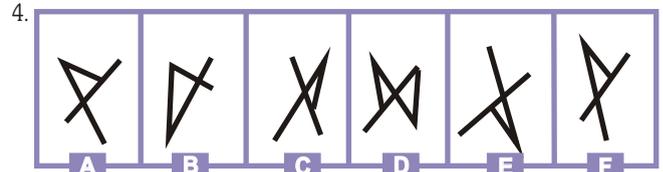
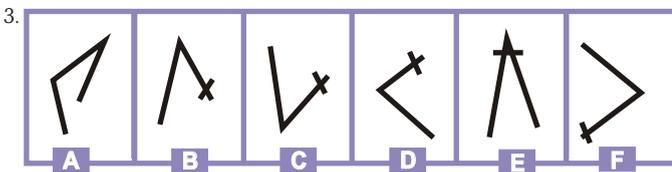
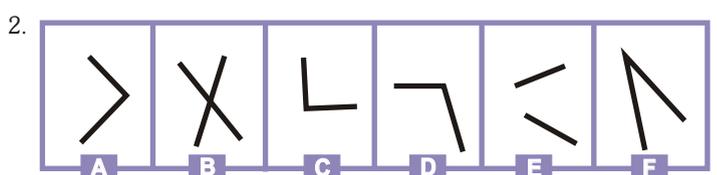
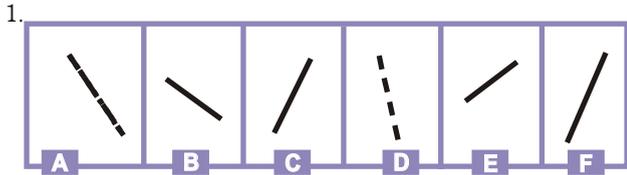


The third and sixth figures are different from the others. They should be checked

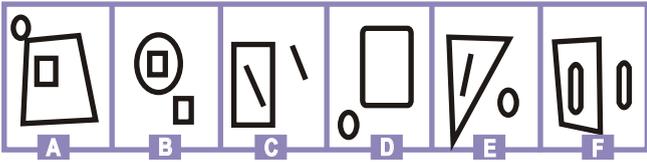
Example 4



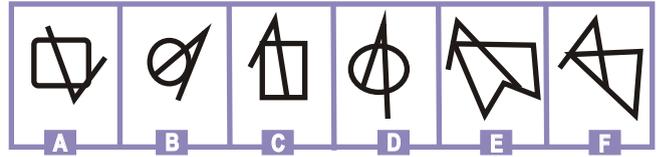
In each figure, we can see the two same objects (one in the left and one in the right) except in first and third figures. For this reason, they are the odd-one-out



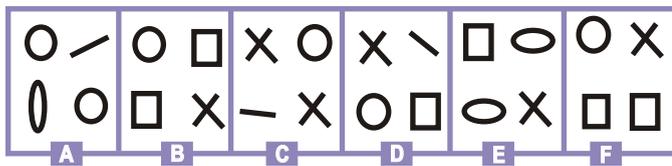
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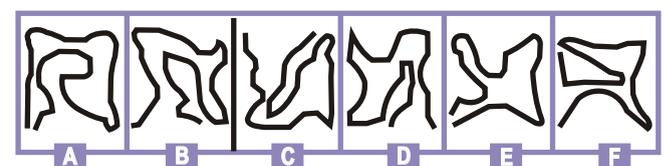
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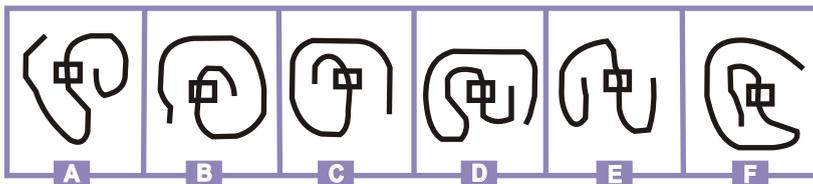
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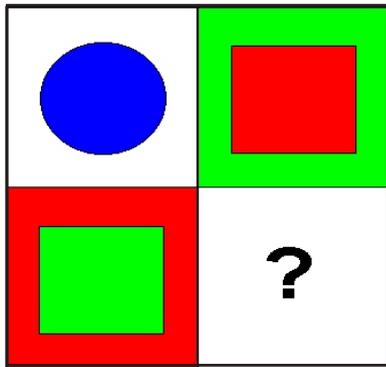


PATTERN SERIES TEST 1

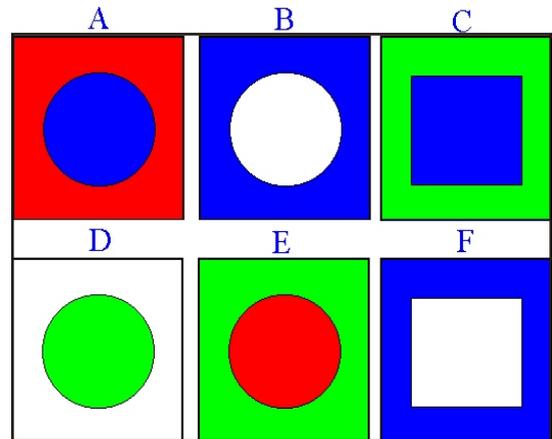
18 QUESTIONS
15 MINUTES

INSTRUCTION

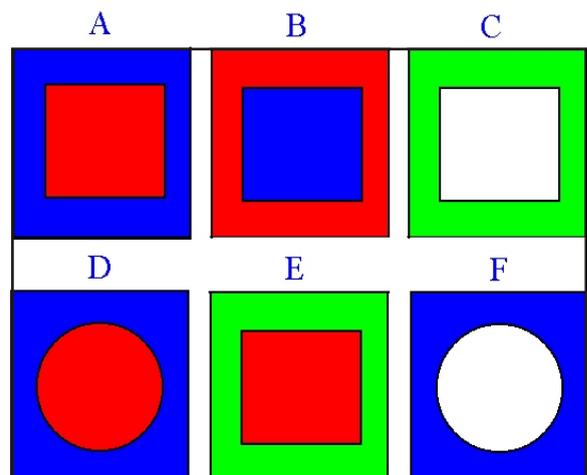
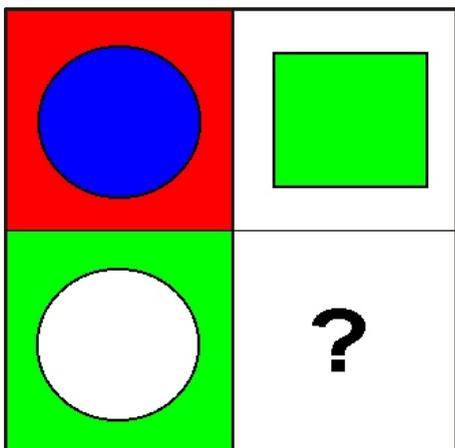
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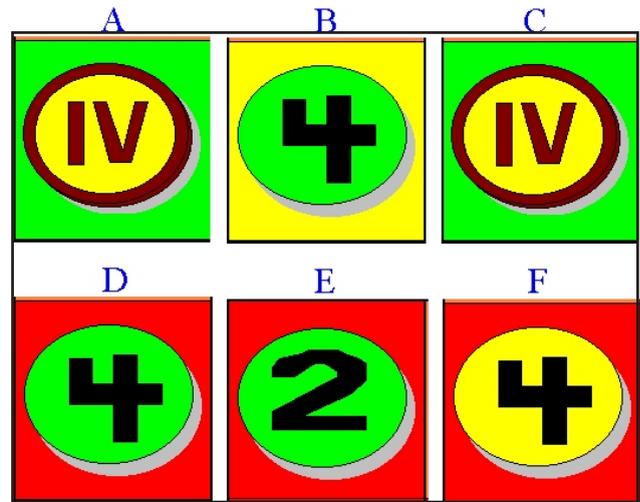
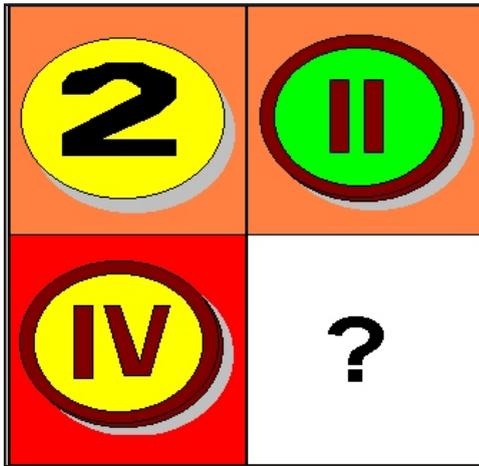
Solution of the example = "inversion in diagonals"



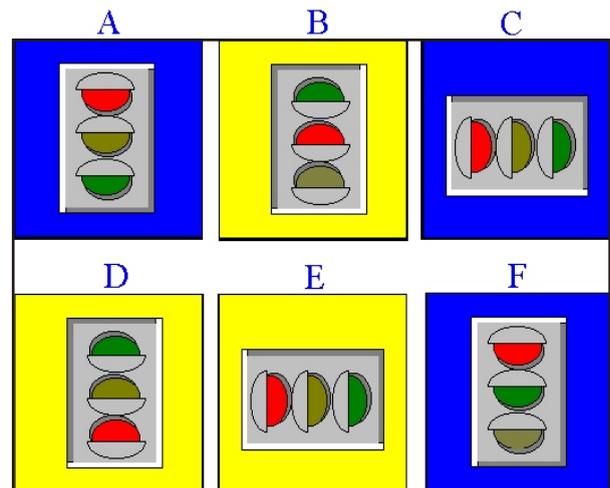
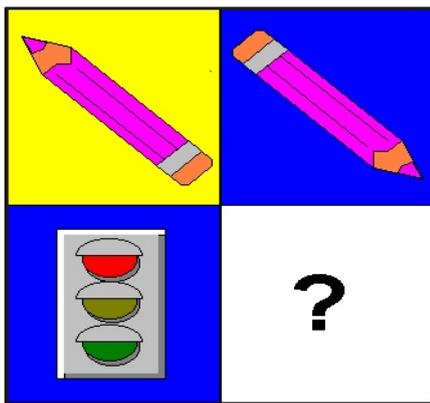
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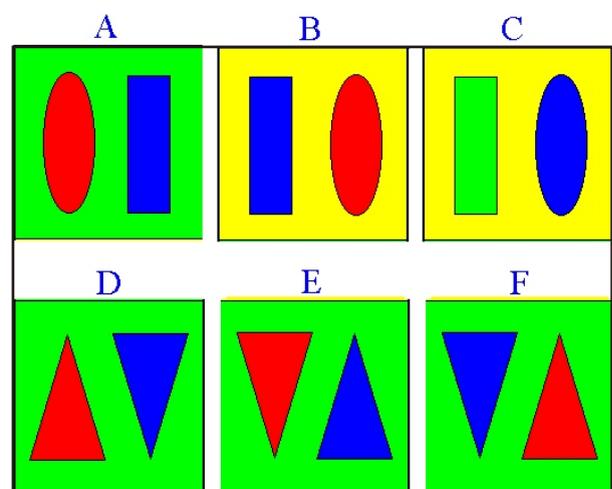
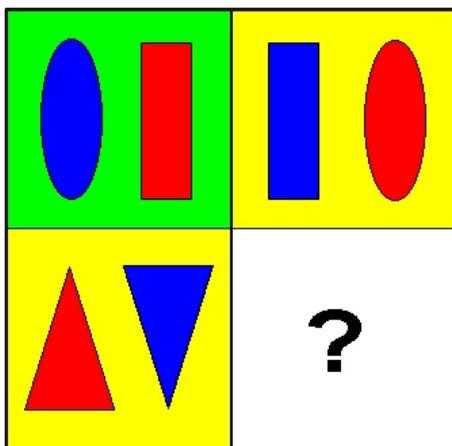
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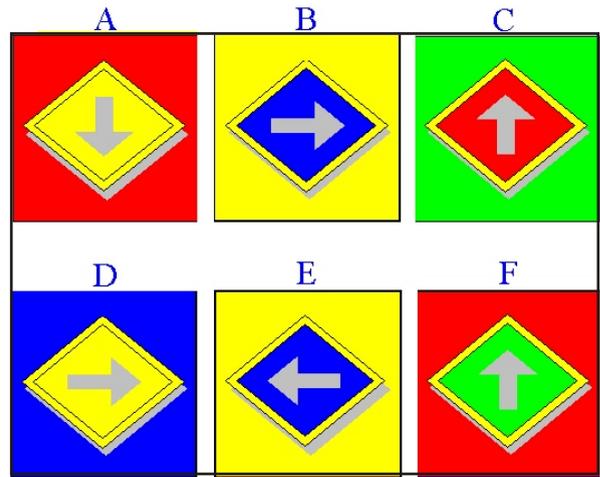
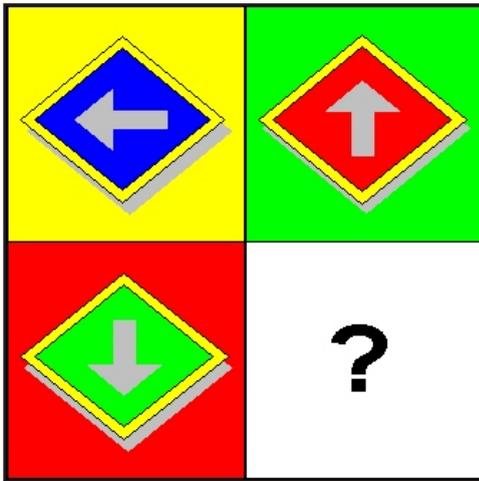
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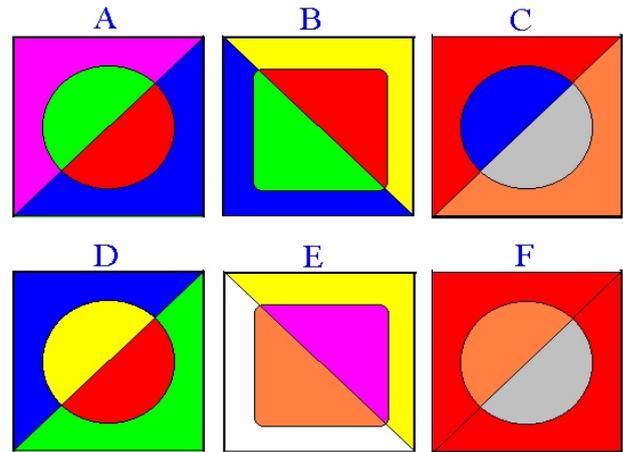
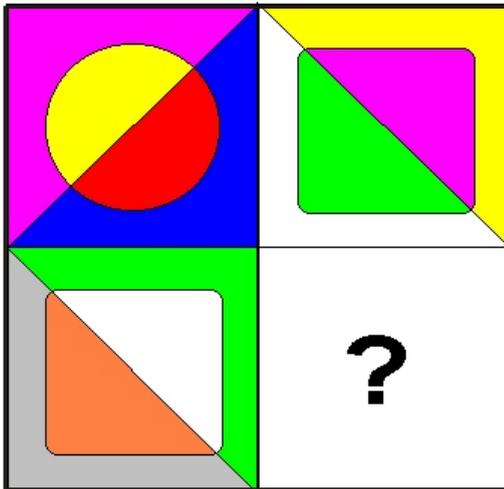
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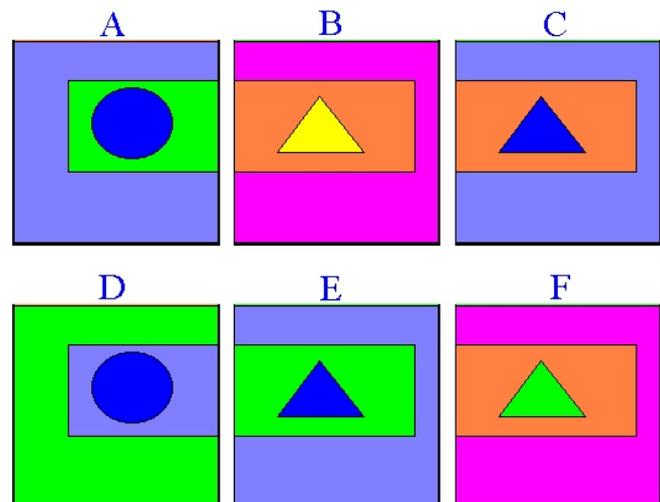
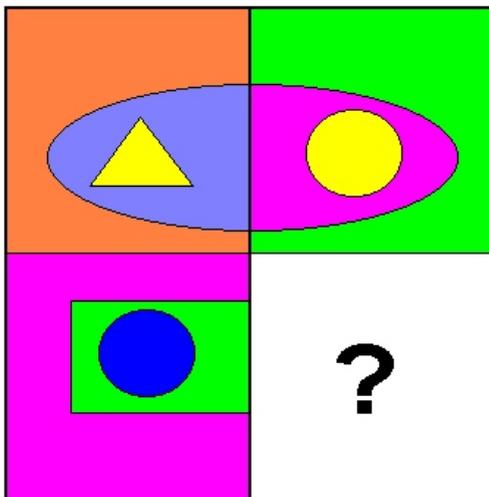
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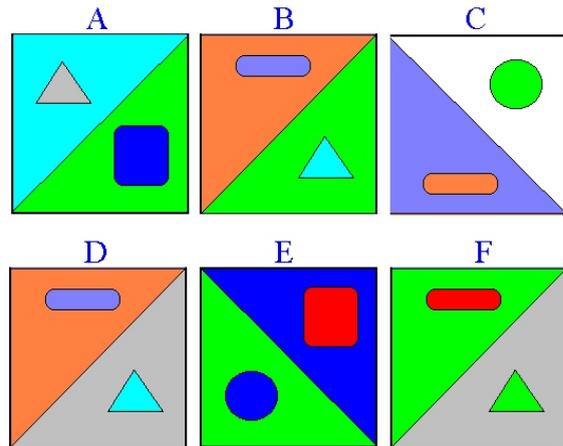
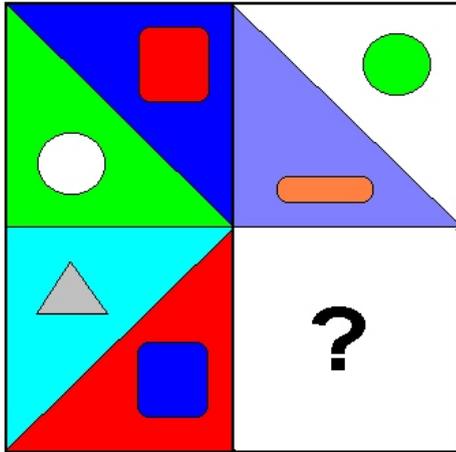
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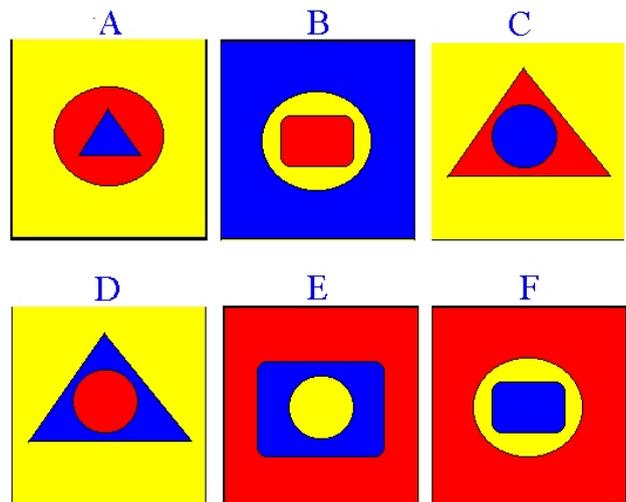
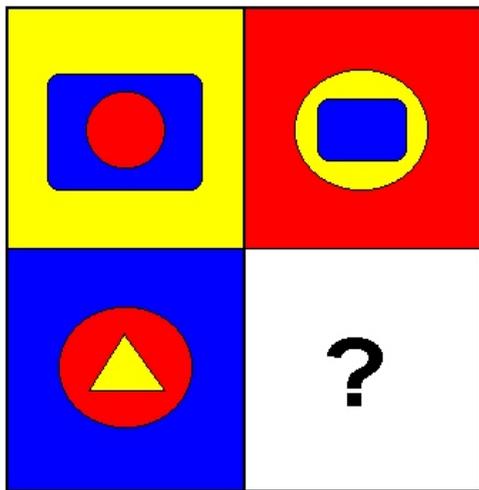
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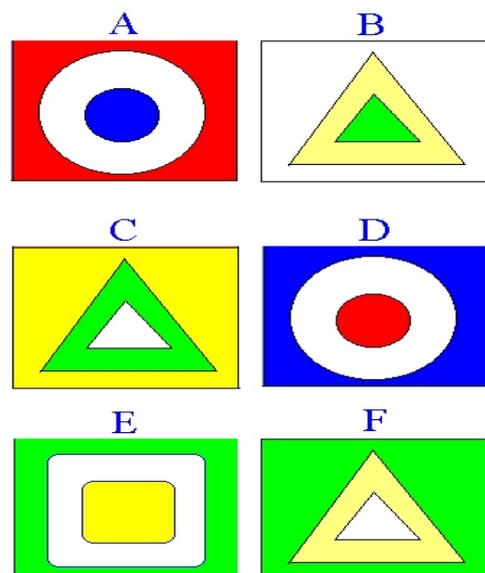
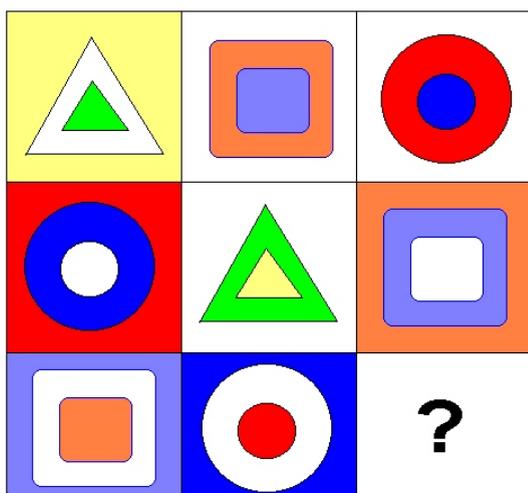
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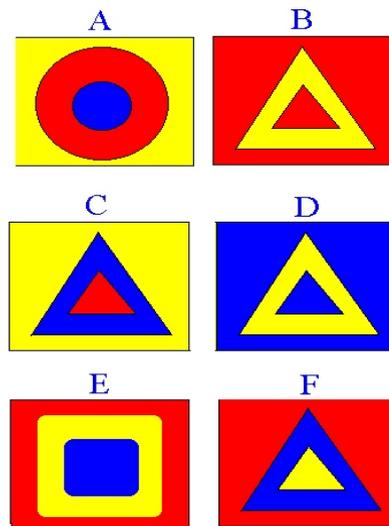
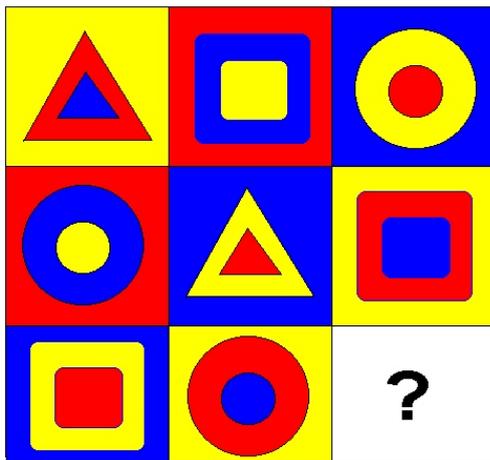
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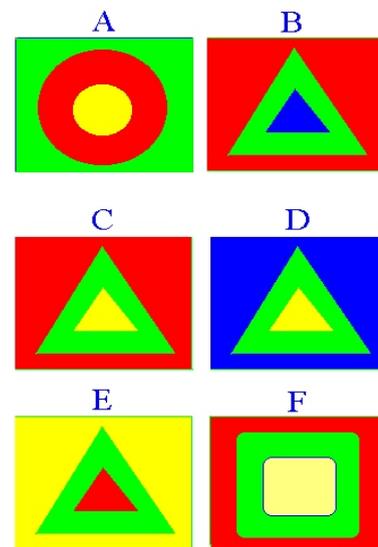
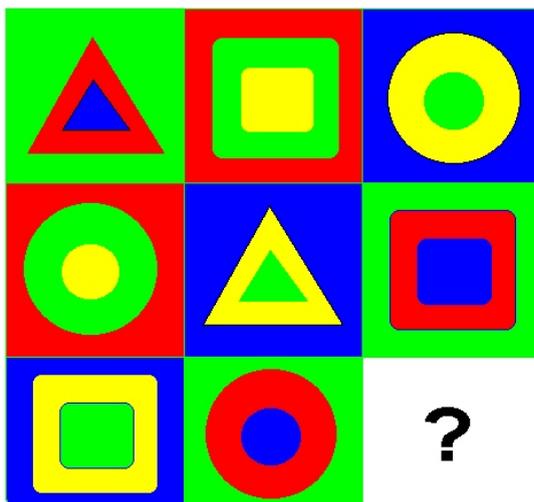
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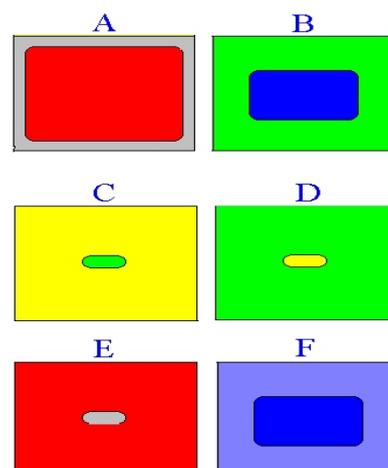
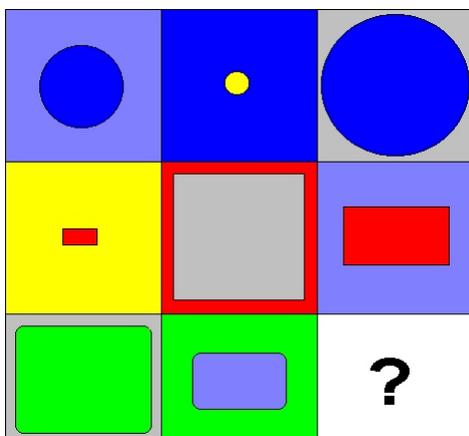
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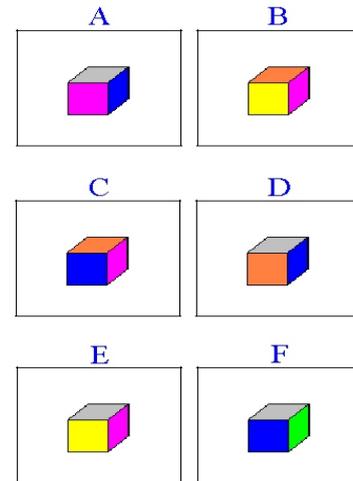
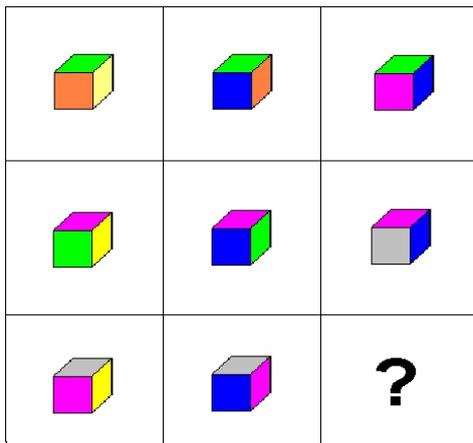
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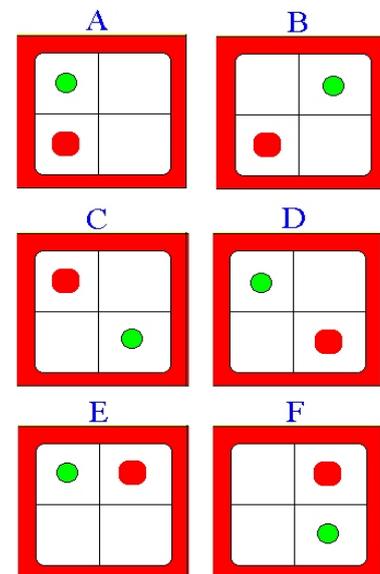
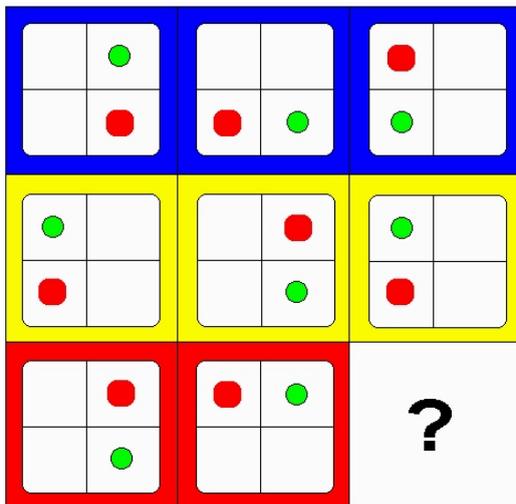
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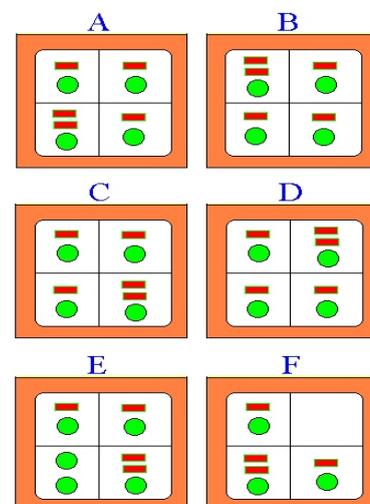
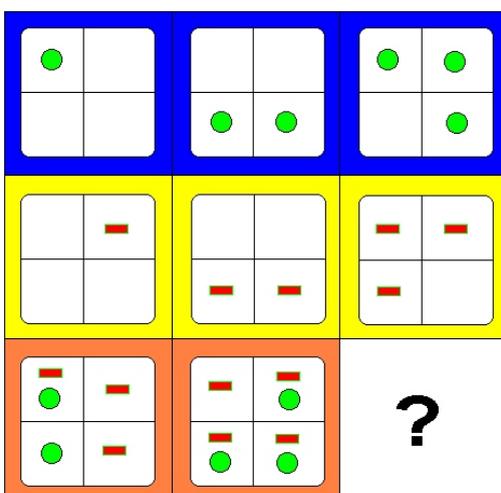
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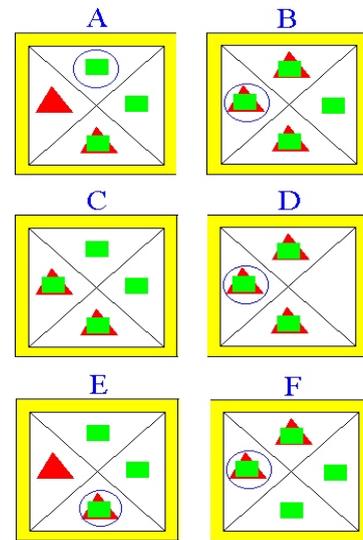
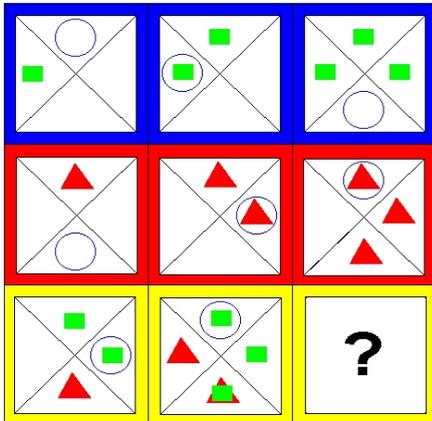
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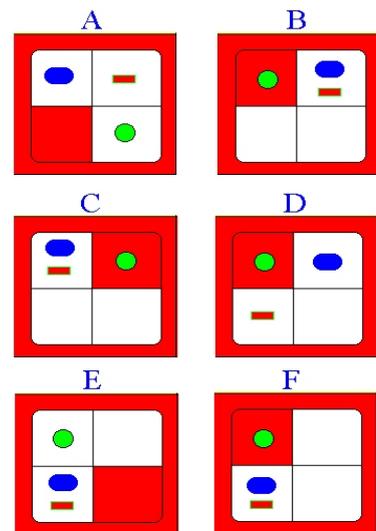
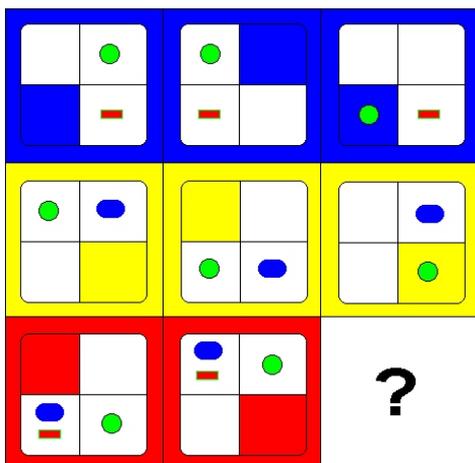
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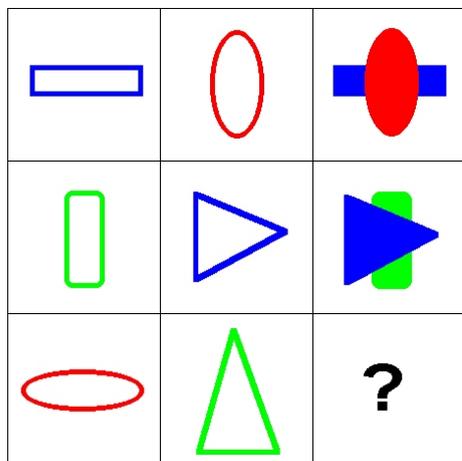
PATTERN SERIES TEST 2

23 QUESTIONS
15 MINUTES

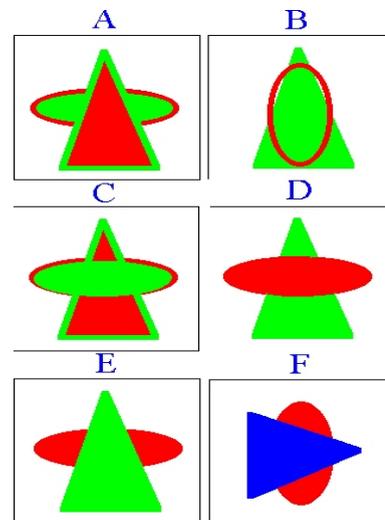
INSTRUCTION

This test intends to measure the extremely high- IQ!
IQ score up to 200!
We recommend you to do all the preceding tests before.

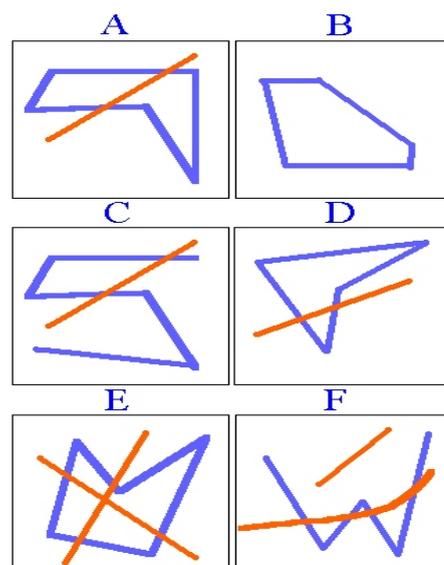
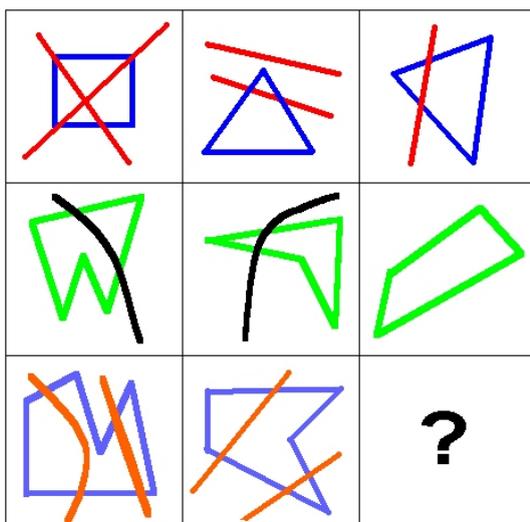
Example :



Solution **E**
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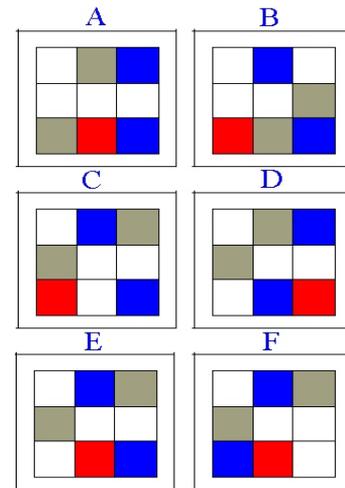
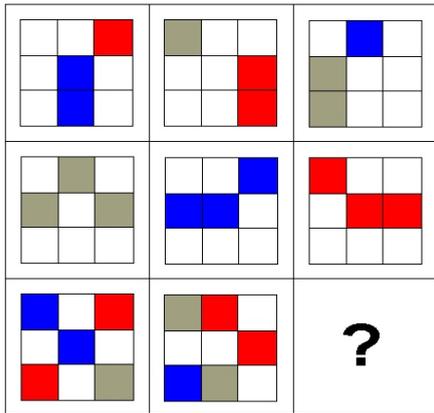


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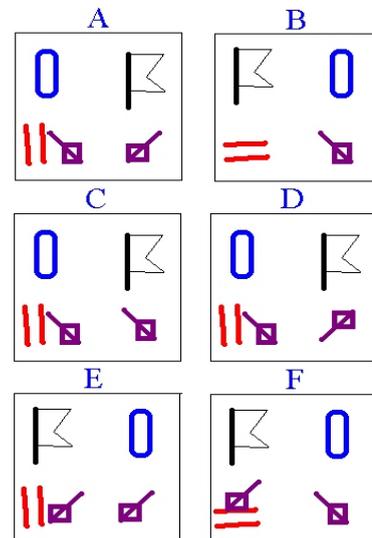
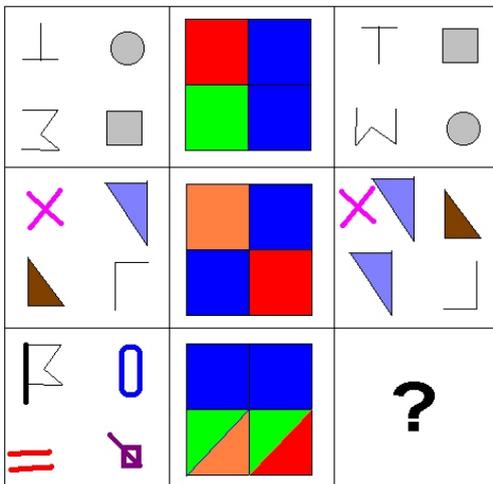


Example 2 ___ "Second column is first column minus one side. Third column is second column minus one line"

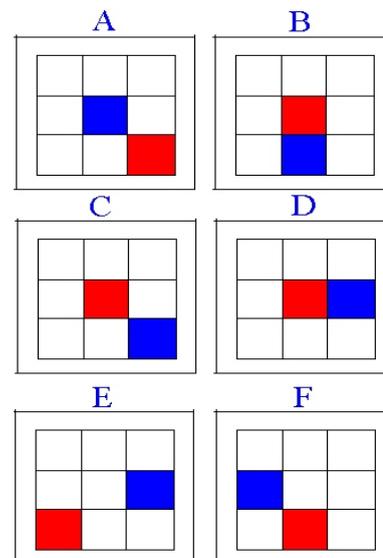
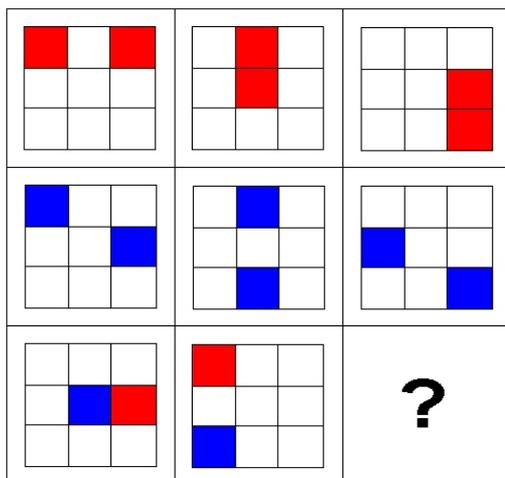
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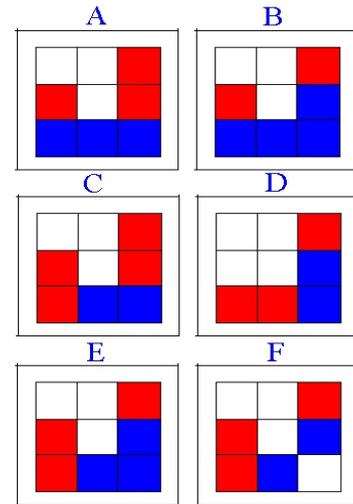
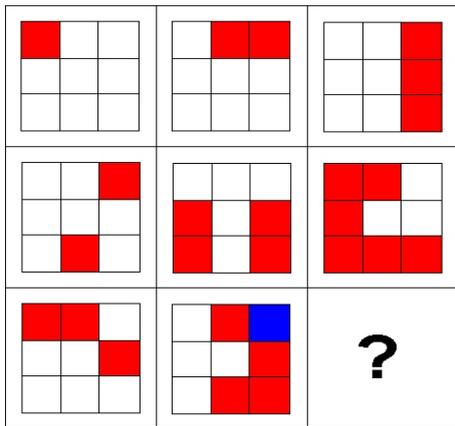
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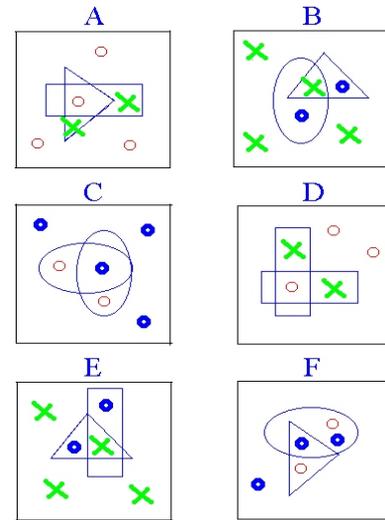
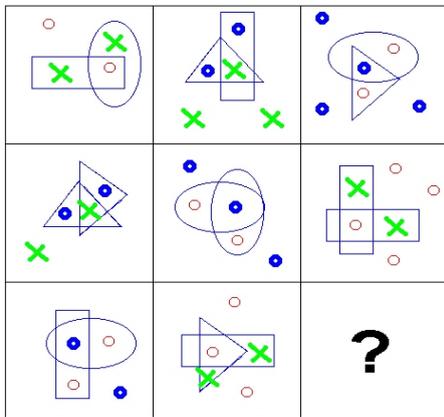
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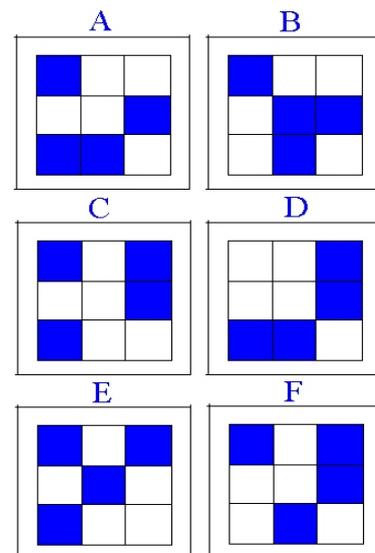
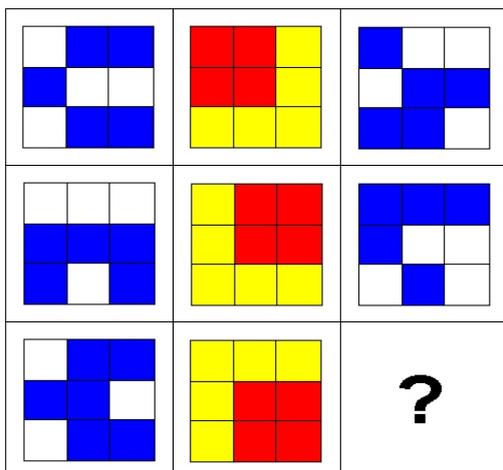
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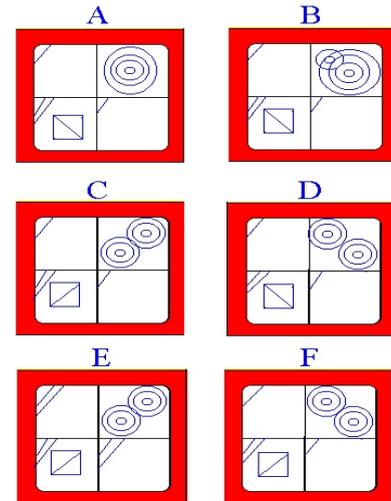
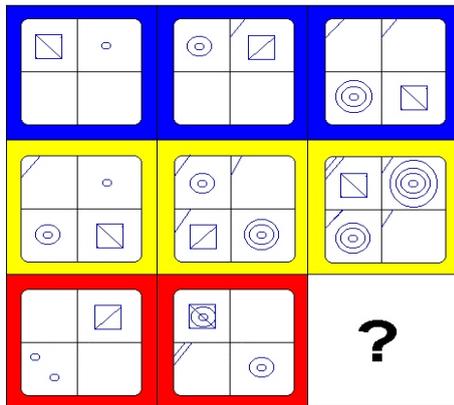
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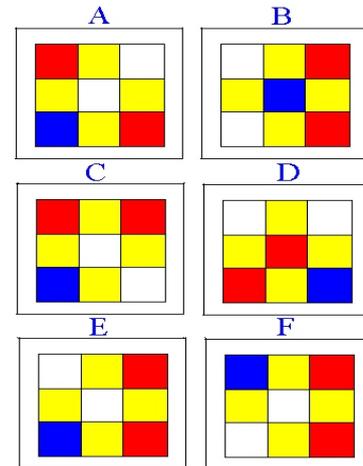
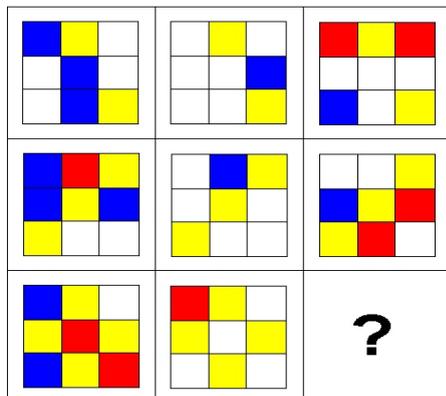
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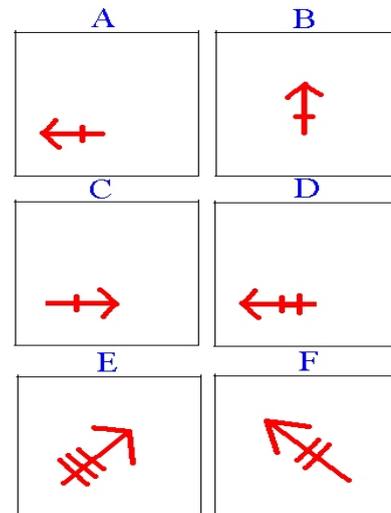
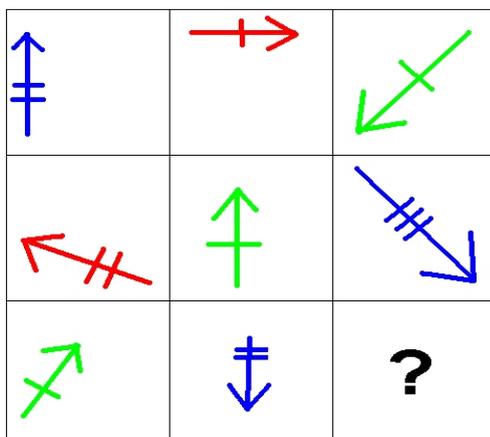
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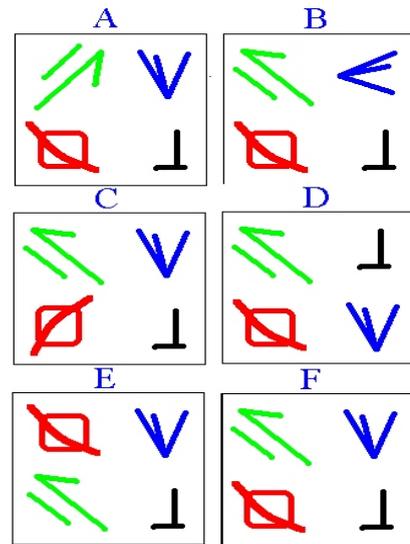
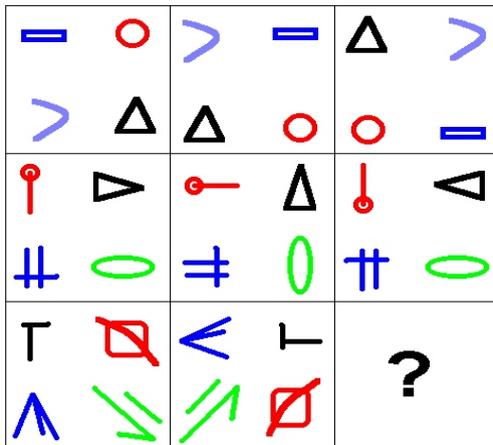
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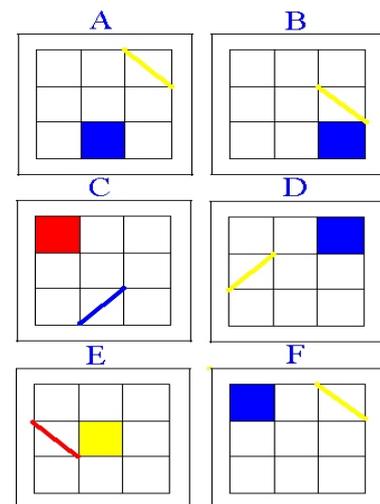
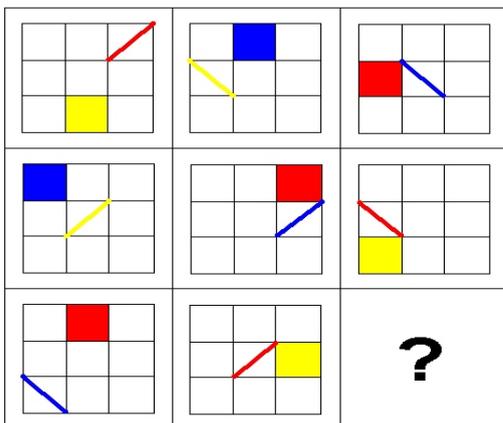
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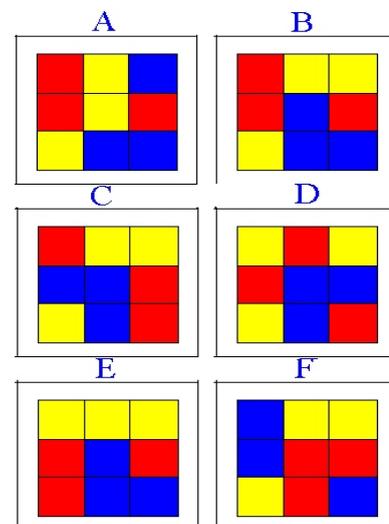
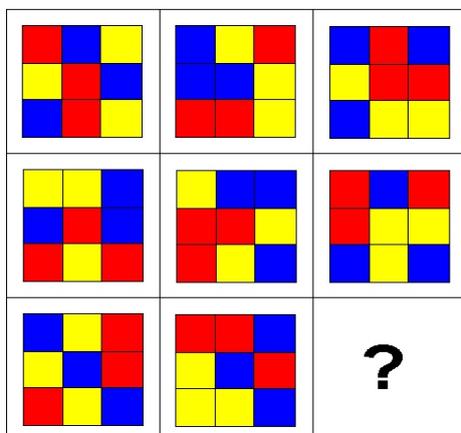
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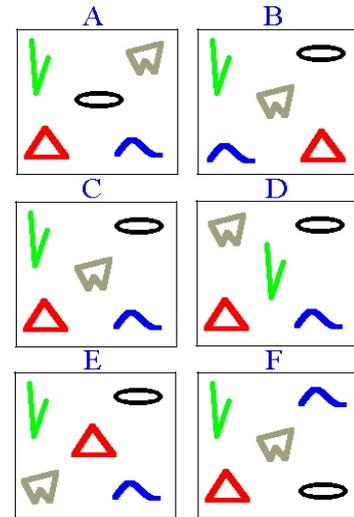
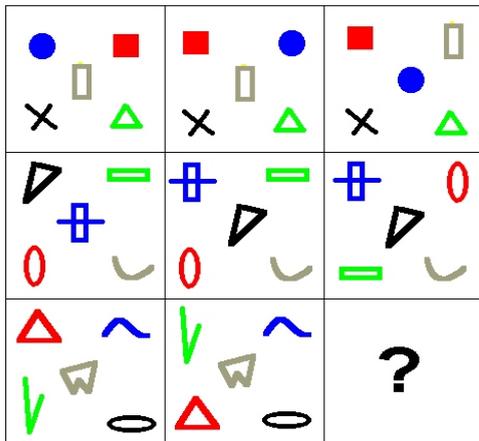
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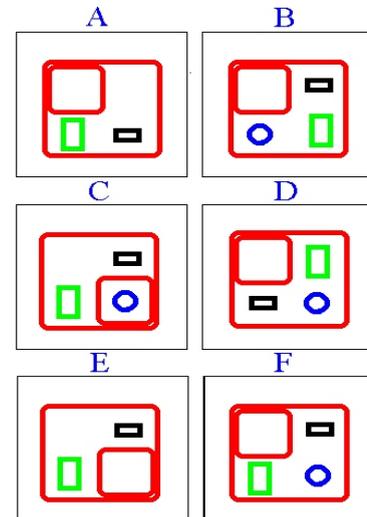
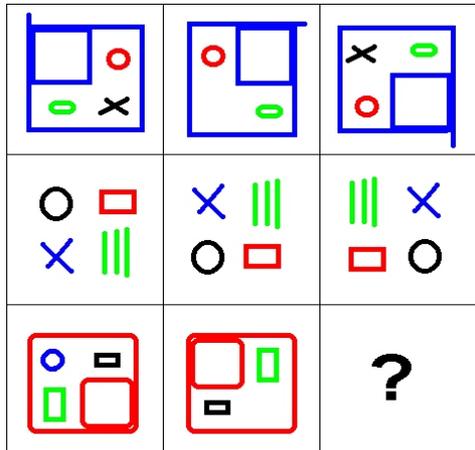
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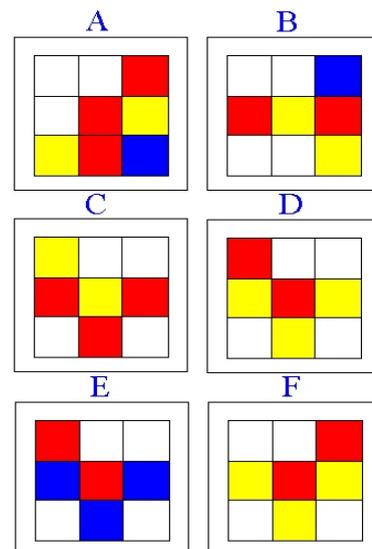
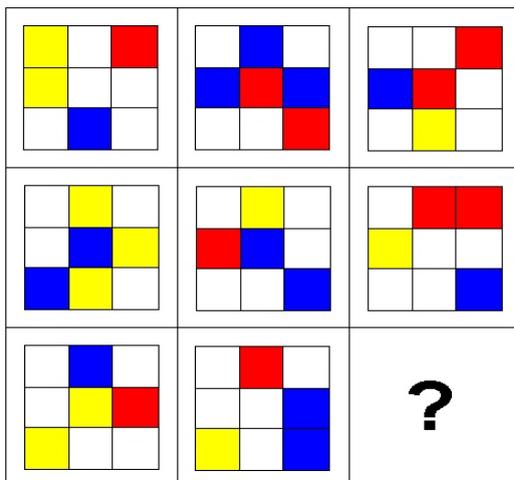
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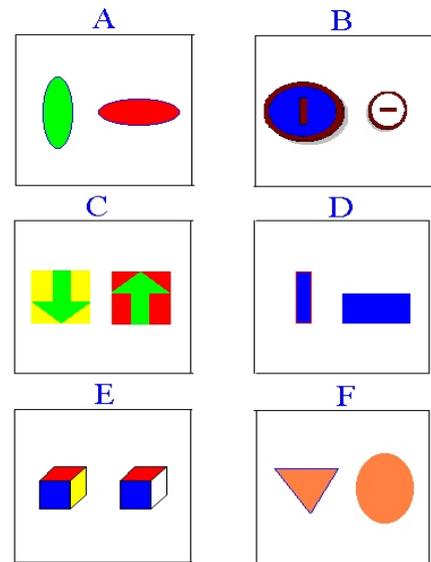
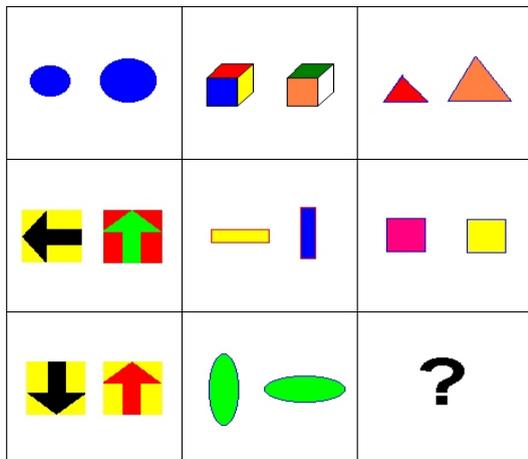
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22.



23.



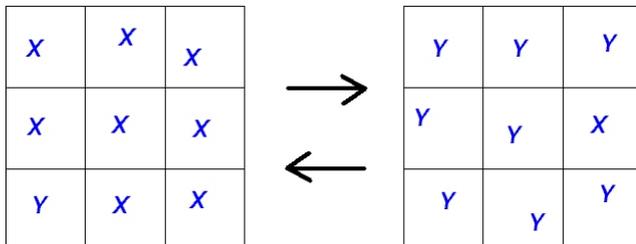
PATTERN SWITCHING TEST

20 QUESTIONS
15 MINUTES

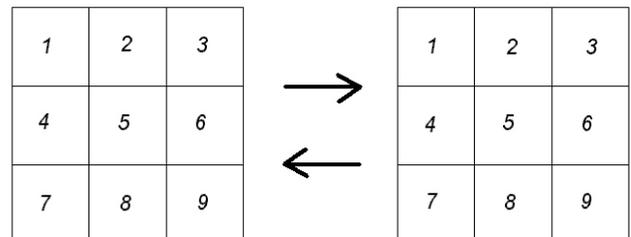
INSTRUCTION

In each item you can see two matrices. These two matrices were logically organised but someone has exchanged two squares....
You must indicate which pair of squares (one square a matrix) was permuted.

Example 1

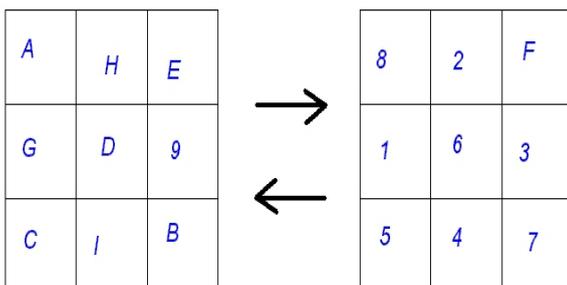


How to give your answer

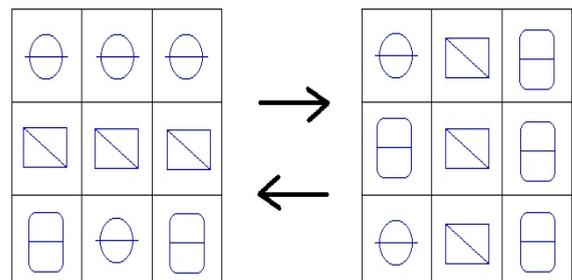


SOLUTION 76

Example 2

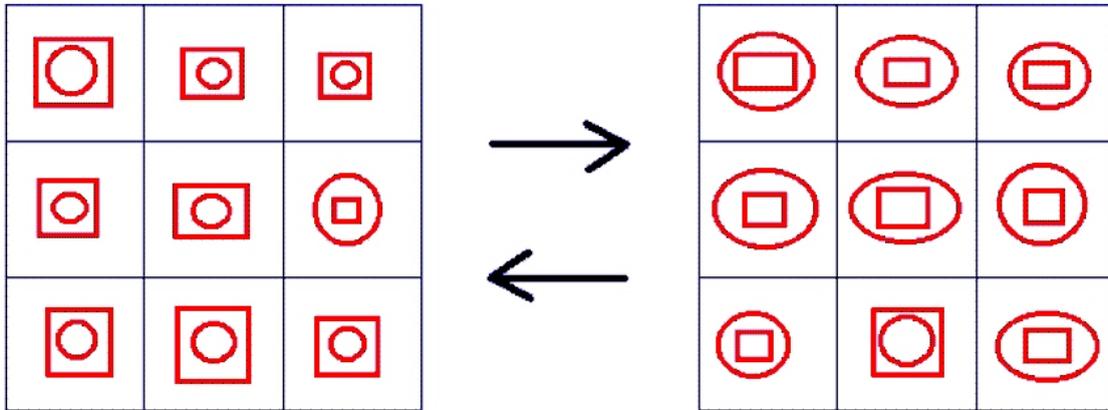


Example 3

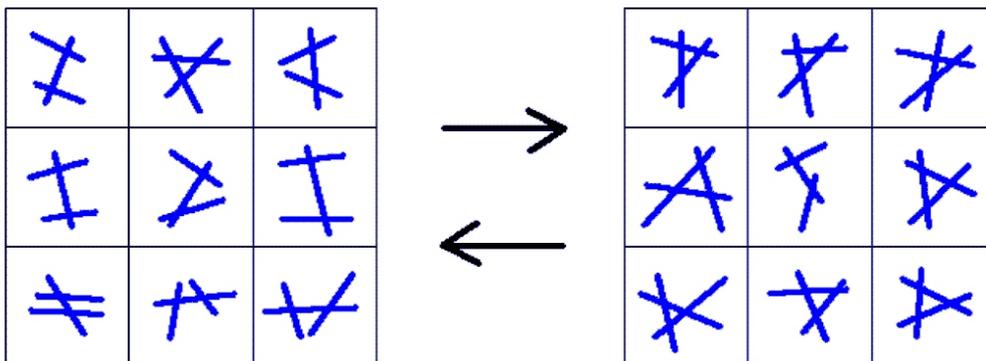


SOLUTION 63

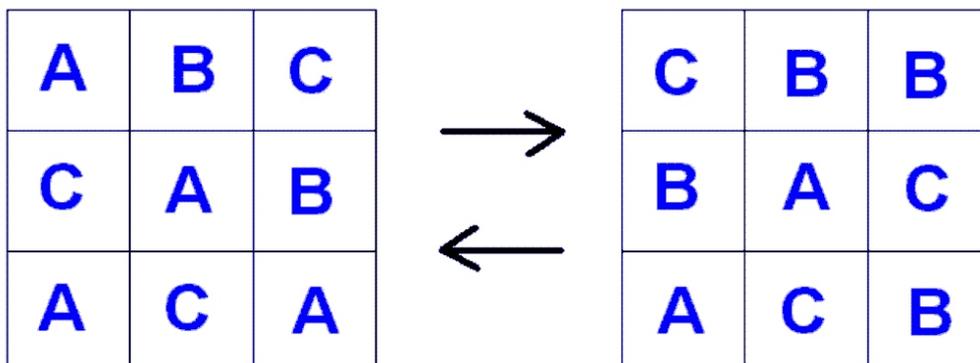
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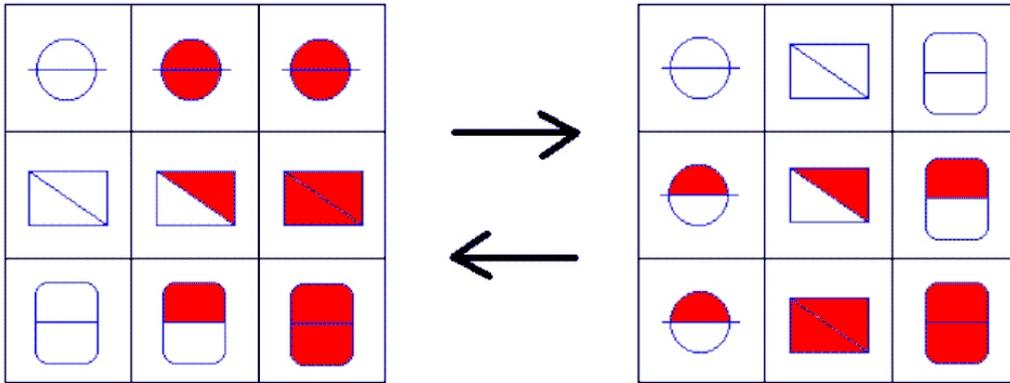
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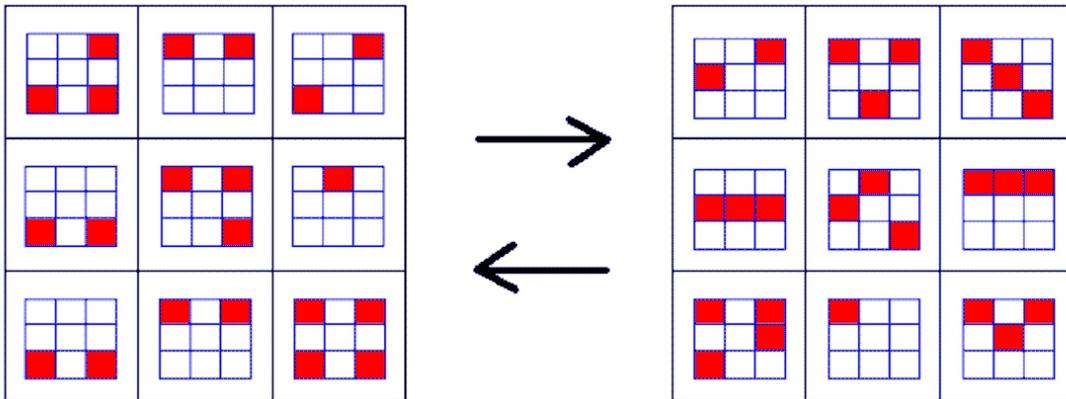
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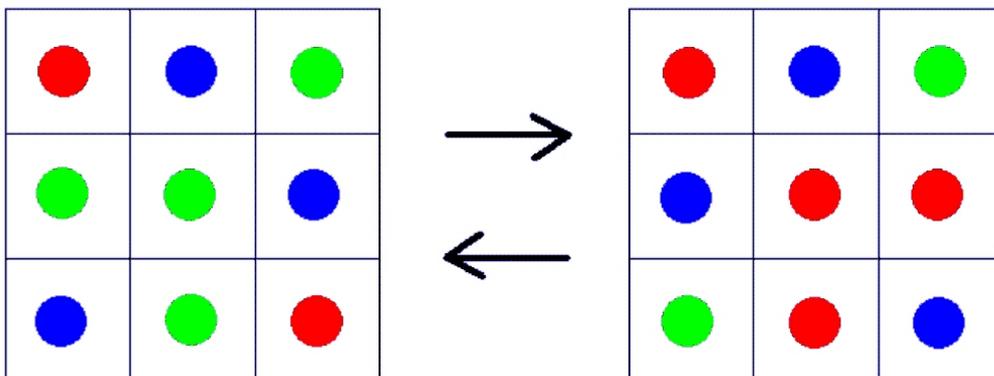
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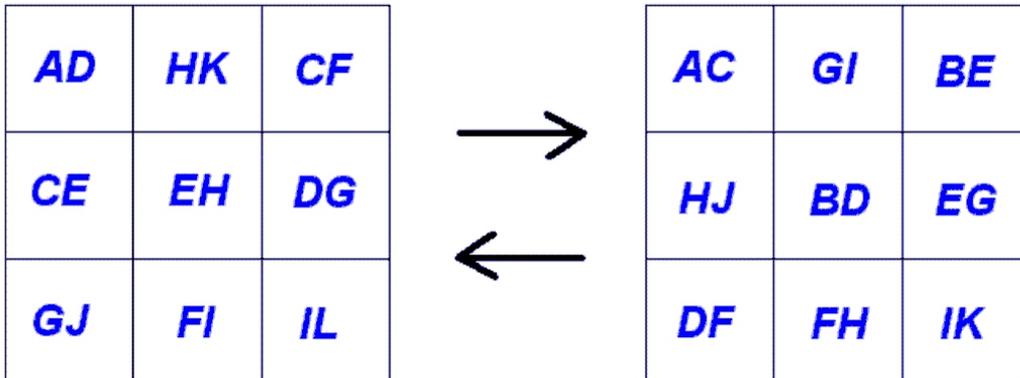
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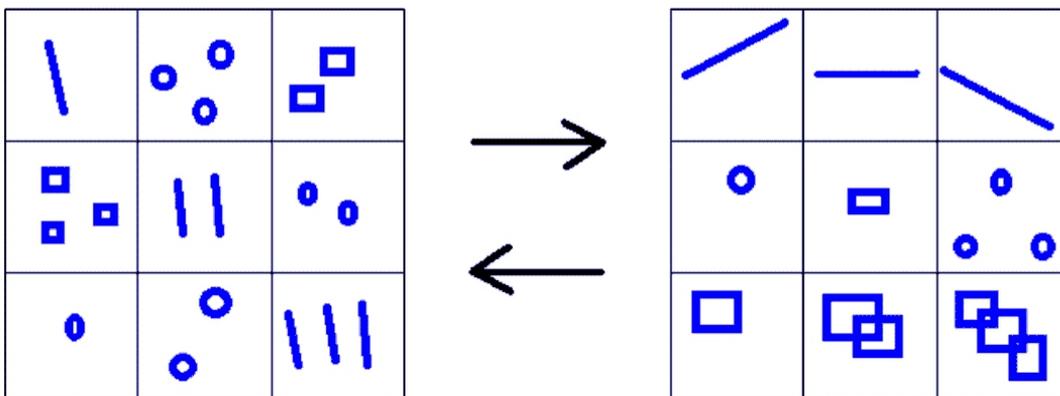
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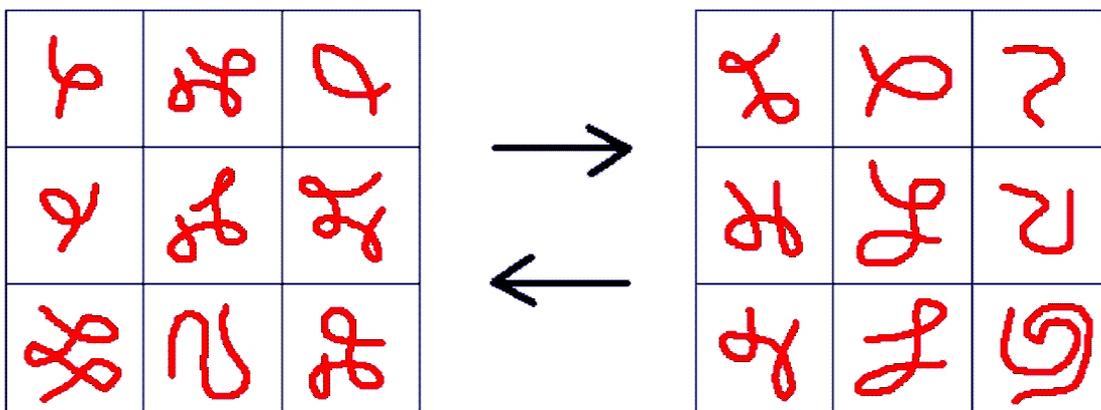
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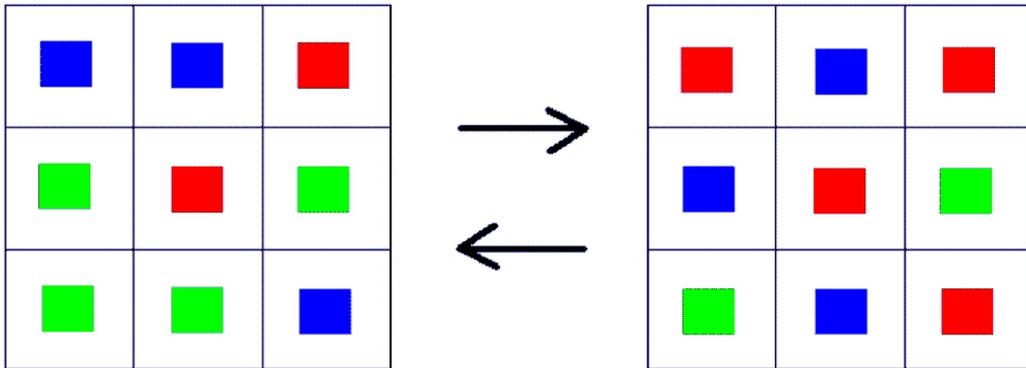
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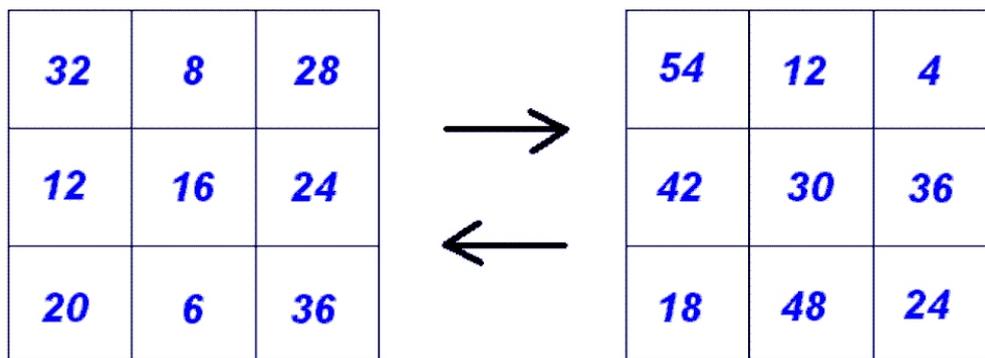
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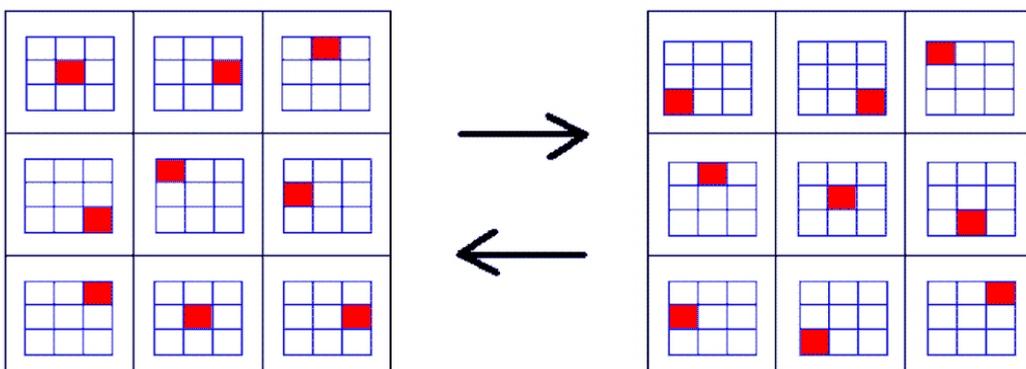
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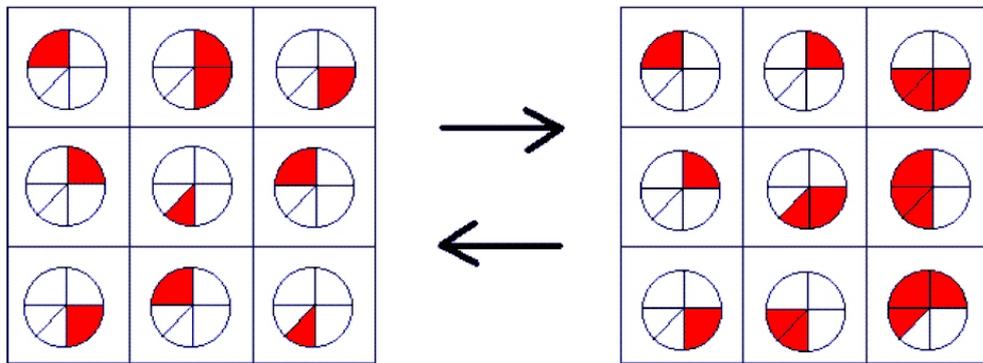
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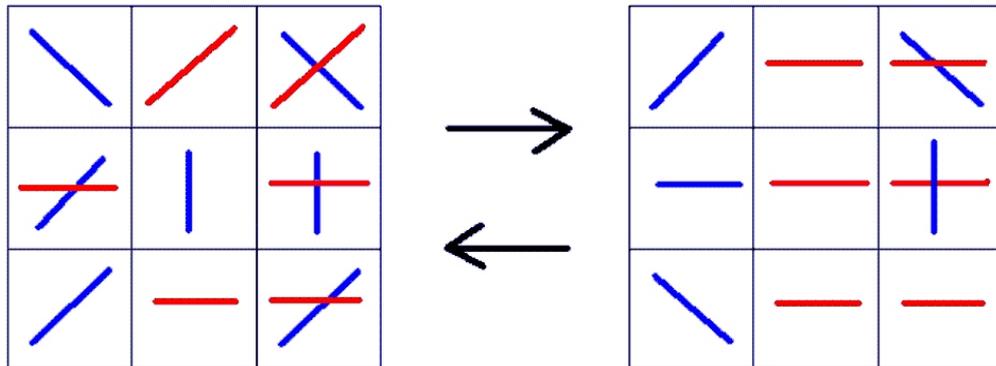
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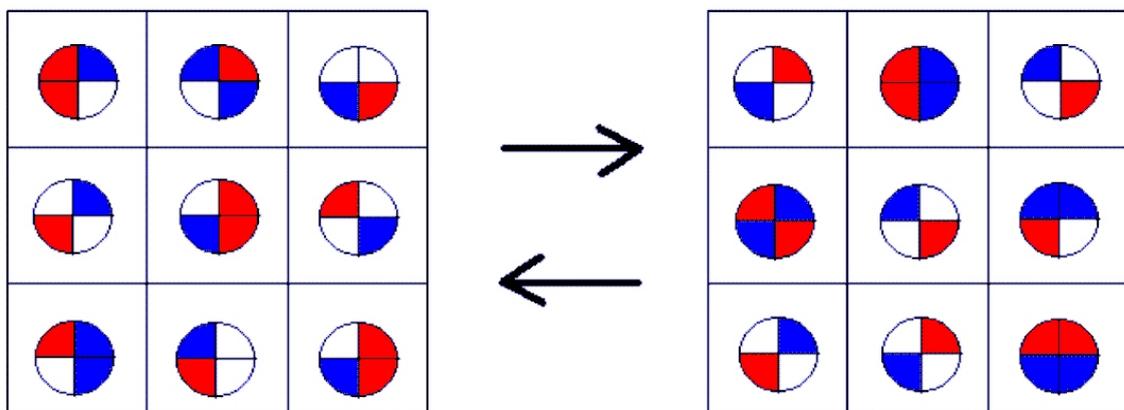
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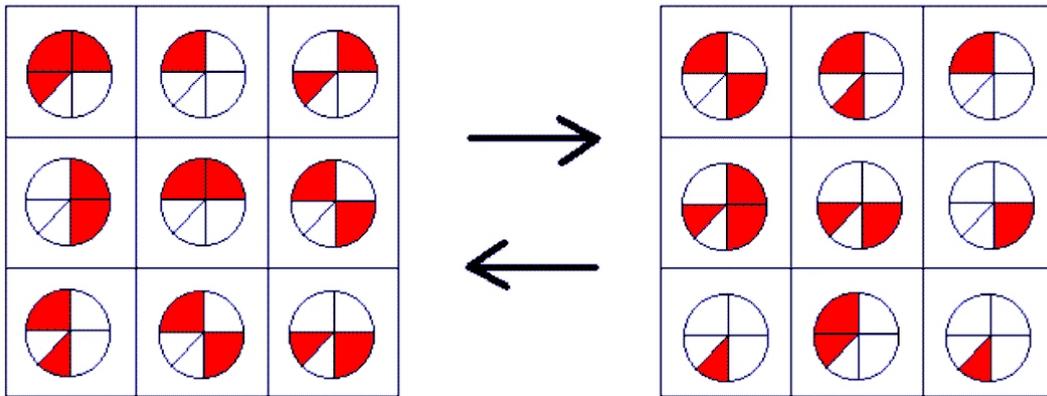
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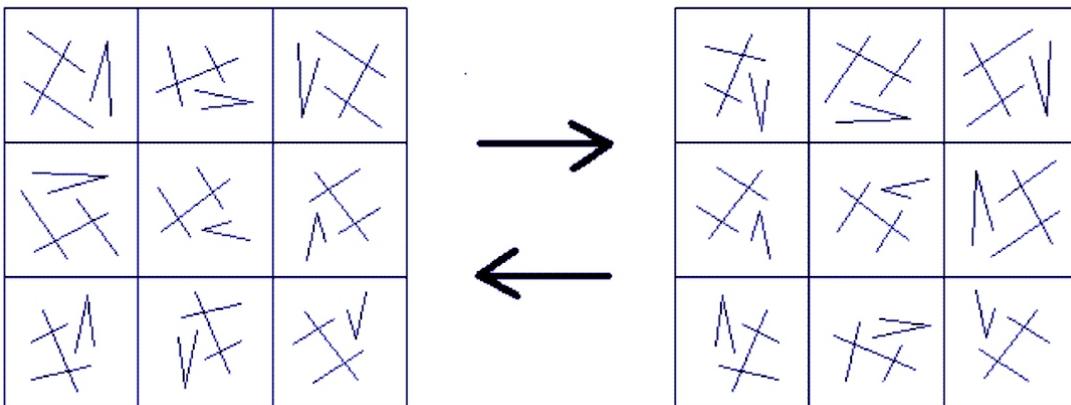
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19.



20.

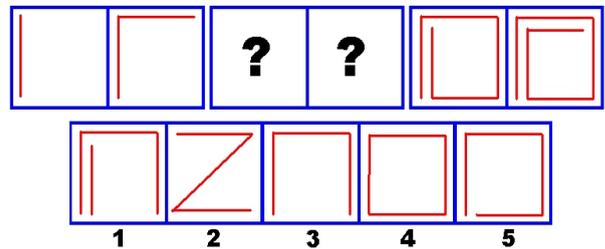
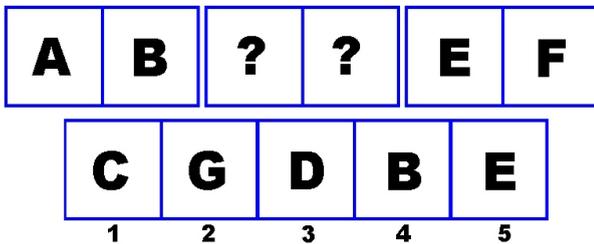
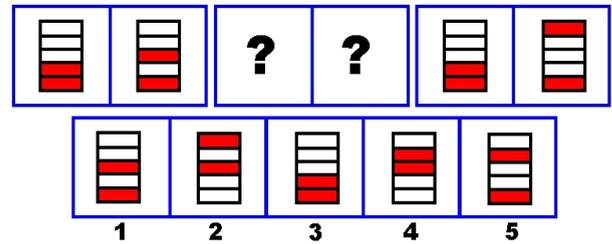
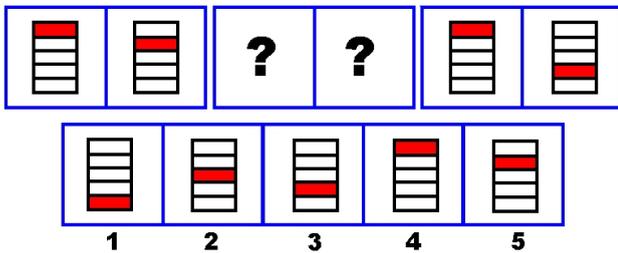
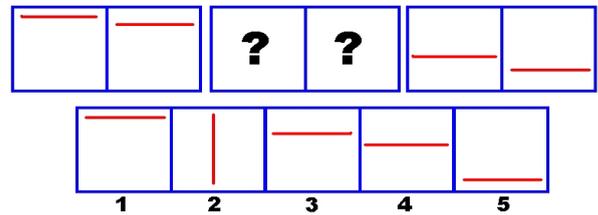
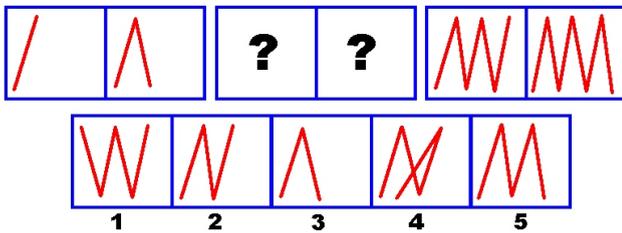


ANALYTIC TEST

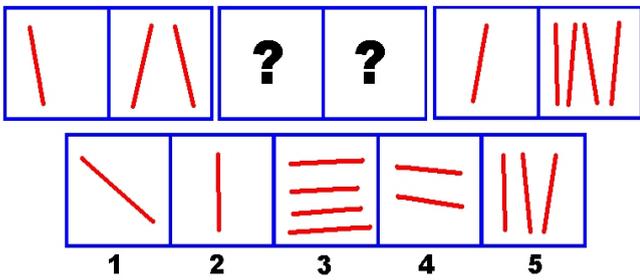
20 QUESTIONS
15 MINUTES

INSTRUCTION

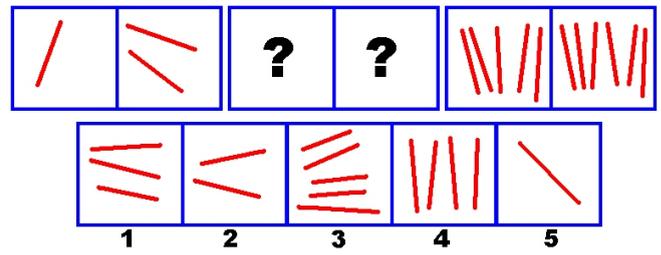
This test intends to measure your partial IQ.
You have only 30 minutes, the maximum score is 170.



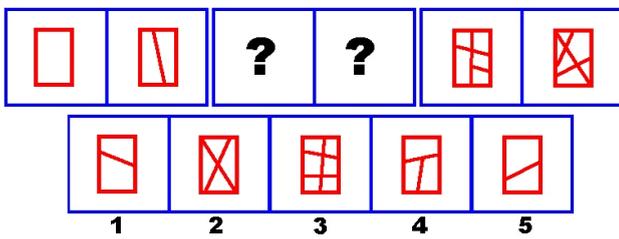
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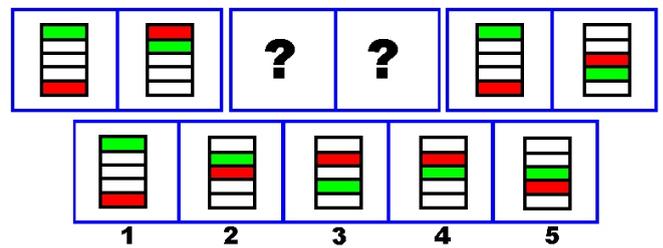
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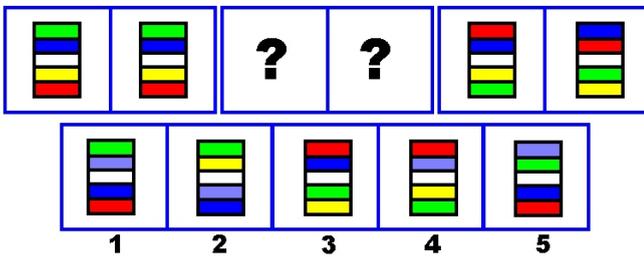
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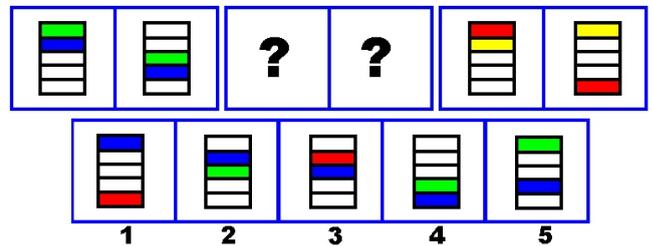
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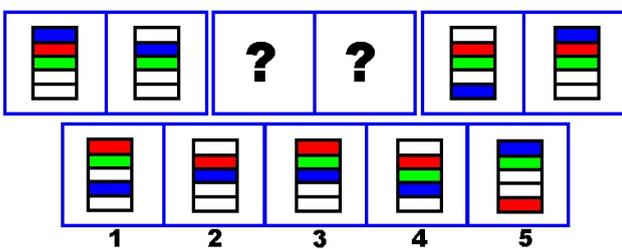
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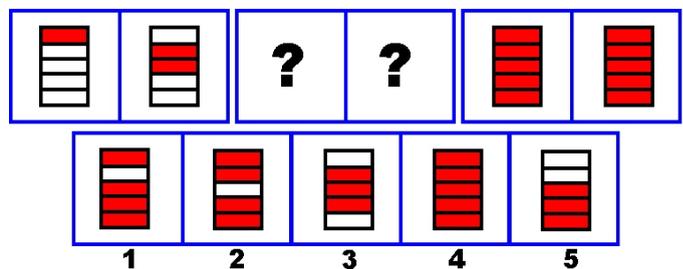
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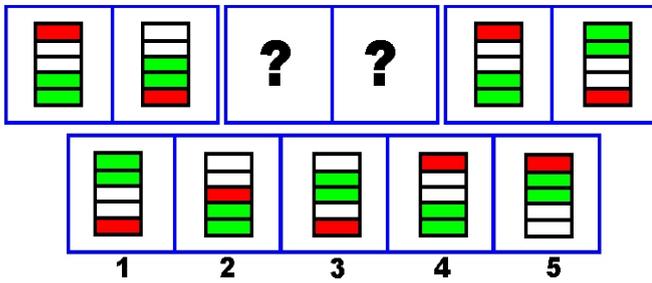
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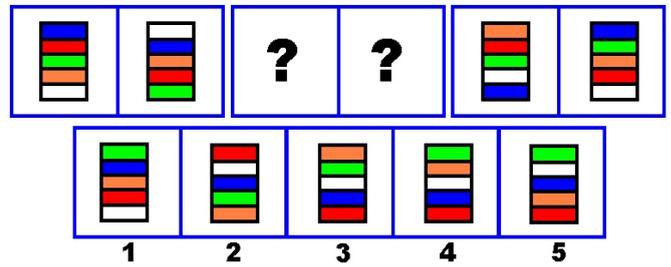
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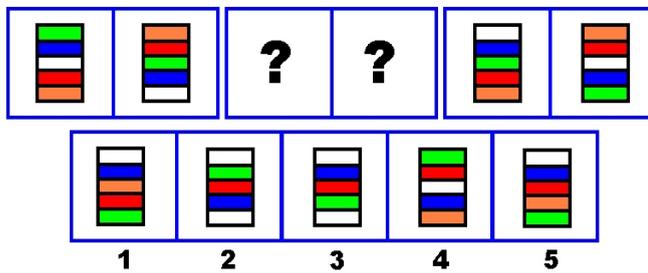
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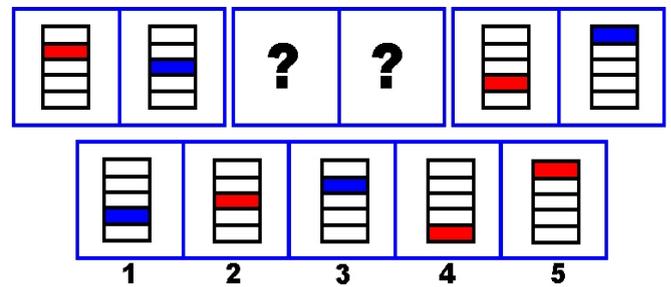
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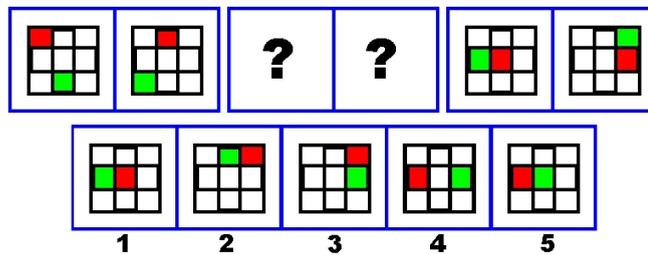
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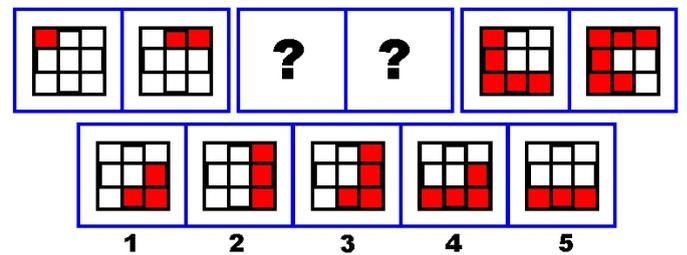
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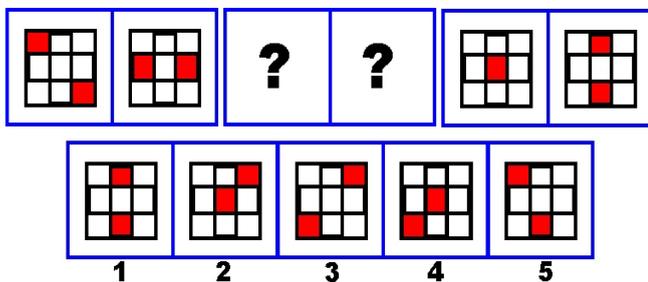
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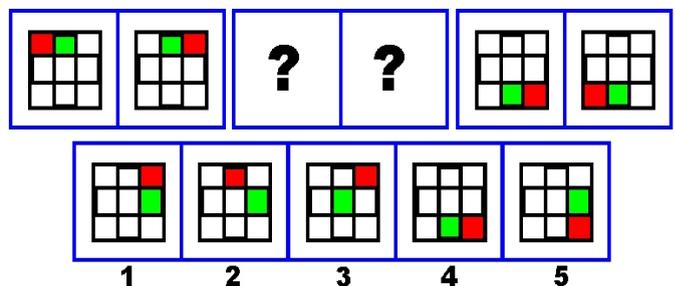
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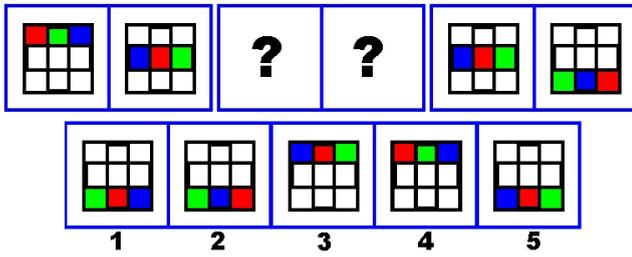
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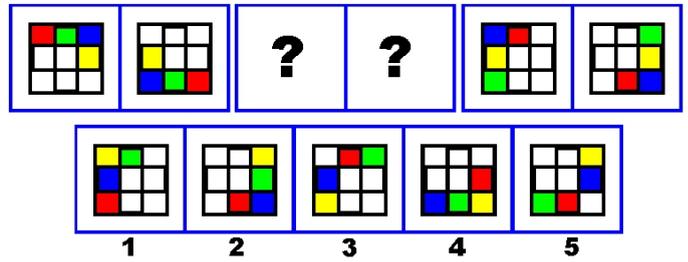
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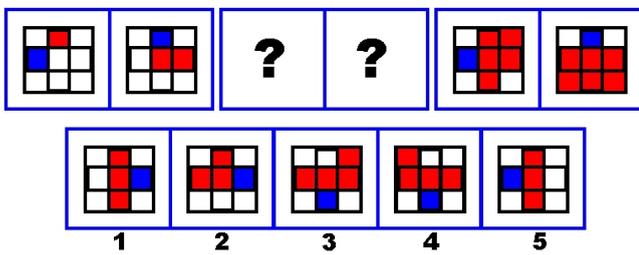
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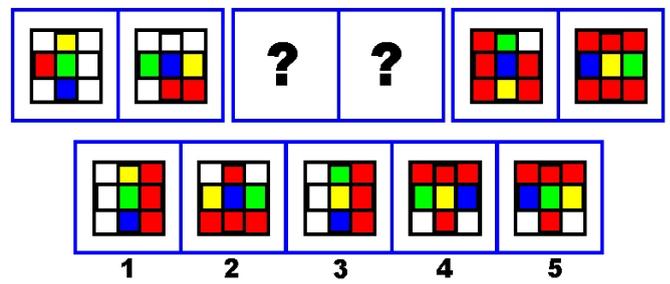
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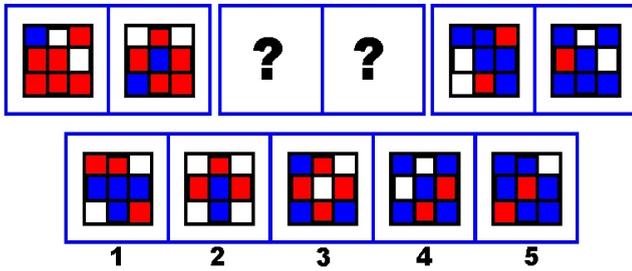
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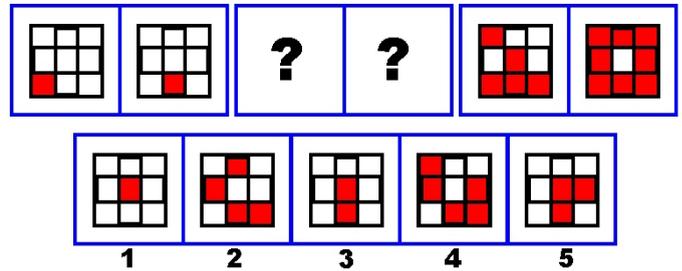
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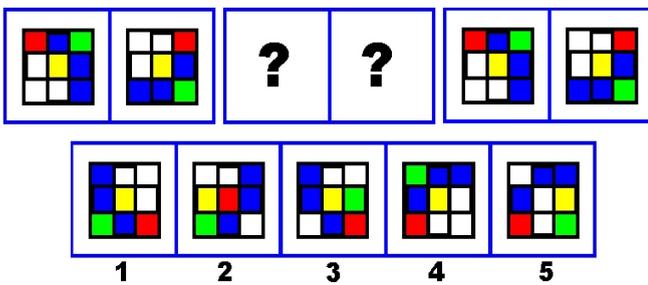
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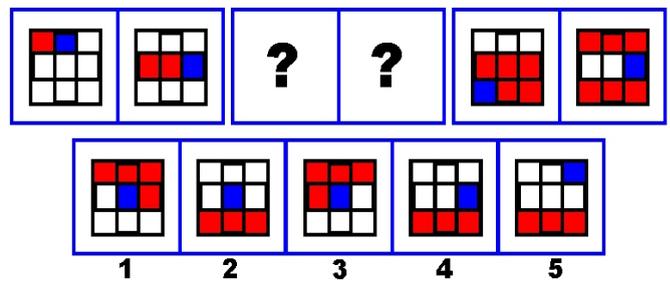
24.



25.



26.



27.

Question 27: A sequence of 3x3 grids. The first two grids show a pattern of colored squares (red, blue, white). The next two are question marks. The last two grids show the pattern continuing. Below are five options labeled 1 to 5.

28.

Question 28: A sequence of 3x3 grids. The first two grids show a pattern of colored squares (red, blue, white). The next two are question marks. The last two grids show the pattern continuing. Below are five options labeled 1 to 5.

29.

Question 29: A sequence of 3x3 grids. The first two grids show a pattern of colored squares (yellow, red, blue, white). The next two are question marks. The last two grids show the pattern continuing. Below are five options labeled 1 to 5.

30.

Question 30: A sequence of 3x3 grids. The first two grids show a pattern of colored squares (red, blue, white). The next two are question marks. The last two grids show the pattern continuing. Below are five options labeled 1 to 5.

PETROLEUM TECHNOLOGY TEST

OIL AND GAS RESERVOIRS

1. What are the three classification used to describe the methods of recovering fluids from oil and reservoirs.

2. Water drive reservoirs has its source- of energy for producing oil during primary recovery coming from?

3. What is the expected oil recovery for a water drive reservoir? _____
4. What are the main types of drive mechanisms in primary recovery?
5. The injection of fluid such as water and gas to displace the oil is called. _____
6. _____ Methods are used to recover residual oil left behind by increasing the volume of the reservoir contacted.
7. The categories found in tertiary recoveries are? _____
8. Chemicals are used to enhance recovery by improving the _____
9. Gas recovery efficiency are in excess of _____
10. Reserves is defined as the amount of oil in a reservoir and are classified as 3ps, which are _____
11. What are the two methods of estimating reserves. _____
12. An entrapment that contains the fluid (oil, gas and water) which is porous and permeable is called. _____
13. The first well you drill is called _____
14. Parameter observed in oil and gas reservoir are _____
15. Given these data of petroleum sample from Abuja field with the following PVT properties. _____
Temperature = 210^of
Pressure = 4470 Psz
Oil gravity = 25API
Gas gravity = 0.70
Producing Gas oil ratio = $\frac{0.64 \text{ msef}}{\text{STB}}$

Determine

- i. Oil formation volume fraction Resbbl/STB
 - ii. Gas formation volume fraction
 - iii. Water formation volume fraction
 - iv. Solution Gas oil ratio (mscf/STB)
 - v. Oil Viscosity, (cp)
 - vi. Water viscosity (cp)
 - vii. Gas viscosity
 - xiii. Bubble point pressure (psia)
 - xi. Under saturated oil compressibility (ps^{-2})
 - x. Under saturated water compressibility (ps^{-2})
16. Reservoir Engineering is what? _____
17. Oil pore volume of reservoir = 300 mmcuft
Solubility of gas in crude = 0.42scf/STB
Initial bottom hole pressure p = 3500 psia
Initial bottom hole temperature T = 105^of
Saturation pressure of the reservoir = 2400 psia
Formation volume factor @ 3500psia and 105^of = 1.33bbl/stb.

Determine

- A. The initial STB of oil the reservoir
 - B. The initial scf of gas in reservoir
 - C. The scf of gas remaining in the reservoir at 1500psia
 - D. Total reservoir gas oil ratio (GOR) at 1500 psia.
18. How would you identify a reservoir with strong water drive? _____
19. In the derivation fo MBE (material balance equation) what are _____
- (A) underlying assumptions
 - (B) respective drive parameters
 - (C) limitations and uses

ANSWER KEY**Oil & Gas Reservoirs**

1. Primary Recovery
2. Water influx
3. 35 to 75% of original oil in place
4. Waterdrive, Gas cap drive, solution gas drive, and combination drive.
5. Secondary Recovery
6. Tertiary recovery
7. A. Miscible fluid displacement e.g Alcohol H₂O, CO₂ + oil
B. Thermal recovery e.g injecting H₂O or steam
C. Chemical recovery e.g polymers and surfactants
8. Sweep efficiency
9. 80%
10. Proved, probable, possible
11. Volumetric or material balance
12. Reservoir
13. Exploration well or wildcat well
14. Bubble point pressure, Dew point pressure critical point pressure, concondensation, concondensation bar.
15. Solution:
Bo = oil formation volume and by standing correlation .

$$B_o = 0.972 + 0.000147T^{1.175}$$

at To 210°F = 650°R

$$\therefore B_o = 0.972 + 0.000147 (650)^{1.175}$$
$$= 1.26 \text{ res bbl/STB}$$

(ii) Bg = Gas formation volume factor resbbl/mscf

$$\text{Where } B_g = 0.02829 \frac{ZT}{P} \frac{\text{cuft}}{\text{scf}} \times$$

OR

$$B_g = 0.00504 \frac{ZT}{P} \text{ resbbl}^{3/4} \text{ xx}$$

Since Z = compressibility factor is a function of reduced temperature at reduced pressure

$$Z = f(T_r, P_r)$$

and by Hankinson and Phillip correlation.

$$P_c = 709.604 - 58.718 r_g$$

$$T_c = 170.491 + 307.344 r_g$$

When r_g = gas specific gravity

P_c = Critical pressure in psi

T_c = Critical Temperature in rankine^oR

$$r_g = 0.1$$

$$P_c = 668.5$$

$$T_c = 385.6$$

$$T_r = \frac{T}{T_c}$$

$$\& \quad P_r = \frac{P}{P_c}$$

$$\frac{210 + 460}{385.6}$$

$$= \frac{4470}{668.5}$$

$$T_r = 1.74$$

$$P_r = 6.68$$

Since $Z = f(T_r, P_r)$

and $Z = f(1.74, 6.68)$

and from chart. Given and read

$$Z = 0.95$$

Substituting into equation xx

$$B_g = \frac{0.00504(0.95)(670)}{4470}$$

$$= 0.0007176 \text{ resbbl/Scf}$$

$$m = 1000$$

$$= 0.7176 \text{ resbbl/Mscf}$$

(iii) Water formation volume factor resbbl/scf

$$B_w = -1.485 \times 10^{-5} p + 0.952 \times 10^A$$

Where B_w = water formation volume fraction

P = pressure

$$T = 210^{\circ}f$$

$$A = 0.0001996(T-100) - 1.2676$$

$$A = -1.04804$$

$$B_w = -1.485 \times 10^{-6}(4470) + 0.952 \times 10^{(-1.04804)}$$

$$B_w = 1.036 \text{ rb}$$

STB

(iv) Solution Gas-oil ratio (R_s)

$$R_s = \frac{\text{vol of Gas}}{\text{vol of Oil}}$$

Using standing correlation

$$R_s = r_g \left(\frac{P + 25.48}{18.2 \times 10^{y_g}} \right) 1.204$$

$$y_g = 0.00091(T) - 0.0125r_{API}$$

$$= 0.00091(210) - 0.0125(25)$$

$$y_g = -0.124 \quad T = 210^{\circ}f$$

$$R_s = 0.7 \left(\frac{4470 + 25.48}{-18.2 \times 10^{-0.1214}} \right) 1.204$$

- (V) Oil viscosity μ_o in (cp) centipoise
Beggs and Robinson Head oil correlation.

$$\text{Mod} = 10^x - 1.0$$

$$x = T^{-1.163} \exp(6.9824 - 0.045658 \text{ rAPI})$$

$$= (210)^{-1.163} \exp(6.9824 - 0.045658(25))$$

$$= 0.669$$

$$\text{Mod} = 10^{0.669} - 1.0$$

$$\text{Mod} = 3.675 \text{ cp}$$

If m_g = Molecular weight

$$\text{Nos} = A \text{Mod}^B$$

$$A = 10.715 (\text{Rs} + 100)^{-0.515} = 0.333$$

$$B = 5.44 (\text{Rs} + 150)^{-0.338} = 0.546$$

$$\text{Mos} = 0.33 (3.675)^{0.546}$$

$$= 2.38 \text{ cp}$$

- (vi) Viscosity of gas μ_g in centipoise cp
Where μ_g - μ_{air}

$$\text{Rg} = \frac{141.5}{131.5 + \text{API}}$$

API = American petroleum institute

μ_{air} = Molecular weight of air

Where $\mu_g = 20 \frac{\text{lb}}{16 \text{ mol}}$ $T_c = 386.0 \text{ R}$
 $P_c = 668 \text{ Ps}^2$

$$P_r = 6.68, \quad T_r = 1.74$$

Step 1 $\mu_i = f(\mu_g, T)$
 $\mu_i = f(20, 210)$

From chart given and read

$$\mu_i = 0.0125 \text{ cp}$$

Step 2 given chart 2 and read of

$$\mu / \mu_i = f(P_r, T_r)$$

$$= f(6.68, 1.74)$$

$$\mu / \mu_i = 2 \quad \mu = \mu_g = 2 \mu_i$$

$$= 0.0125 \times 2$$

$$= 0.025 \text{ cp}$$

- (vii) Viscosity of water μ_w

$$\mu_w = 4.33 - 0.07T + 4.73 \times 10^{-4} T^2$$

$$- 1.415 \times 10^{-6} T^3 + 1.56 \times 10^{-9} T^4$$

$$T = 210^\circ \text{F}$$

$$\mu_w = 0.41 \text{ cp}$$

- (viii) Bubble point pressure (P_b psia)

Where

$$P_b = 18.2 \left(\frac{\text{Rsb}}{\text{Rg}} \right)^{0.82} \times 10^{\text{yg} - 1.4}$$

$$= 18.2 \left(\frac{745}{0.7} \right)^{0.82} \times 10^{-0.1214} - 1.4$$

$$P_b = 4,453 \text{ psia}$$

- (ix) Undersaturated oil compressibility c_o
This is calculated with vasquez & beggs Correlation

$$c_o = \frac{3R_{sb} + 17.2T - 1.180rg + 12.6(r_{API})}{-1.433} \times 10^5$$

$$= \frac{3(745) + 17.2(210) - 1.180(0.70) + 12.61(25)}{4.470 \times 10^5}^{-1.433}$$

$$c_o = 1.378 \times 10^{-5} \text{ psi}^{-1}$$

- (X) Undersaturated water compressibility, using Bradley correlation. (C_w)

$$t/c_w = m_1 p + m_2 C_o + m_3 T + m_4$$

$$m_1 = 7.033, m_2 = 54.13, m_3 = 537, m_4 = 403.3 \times 10^3$$

$$T = 210^\circ \text{f}$$

C_w = is thus calculated

16. This is the application of scientific principles to practical enhance the designing of oil & gas recovery from Reservoir

17. $A = \text{STOIIP (N)}$

$$\text{Stock tank oil initial in place} = \left(\frac{VP}{5.615} \right) \frac{1}{(Boi)}$$

VP = pore volume

Boi = oil formation volume fracture initial

$$N = \left(\frac{300 \times 10^6}{5.5615} \right) \left(\frac{1}{1.33} \right)$$

$$N = 40 \text{ mmSTB}$$

18. i. Recovery efficiency is 32 - 75%
ii. Pressure is maintained and water decline slowly
iii. GOR gradually increase
iv. Dry oil is produce until water breakthrough
v. Oil rate remains constant but gradually declines as water breakthrough

19. A.

- (i) Reservoir is considered to be tank of constant value
(ii) the temperature and pressure and rock and fluid properties are not space dependent
(ii) equilibrium is also attained e.g between oil and solution gas.

OIL WELL PRODUCTION TEST

1. A pipeline reaching from the top of the ground to the oil-producing formation is called _____
2. What keep surface waters and loose earth from entering the well _____
3. The intermediate string is a second protective measure also referred to as safe string) to case off salt and anhydrate set at 5000ft or more. _____
4. The final string of casing, that extend from the surface through the surface and intermediate to the top of act something through the producing zone at a depth of 20,000ft or more is called. _____
5. To cease efforts to produce oil or gas from well and to plug a depleted formation and salvage all material and equipment is referred to as _____
6. What keep sand and solids out of the well, yet allow the passage of oil and gas into the well. _____
7. Shooting of metal bullets through the casing so that holes are left in the casing at the desired depth is called. _____
8. Perforating with shaped charges rather than bullets the perforate a casing is called. _____
9. An equipment used to maintain surface contract of the well, it is usually made of steel, cast or forged and machined to a close fit and forms a set to prevent well fluids from blowing or leaking at the surface is called. _____
10. Well head kind and configuration are determined by _____
11. A well head comprises the following except i) casing head, tubing head, Christmas tree, stuffing box, pressure gauge, wildcart _____
12. A group of valves which controls the flow of oil and gas from a well due to its shape and large number of fitting branching is and large number of fittings branching is referred to in the petroleum industry as _____
13. In the course of oil gas production, the order take the sequence as follow. _____
14. If a well is not producing by Natural flow, what is installed to supplement the formation pressure. _____
15. An artificial lift in surface equipment that impact an up and down motion to a sucker rod string to which is attached a piston (or plunger) pump submerged in the fluid of a well is called. _____
16. The most frequently conducted well test is called. _____
17. The measure of the reservoir pressure of the well taken at a specific depth or at micpoint of the Producing intorval is called. _____

18. The combination of potential test and BHP test is called. _____
19. The simplest form of oil and gas separator, separating by force of gravity is called a _____
20. Modern separators use other types of forces like. _____
21. The prevention of hydrate formation in a separator is carried out by 3 methods. Which are _____
22. Oil, water-cut oil, and water produced by the well move from the well head or separator through the facilities and finally into _____
23. The number of tanks in a battery will vary, as will their size, depending on the daily production of _____
24. Obtaining of samples in storage tanks are done by either of these two methods. _____
25. Gas sampling is done in the _____
26. What units have changed the processes of measuring, sampling, testing and transferring oil from a tedious, time-consuming business that requires many man hours and is error-prone into an efficient operation. _____
27. A well that came in at 100 bbl/day has declined to 80 bbl/day at the end of the first year. _____
 - A. Calculate the yearly and monthly decline rates
 - B. Calculate the yearly and monthly continuous decline rates.
 - C. If the economic limit of the well is 2 bbl/day, calculate the life of the well and its cumulative production.
28. A well producing from a pay zone between 4000 and 4050 ft, is completed with $2\frac{7}{8}$ in tubing hung at 4000 ft. The well has a static pressure BHP of 2000 psz and a productivity index (PI) of 0.3 bbl/day / psi and produces a GOR (Gas and Ratio) of 400 cu.ft/bbl and a water cut of 10% at what rate will it flow in THP of 100 psz. _____
29. What is used to estimate reserves and production optimization performance. _____
30. All these include the advantages of decline curves except. _____
31. All these include the disadvantages of decline curve except. _____
32. Types of decline curve include _____
33. Causes of decline involve. _____

_____ANSWER KEY_____

1. Oil well
2. Surface string
- 3.
4. Oil string
5. Abandon
6. Liner
7. Gun perforation
8. Jet perforation
9. Well Head
10. Well conditions
11. Wildcat
12. Christmas tree
13. A
14. Artificial lift
15. Beaming pumping
16. Potential test
17. Bottom -hole pressure test (BHP test)
18. Productivity test
19. Small tank
20. Centigal and impact firce
21. (1) heating the gas stream
(2) removing water vapour from Gas by using an antifreze agent
(3) the use of liquid absorbents
22. Stock tanks or tank battery

- 23. The well or wells and the frequency of pipeline output
- 24. Thief-sampling method or bottle sampling method
- 25. Field
- 26. Lease automatic custody transfer (LACT)

27. Year decline rate = $q = q_0 (1 - da)$
 Where da = annual decline rate
 q_0 = initial production rate at $t = 0$
 q = production at the point of decline
 $q = q_0 (1 - da)$ (1)
 $q = 80 \text{ bbl/day}$ $q_0 = 100 \text{ bbl/day}$.
 Substituting in(1)
 $80 = 100 (1 - da)$
 $80 = 100 - 100 da$
 $100 da = 100 - 80$
 $100 da = 20$
 $da = 1 - 0.8 = 0.2 = 20\%$

monthly deconsecrate
 $(1 - dm)^{12} = 1 - da$ (ii)
 Substituting da in (ii)
 $(1 - dm)^{12} = 1 - 0.2$
 $1 - dm = (0.8)^{1/12}$
 $dm = 1 - (0.8)^{1/12}$
 $dm = 1 - (0.8)^{0.0833} = 0.0184$
 $dm = 0.0184 \times 100 = 1.84\%/\text{month}$

Year continuous decline rate (ba)
 $\exp(-ba) = 1 - da$
 $\exp(-ba) = 1 - 0.2$
 $-ba = \ln(1 - 0.2)$
 $ba = \frac{-0.223}{-1}$
 $= 0.223$

Monthly continuous decline rate (bm)
 $ba = 12bm$
 $0.223 = 12bm$
 $bm = \frac{0.223}{12}$
 $= 0.0186$

Using 1 year as the time
 $q = q_0 \exp(-bt)$
 $q = 100 \times 365$
 $q = 2 \text{ bbl/day} = \text{economic life of use}$
 $q = 2 \times 365$
 $\therefore 2 \times 365 = 100 \times 365 \exp(-bt)$
 Recall $ba = 0.223$
 $2 \times 365 = 100 \times 365 \times \exp(-0.223t)$
 $\exp(-0.223t) = \frac{2 \times 365}{100 \times 365}$
 $= 0.02$

$$0.223T = \ln(0.02)$$

$$T = \ln \frac{0.02}{0.223}$$

$$= 17.5\text{yrs}$$

Economic life of the well = 17.5yrs

28. Given q = gross production rate
 q_w = water production rate
 q_o = oil production rate
 q_g = gas production rate

$$\text{GOR} = 400\text{ft}^3/\text{bbl} = \frac{q_g}{q_o}$$

$$\text{Also } q = q_o + q_w$$

$$= q_o = q - q_w$$

$$\text{GLR} = \text{Gas liquid ratio} = \frac{q_g}{q_o} \text{ where } q_g = 400q_o$$

$$\text{GLR} = 400 \frac{(q - q_w)}{2} = 400 \frac{(1 - q_w)}{2}$$

$$\text{but } \frac{q_w}{q} = 0.1$$

$$\text{GLR} = 400 (1 - 0.1)$$

$$= 400 \times 0.9$$

$$= 360\text{ft}^3/\text{bbl}$$

$$\text{GLR} = 0.36\text{mcf}/\text{bbl}$$

$$\text{Where } j = \text{PI} = 0.3\text{bbl}/\text{dpsi}$$

$$\text{THP} = 100\text{psi}$$

$$\text{Ps} = \text{static pressure}$$

$$= 2000\text{psi}$$

$$\begin{aligned} \text{Maximum production rate} &= J \times \text{Ps} \\ &= 0.3 \times 2000 \\ &= \frac{600\text{ bbl}}{\text{day}} \end{aligned}$$

30. Decline curve: its primary used for forecasting future production
- 31.
- 32.
33. Constant percentage declines (exponential), Harmonic and hyperbolic decline curves.
34. When more H_{2o} & gas are produced, production declines (BHP, GOR, WOR) and changes in
 I the drainage area
 ii. Changes in PI (productivity index)
 iii. Changes in efficiency in vertical and horizontal flow.

DRILLING FOR OIL AND GAS ENGINEERING TEST

1. What are the characteristic of a reservoir rock must posses _____
2. What are the types of petroleum traps _____
3. Exactly shock waves on the surface that penetrate downward into the rock layers, or finding traps. For oil and gas, the science is called. _____
4. All these instruments are used for petroleum explanation except. _____
5. The actual location on which the well is to be drilled and selected by an operating company is called _____
6. What are the various kinds of oil and gas wells classified into _____
7. If a well is a wilcat, what type of offshore mg system is used _____
8. Mobile rigs includes _____
9. Dry drilling a development well, _____ must be built and erected at a suitable site in the waters over the reservoir
10. The rotation of some hard objects called _____ against a rock formation and applying pressure to it and rotation is maintained, by which rocks are continually evacuated is called _____
11. The very basic needs of drilling a hole in the ground is as follows. _____
12. Types of modern techniques of drilling include _____
13. Circulation pump, fluid (or air), Drill string, bits cooling and discharge of cuttings, recirculation. _____
14. Rotation function in Drilling are achieved by what order. _____
15. Hoisting or lowering capabilities are achieved by what order. _____
16. List five types of bits you know _____
17. Tools placed in the drill string that resist the tendencies of the bits to seek other direction these tools are called _____
18. Enlarging of an undersize hole by a bits is done by a _____
19. The tchnique of allowing the drill string to be intentionally diverted to a given target is called. _____

20. Forcing a bit to seek a specific angle of travel is called. _____
21. The drilling of metal is referred to as _____
22. The _____ is a tool capable of transmitting the rotary torque necessary for drilling, and dampening These vibrations.
23. The Dependability of a drill string is linked to 2 important facts. _____
24. _____ Is a formation capable of producing enough oil and gas to make it economically feasible for the operating company to complete the well. _____
25. The question an operating company ask after drilling a well is _____
26. In making these decision and answers to these question _____ is carried out.
27. Formation evaluation involves all these except _____
28. Formation core sample include any of the two _____
29. After careful consideration of data obtained by various tests ran on the formation (pay zone) by operating company. What decisions are taken. _____
30. Determine the core pressure of a normally pressured formation in a Niger Delta at a depth of 9000ft. Given the pore pressure gradient (ppg) = 0.465psi/ft. What could be considered normal at the same depth for a Well drilled in the North sea where the pore pressure gradient is 0.452psi/ft. _____
31. A penetration rate of 23ft/hr was observed while drilling in shade of a depth of 9515ft. Using a 9.875 inch bits in the Us Gulf coast area the weight on bits was 25,500 lbf and the rotary speed was 113rex/min. The equivalent circulating density (ECD) at the bit ws 9.5 iba/aa) _____
32. Calculate expected fracture pressure gradient in ppg. If pore pressure gradient p/d = 0.65psi/ft. _____

ANSWER KEY

1. Porosity, permeable, exist in a special way
2. Structural and stratigraphic traps
Structural traps are formed because of a deformation in the rock layer that contains the hydrocarbon e.g are fault and antic lines.
3. Seismology
4. D.- Viscometer
5. Drill site
6. Exploration well and development well
7. Mobile rigs
8. Jack-ups, submersibles, semi submersibles and a drill ship
9. Offshore platform
10. Bit, Drilling
11. Rotation, circulation and hosting and housering
12. Rotary drilling and coiled tube drilling
13. Circulation pump, fluid (or air), drill string, bits cooling and discharge of cuttings, recirculation.
14. Power source, rotary table (circular disc), kelly, swivel, drill string, bits
15. Draw works (pulleys), Derrick, Swivel, kelly Drill string and bits
16. Fish tail, milled tooth, tungsten carbide teeth roller cutter, drag bit, roller bearing, journal bearing
17. Stabilizers
18. Reamer
19. Directional Drilling
20. Whip stocking
21. Milling
22. Shock sub
23. Inspection & Maintenance
24. Pay zone

25. Does this well contain enough oil or gas to make it worthwhile to run the final production string of casing and complete the well.
26. Formation evaluation
27. Seismology - C
28. A- Core barrel
29. Production casing and complete the well or to plug and abandon the well

30. Dept = 9,000ft, Normal gradient = 0.465 psi
ft

$$\begin{aligned} \text{Pressure} &= 9000 \times 0.465 \\ &= 4185\text{psig} \end{aligned}$$

$$\text{Pore pressure} = 9000 \times 0.452 = 4068\text{psig}$$

31.
$$\text{Dexp} = \log\left(\frac{23}{(60)(113)}\right) = \log\left(\frac{R}{60N}\right)$$

$$\log\left(\frac{(12)}{(1000)} \frac{(25.5)}{(9.875)}\right) \log\left(\frac{RW}{1000\text{dB}}\right)$$

$$= 1.64\text{bt - units}$$

Modified d-exponents is defined, normal gradient in the Gulf Coast area

$$= 0.465\text{psi/ft}$$

$$N = \frac{0.465}{0.052} = 8.94\frac{\text{ibn}}{\text{gal}}$$

Where $d_c = \text{modified } d = \frac{d_{sn}}{S_e}$

$$= 1.64 \frac{8.94}{9.50}$$

$$= 1.54\text{d-units}$$

32. Where $P_f(\text{min}) = f_{\text{min}} = \text{min fracture pressuring}$

$$D = \frac{1}{3}(1 + (2p/D))$$

$$f_{\text{man}} = \frac{1}{2}(1 + p/D)$$

D = Depth

$$F_{\text{min}} = P_{f\text{min}}/D = \frac{1 + 2 \times 0.65}{3 \times 0.052}$$

$$= 14.7\text{ppg}$$

$$P_{f/d}(\text{max}) = f_{\text{max}} = 1 + 0.65/2 \times 0.52$$

$$= 15.8\text{ppg}$$

GENERAL FINANCIAL TEST

100 QUESTIONS

30 MINUTES

DIRECTIONS

Each of the following questions have five or four answers.
Select the best of the available choices.

1. Banks are important to the study of money and the economy because they:
 - A. Provide a channel for linking those who want to save with those who want to invest.
 - B. Have been a source of rapid financial innovation that is expanding the alternatives available to those wanting to save their money.
 - C. Are the only financial institution to play a role in determining the quantity of money in the economy.
 - D. Each of the above (A, B, and C)
 - E. Only A and B of the above
2. Bond markets are important because:
 - A. They are easily the most widely followed financial markets in Nigeria.
 - B. They are the markets where foreign exchange rates are determined.
 - C. They are the markets where interest rates are determined.
 - D. Each of the above.
 - E. Only A and B of the above
3. Which of the following are true statements?
 - A. Money is defined as anything that is generally accepted in payment for goods and services or in the repayment of debts.
 - B. The inflation rate is measured as the rate of change in the aggregate price level.
 - C. The inflation rate increases whenever the aggregate price level increases.
 - D. All of the above are true statements.
 - E. Only A and B of the above are true statements.
4. Which of the following are long-term financial instruments?
 - A. A 3-month negotiable certificate of deposit
 - B. A bank's acceptance
 - C. A six-month loan
 - D. A treasury bill
 - E. None of the above
5. Which of the following statements about the characteristics of debt and equity is NOT true?
 - A. They can both be long-term financial instruments
 - B. They can both be short-term financial instruments
 - C. They both involve a claim on the issuer's income
 - D. They both enable a corporation to raise funds
 - E. None of the above
6. Securities are _____ for the person who buys them and _____ for the individual or firm that issues them.
 - A. Asset; liabilities
 - B. Liabilities; assets
 - C. Negotiable; nonnegotiable
 - D. Nonnegotiable; negotiable
7. Which of the following statements is true?
 - A. A bond is a debt security that promises to make payments for a specified period of time.
 - B. The maturity of a debt instrument is the time (term) to that instrument's expiration date.
 - C. A debt instrument is short term if its maturity is less than one year.
 - D. All of the above are true

8. If bad credit risks are the ones who must actively seek out and (therefore) receive loans from financial intermediaries then face the problem of
- A. Moral hazard
 - B. Adverse selection
 - C. Free-riding
 - D. Costly state verification.
9. Which of the following are short -term financial instruments?
- A. A negotiable certificate of deposit
 - B. A banker's acceptance
 - C. A treasury bond
 - D. Both A and B of the above
 - E. Both B and C of the above.
10. Financial intermediaries
- A. Reduce transactions and information cost for borrowers and savers
 - B. Improve the lot of the small saver
 - C. Are involved in the process of indirect finance
 - D. Do each of the above
 - E. Do only A and B of the above
11. Which of the following statements are true?
- A. Most common stocks are traded over-the counter, although the largest corporations have their shares traded on organized stock exchanges such as the New York Stock Exchange
 - B. Since a corporation gets a share of the broker's commission, a corporation acquires new funds whenever its securities are sold
 - C. Capital market securities are usually more widely traded than short-term securities and so tend to be more liquid
 - D. All of the above are true.
12. The conversion of a barter economy to one that uses money increases efficiency by reducing
- A. The need to exchange goods
 - B. The need to specialize
 - C. The need to employ team production methods
 - D. Transaction costs
13. If there are four goods in a barter economy (i.e., An economy in which no money is used), then one needs to know six prices in order to exchange one good for another. If, however, there are six goods in a barter economy, one needs to know _____ Prices in order to exchange one good for another.
- A. 15
 - B. 12
 - C. 9
 - D. 6
14. Whatever a society uses as money, the distinguishing characteristic is that
- A. It must be completely inflation proof
 - B. It must be generally acceptable as payment for goods and services and the repayment of debt
 - C. It must contain some amount of a valued commodity
 - D. It must be produced by government
15. Economists find no completely satisfactory way to measure the money supply because
- A. Some needed financial asset statistics are not publicly released
 - B. The "moneyness" of an asset is a matter of degree
 - C. Economists are ideologically divided concerning the general meaning of money
 - D. Economists receive insufficient statistical training
16. When compared to exchange systems that rely on money, disadvantages of the barter payment system include:
- A. The requirement of a double coincidence of wants
 - B. Lowering the cost of exchanging goods over time
 - C. Encouragement of specialization (division of labor)
 - D. All of the above
17. Which of the following assets would NOT be included in a theoretical approach to the measurement of the money supply:
- A. Currency
 - B. Traveler's checks
 - C. Checking account deposits
 - D. Corporate bonds

18. People hold money even during high inflation when other assets are better stores of value. This can be explained by the fact that money
- Is increasing
 - Is the most liquid medium of exchange
 - Is legal tender and hence must be used in goods and services exchanges
 - Is highly durable
19. Recent financial innovations involving the creation of new secondary markets for securities make attempts to define satisfactory measures of money more difficult because
- Money is no longer important to the economy
 - The range of assets with money-like characteristics has increased
 - Information on transactions in these new markets is not publicly released
 - These new secondary markets tend to cause inflation
20. Which of the following are true in general for fixed payment loans?
- The borrower repays the entire principal plus interest at the maturity date.
 - Installment loans and mortgages are frequently of the fixed payment type.
 - The borrower repays the loan by making the same payment every month
 - Both A and B of the above
 - Both B and C of the above
21. Which of the following are true in general for coupon bonds?
- When a coupon bond is priced at its face value, its yield to maturity equals its coupon rate.
 - The purchase price and yield to maturity for a coupon bond are negatively related, all else remaining constant.
 - For a coupon bond, its yield to maturity is greater than its coupon rate when its purchase price is below its face value.
 - All of the above are true
 - Only A and B of the above are true.
22. In which of the following situations will you refer to be borrowing?
- The interest rate is 9 percent and the expected inflation rate is 7 percent.
 - The interest rate is 4 percent and the expected inflation rate is 1 percent.
 - The interest rate is 13 percent and the expected inflation rate is 15 percent
 - The interest rate is 25 percent and the expected inflation rate is 50 percent.
23. If the expected return on ABC stock falls from 5 to 10 percent and the expected return on CBN stock is unchanged, then the expected return of holding CBN stock _____Relative to ABC stock and the demand for CBS stock
- Rises; rises
 - Rises; falls
 - Falls; rises
 - Falls; falls
24. If wealth increase, the demand for stocks _____and that long-term bonds _____
- Increases; increases
 - Increases; decreases
 - Decreases; decreases
 - Decreases; increases
25. If interest rates on Treasury bonds are suddenly expected to shoot up, then other things equal, the demand for houses will _____and that of Treasury bonds will _____
- Increase; increase
 - Increase; decrease
 - Decrease; decrease
 - Decrease; increase
26. When the price of a bond is above the equilibrium price, there is an excess _____.For (of) bonds and price will_____
- Demand; rise
 - Demand; fall
 - Supply; fall
 - Supply; rise

27. A decrease in the expected rate of inflation will _____ The expected return on bonds relative to the that on _____ Assets.
A. Reduce; financial
B. Reduce; real
C. Raise; financial
D. Raise; real
28. The poor people have difficulty getting loans because
A. they typically have little collateral
B. they are more likely to be dishonest
C. they are less likely to be benefit from access to financial markets
D. of all of the above
E. of none of the above
29. Factor that lead to worsening conditions in financial markets include _____
A. declining bonds prices
B. declining stock prices
C. unanticipated increases in the price level
D. all of the above
E. Only (a) and (b) of the above
30. The process of transforming otherwise illiquid financial assets into marketable capital market instruments is know as _____
A. Securitization
B. Internationalization
C. Arbitrage
D. Program trading
E. None of the above
31. If a bank has excess reserves of N10,000 and demand deposit liabilities of N80,000, and if the reserve requirement is 20 percent, then the bank has actual reserves of _____
A. N16,000
B. N6,000
C. N26,000
D. N20,000
E. N36,000
32. If a bank has excess reserves of N7,000 and demand deposit liabilities of N10,000 and if the reserve requirement is 15 percent , then the bank has actual reserves of _____
A. N17,000
B. N22,000
C. N27,000
D. N29,000
33. A bank has excess reserve of N1,000 and demand deposit liabilities of N80,000 when the reserve requirement is 20 percent. If the reserve requirement is lowered to 10 percent, the bank's excess reserve will be
A. N1,000
B. N8,000
C. N9,000
D. N17,000
34. If the required reserve ratio is 20 percent, the simple deposit multiplier is _____
A. 5.0
B. 2.5
C. 4.0
D. 10.0
35. A simple deposit multiplier equal to two implies a required reserve ratio equal to
A. 100 percent
B. 50 percent
C. 25 percent
D. 0 percent
36. In the simple deposit expansion model, an expansion in checkable deposits of N1,000 when the requirement reserve ratio is equal to 20 percent implies that the fed
A. Sold N200 in government bonds
B. Sold N500 in government bonds
C. Purchased N200 in a government bonds
D. Purchased N500 in government bonds
37. The ratio that relate the change in the money supply to a given change in the monetary base is called the _____
A. Money multiplier
B. Required reserve ratio
C. Deposit ratio
D. Discount rate
38. The money multiplier is _____
A. Negatively related to the currency-check able deposit ratio
B. Positively related to the required reserve ratio
C. Positively related to holdings of excess reserves
D. Both (a) and (b) of the above

39. Factors that cause the excess reserves ratio to fall include:
- A. A decline in expected deposit outflows
 - B. Arise in market interest rates
 - C. A decline in market interest rates.
 - D. Only A and B of the above
 - E. Only A and C of the above
40. Factors that cause an increase in the money multiplier include:
- A. An increase in the required reserve ratio
 - B. A decrease in market interest rates.
 - C. An increase in expected deposit outflows
 - D. None of the above
41. Factors that cause a decline in the money multiplier include:
- A. An increase in the required reserve ratio
 - B. A decrease in the market interest rate
 - C. An increase in expected deposit outflows
 - D. All of the above
 - E. Only A and B of the above
42. Factors that cause an increase in the money supply include:
- A. A lowering of the required reserve ratio
 - B. An increase in the market interest rate
 - C. An increase in expected deposit outflows
 - D. All of the above
 - E. Only A and B of the above
43. Factors that cause a decline in the money supply include:
- A. A decrease in the nonborrowed monetary base
 - B. A decrease in market interest rates
 - C. An increase in expected deposit outflows
 - D. All of the above
 - E. Only A and B of the above
44. The federal uses three policy tools to manipulate the money supply: open market operations, which affect the ____; changes in the discount rate, which affect the ____ by influencing the quantity of discount loans; and changes in reserve requirements, which affect the ____.
- A. Money multiplier; monetary base; monetary base
 - B. Monetary base, money multiplier; monetary base
 - C. Monetary base; monetary base; money multiplier
 - D. Money multiplier; money multiplier; monetary base
45. Open market operations as a monetary policy tool have the advantages that ____.
- A. They are flexible and precise
 - B. They are easily reserved if mistakes are made
 - C. They can be implemented quickly without administrative delays
 - D. All of the above
 - E. Only A and B of the above
46. Price stability is desirable because ____.
- A. Inflation creates uncertainty, making it difficult to plan for the future
 - B. Everyone is better off when price are stable
 - C. Price stability increase the profitability of the federation
 - D. It guarantees full employment
47. Although the goals of high employment and economic growth are closely related, policies can be specifically aimed at encouraging economic growth by
- A. Encouraging firms to invest
 - B. Encouraging people to save
 - C. Doing both (a) and (b)
 - D. Doing neither (a) nor (b) of the above
48. Which of the following is a potential operating target for the central bank?
- A. The monetary base
 - B. The M1 money supply
 - C. Nominal GNP
 - D. The discount rate

49. Interest rates are difficult to measure because
- A. Data on them are not timely available
 - B. Real interest rates depend on the hard-to-determine expected inflation rate.
 - C. They fluctuate too often to be accurate
 - D. They cannot be controlled by the fed
50. The average number of times that a Naira is spent in buying the total amount of final goods and services produced during a given time period is known as
- A. Gross national product
 - B. The spending multiplier
 - C. The money multiplier
 - D. Velocity
51. The velocity of money is
- A. The average number of times that a Naira is spent in buying the total amount of final goods and services
 - B. The ratio of the money stock to high-powered money
 - C. The ratio of the money stock to interest rates
 - D. None of the above
52. If the money supply is 500 and nominal income is 3,000 the velocity of money is
- A. 60
 - B. 6
 - C. 1/6
 - D. Undefined
53. Keynes's hypothesized that the precautionary component of money demand was primarily determined by the level of
- A. Interest rate
 - B. Velocity
 - C. Income
 - D. Stock market prices
54. Because Keynes's assumed that the expected return on money was zero, he argued that
- A. People would never hold money
 - B. People would never hold money as a store of wealth
 - C. People would never hold money as a store of wealth when the expected return on bonds was negative
 - D. People would hold money as a store of wealth only when forced to buy government policy
55. Keynes argued that the transactions component of the demand for money was primarily determined by the level of people's _____, which he believed were proportional to _____
- A. Transactions; income
 - B. Transaction; age
 - C. Incomes; wealth
 - D. Incomes; age
56. The _____ sensitive the demand for money to interest rates, the _____ unpredictable velocity will be
- A. More; more
 - B. More; less
 - C. Less; more
 - D. Less; less
57. If aggregate demand is less than the level of aggregate output
- A. Inventory investment will be unaffected
 - B. Inventory investment will be positive
 - C. Inventory investment will be negative
 - D. Insufficient information to determine the level of inventory investment
58. If aggregate demand less than actual output,
- A. Unplanned inventory accumulation will cause output to rise
 - B. Unplanned inventory depletion will cause output to fall
 - C. Unplanned inventory depletion will cause output to rise
 - D. Unplanned inventory accumulation will cause output to fall
59. The expenditure multiplier is the ratio of
- A. The change in equilibrium output to a change in the monetary base
 - B. The change in the money supply to a change in the monetary base
 - C. The change in the money supply to a change in the autonomous expenditure
 - D. The change in equilibrium output to a change in the autonomous expenditure

60. In a closed economy, aggregate demand is the sum of
- A. Consumer expenditure, actual investment spending, and government spending
 - B. Consumer expenditure, planned investment spending, and government spending
 - C. Consumer expenditure, actual investment spending, government spending, and net exports
 - D. Consumer expenditure, planned investment spending, government spending, and net exports
61. If the consumption function is $C=20+0.5Y_D$, then an increase in disposable income by 100 will result in an increase in consumer expenditure by
- A. 25.
 - B. 70.
 - C. 50
 - D. 80
 - E. 100
62. The ratio of the change in aggregate output to a change in planned investment spending is called
- A. The marginal propensity to consume.
 - B. Autonomous consumer expenditure
 - C. The expenditure multiplier
 - D. Unplanned inventory accumulation
63. As interest rate rise, the opportunity cost of holding money _____ and the demand for money _____
- A. rises; rises
 - B. rises; fall
 - C. falls; rises
 - D. falls; falls
64. Keynes reasoned that consumer expenditure is related to
- A. Transitory income
 - B. Permanent income
 - C. Disposable income
 - D. Earned income
65. In deriving the aggregate demand curve a _____ price level _____ the money supply in real terms, rises interest rates, and _____ the equilibrium level of aggregate output
- A. Higher; reduces; raises
 - B. higher; reduces; lowers
 - C. lower; increase; raises
 - D. Lower; increases; lowers
66. The condition of a continually rising price level is defined as
- A. Stagflation
 - B. Stagnation
 - C. Disinflation
 - D. Inflation
67. Which of the following is least likely to lead inflationary monetary policy?
- A. Rising unemployment
 - B. Expanding federal budget deficits
 - C. Declining oil prices
 - D. Conflict in the middle East
68. Countries with the highest inflation rates are likely to have
- A. The highest rates of money growth
 - B. Small budget deficits relative to GDP
 - C. The lowest interest rates
 - D. All of the above
69. According to the monetarist view of inflation, an increase in the money supply will cause
- A. Output to increase in the short run, but not in the long run.
 - B. An increase in the price level, but no permanent effect on aggregate output
 - C. Government budget deficits to increase
 - D. Only a and b of the above
70. If a cost-push inflation occurs because of the push by workers to get higher wages, then one can infer that the government
- A. Has a high employment target
 - B. Has pursued an accommodating monetary policy
 - C. Has chosen to reduce its budget deficit
 - D. Only (a) and (b) of the above

71. Which of the following is not a primary reason why many people hold cash
- A. To undertake transactions
 - B. To avoid credit
 - C. To have an emergency reserve
 - D. To have a store of value
72. Holding cash in a temporary “parking place” is associated with which cash motive?
- A. Undertaking transactions
 - B. Holding an emergency reserve
 - C. Holding a store of value
 - D. Paying off credit
73. Which of the following is not a characteristics of certificate of deposit (CDS) ?
- A. You pay a penalty for early redemption
 - B. You “lock in” (are guaranteed) the stated interest if you hold the CD until maturity
 - C. They are preferred over money market deposit if you expect interest rates to fall
 - D. They have a minimum maturity of three years
74. Depositors often cite _____ as the most important consideration in selecting a particular bank.
- A. Safety
 - B. Low charges
 - C. Size
 - D. Geographical convenience
75. The least effective method of protecting against overdrafts is to
- A. Maintain large-than-normal account balance
 - B. Arrange for automatic transfers from a savings account
 - C. Arrange for a credit-card loan to cover the overdraft
 - D. Ignore them since banks do not charge for overdrafts
76. Which of the following checks does not guarantee payment?
- A. A person check
 - B. A certificate check
 - C. A cashier’s check
 - D. A traveler’s check
77. Chris savings account (offering 12% simple interest) showed the following activity for the month of June:
- | | |
|---------------------|--------|
| Opening balance | N2,000 |
| 6/10 Deposit | 1,000 |
| 6/20 Withdrawal | (800) |
| 6/30 Ending Balance | 2,200 |
- Interest earned in June with the FIFO method would be
- A. N24.00
 - B. N12.00
 - C. N18.67
 - D. N21.33
78. Secured credit cards are
- A. Issued only to those who are the most credit worthy
 - B. Issued only to corporations that have been operating for at least five years
 - C. Useful for those who are trying to overcome a poor credit history
 - D. Protected by an unlimited lines of credit
79. A “charge bank” occurs when
- A. A credit card holder is charged interest on past purchases.
 - B. A borrower is charged additional interest for early repayment of a loan
 - C. A consumer returns previously charged merchandise
 - D. A card issuer charges a disputed amount back to the merchant
80. “Credit blocking” is the industry term for:
- A. Illegally denying credit to individuals because of their race or gender.
 - B. Reducing your credit limit because of an anticipated charge
 - C. Legally denying credit to individuals who have a past record of credit abuse
 - D. Denying high-risk individuals access to low-cost lines of credit

81. Interest is computed by applying the annual percentage rate to the outstanding loan balance under the:
- A. Simple interest method
 - B. Add-on interest method
 - C. Discount interest method
 - D. Rule of 78
82. Interest on a twelve-month installment loan is to be calculated using the discount method. If the purchase to be financed is N1,000 and the discount rate is 60%, then your monthly payment is about
- A. N76.67
 - B. N86.07
 - C. N88.33
 - D. N88.65
83. One advantage of a tangible asset over an intangible one is that
- A. Its price is guaranteed to increase over time
 - B. It can be enjoyed or used while it is owned
 - C. It represents a claim to an intangible asset
 - D. You receive a title providing evidence of ownership
84. Which alternative is an example of an intangible asset?
- A. A common stock
 - B. A bond
 - C. A mutual fund share
 - D. All of the above
85. An example of a current return is:
- A. A quarterly dividend received from a common stock
 - B. The price appreciation of a common stock
 - C. The sale of a common stock at a profit
 - D. The sale of a common stock at a loss
86. A risk averter is someone who
- A. Never takes risks
 - B. Expects adequate compensation for undertaking risky investments
 - C. Limit his/her investments to insured savings accounts
 - D. Avoids risk by simply not investing
87. A short position is described as one
- A. Inadequate margin in a margin account
 - B. Securities you have sold but do not own
 - C. An order to sell stock at a price below its current market price
 - D. Securities you purchased but have not yet taken delivery of the shares
88. A long position is described as one
- A. Where you buy, and then own securities
 - B. Where you have accumulated considerable investment gains
 - C. Where you have held the same securities for many years
 - D. Where you borrowed money to buy the securities
89. You bought a stock at N50 a share and it has increased in price to N70 a share. You think its price will increase even more but you are also concerned that it might go back to N50, eliminating the entire gain. Given this information, you should place which kind of order?
- A. Stop-loss
 - B. Profit-retention
 - C. Limit
 - D. Deferred sales
90. one motive for holding cash is to undertake transactions
- A. True
 - B. False
91. An emergency reserve is held for transactions purposes
- A. True
 - B. False
92. Because it pays higher interest, a CD is considered more liquid than a passbook saving account
- A. True
 - B. False
93. Rates of interest on passbook saving are usually lower than rates available on other savings accounts
- A. True
 - B. False

94. A CD enable you to lock in a current interest rate
A. True
B. False
95. The safest endorsement of a check is a blank endorsement
A. True
B. False
96. An overdraft and "bounced check" mean the same thing
A. True
B. False
97. The primary function of the specialist is to maintain an orderly and continuous market
A. True
B. False
98. A margin account allows you to borrow funds through your broker
A. True
B. False
99. Selling short means selling a stock you own before its price reaches your expected target
A. True
B. False
100. If you instruct your broker to buy a stock at a specific price, you have given a market order.
A. True
B. False

ANSWER KEY

- | | | | | | | |
|-------|-------|-------|-------|-------|-------|--------|
| 1. E | 16. A | 31. C | 46. A | 61. C | 76. A | 91. B |
| 2. C | 17. D | 32. B | 47. C | 62. C | 77. A | 92. B |
| 3. E | 18. B | 33. C | 48. A | 63. B | 78. C | 93. A |
| 4. E | 19. B | 34. A | 49. B | 64. C | 79. D | 94. A |
| 5. B | 20. E | 35. B | 50. D | 65. B | 80. B | 95. B |
| 6. A | 21. D | 36. C | 51. A | 66. D | 81. A | 96. A |
| 7. D | 22. D | 37. A | 52. B | 67. C | 82. C | 97. A |
| 8. B | 23. A | 38. A | 53. C | 68. A | 83. B | 98. A |
| 9. D | 24. A | 39. D | 54. C | 69. D | 84. D | 99. B |
| 10. D | 25. B | 40. B | 55. A | 70. D | 85. A | 100. B |
| 11. A | 26. C | 41. D | 56. A | 71. B | 86. B | |
| 12. D | 27. D | 42. E | 57. B | 72. C | 87. B | |
| 13. A | 28. A | 43. D | 58. D | 73. D | 88. A | |
| 14. B | 29. E | 44. C | 59. D | 74. D | 89. A | |

COMPUTER TECHNOLOGY TEST

30 QUESTION

10 MINUTES

DIRECTIONS

For each of the question in this test, carefully read, and check the best answer. Answer choices that have a circle require one correct answer. Answer choice that have a square have more than one answer.

- The laser printer component that regulates the voltage and current to the photosensitive drum is the _____
 A. Cleaning
 B. Primary grid
 C. Primary corona
 D. Power grid
- Alternative names for Ultra SCSI include _____
 A. Fast SCSI
 B. Wide SCSI
 C. SCSI-3
 D. SCSI-2
- EMI is an acronym for _____
 A. Electronic Material Interface
 B. Electro-Material Interface
 C. Electro-Magnetic Interface
 D. Electro-Magnetic Interference
- What size is the address bus on a 386SX? _____
 A. 8-bit
 B. 16-bit
 C. 24-bit
 D. 32-bit
- When a byte fails to have the appropriate number of bits, it causes _____
 A. Slow processing
 B. System crash
 C. Parity error
 D. Nothing. There is no mandated amount of bits a character needs
- Telephone-grade cabling uses what type of connector? _____
 A. RJ-11
 B. RJ-45
 C. RG-58
 D. RS-232
- You use a multimeter to measure flowing current in terms of _____
 A. Amps
 B. Volts
 C. Ohms
 D. Interrupts
 E. Watts
- What is the DOS/Windows tool used to reorganize the hard disk to optimize its performance? _____
 A. SCANDISK
 B. DRVSPACE
 C. DEFRAG
 D. CHKDSK
- Who should make the final decision regarding whether to upgrade a personal computer? _____
 A. Technician
 B. Service Company
 C. Customer
 D. Purchasing Department
- The most popular battery in use laptop computers today is _____
 A. Nickel-cadmium
 B. Lead-based
 C. Lithium
 D. Nickel/metal/hydride
- When two IDE hard disk are installed in a PC, one must be the _____ and the other the _____
 A. Boot, backup
 B. Master, slave
 C. Primary, Secondary
 D. Master, sub-master



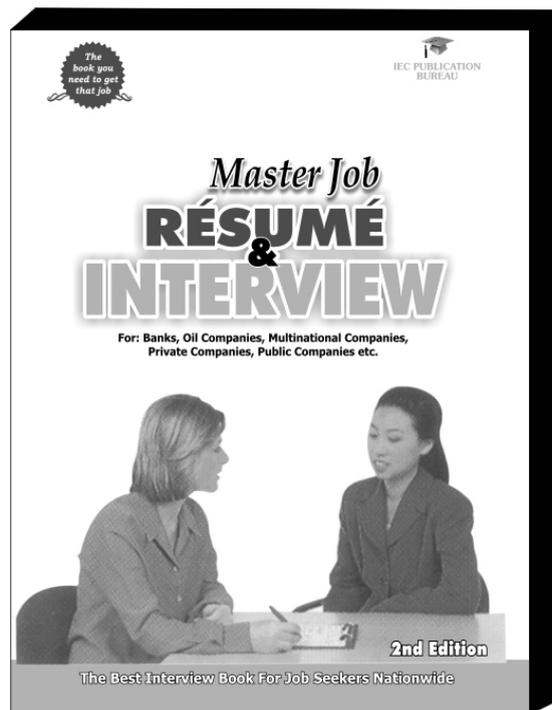
12. The distance between dots on a laptop screen is known as _____
- A. Resolution
 - B. Dot pitch
 - C. Interlacing
 - D. Filament
13. Which command do you use to delete directories or subdirectories? _____
- A. RD
 - B. XDEL
 - C. DELTREE
 - D. DEL
 - E. ERASE
14. For a PC Card to work properly, it must have a running on the portable PC. _____
- A. PC Card socket
 - B. PCMCIN driver
 - C. Software enabler
 - D. Port replicator
15. Which of the following Microsoft utilities do you use to put files in contiguous order on a hard drive? _____
- A. Scan Disk
 - B. Defrag
 - C. Config
 - D. Command
16. Which of these types of batteries is the most appropriate choice for a portable PC? _____
- A. NiCad
 - B. NiMH
 - C. Li-Ion
 - D. Alkaline
17. Which type of printer should not be connected to a manual switch box? _____
- A. Dot matrix
 - B. Inkjet
 - C. Laser
 - D. Daisywheel
18. What size is the data bus on a 386SX? _____
- A. 8-bit
 - B. 16-bit
 - C. 24-bit
 - D. 32-bit
19. A procedure that copies the BIOS code from ROM into RAM when the computer boot sequence begins is called _____
- A. Mirroring
 - B. Shadowing
 - C. Switching
 - D. BIOS backup system (BBS)
20. BIOS is the acronym for _____
- A. Basic Input/Output System
 - B. Binary Input/Output System
 - C. Beginning Instruction of the Operating System
 - D. Boot input/output Sequence
21. The bottom layer of the OSI model is _____
- A. Physical
 - B. Data link
 - C. Network
 - D. Transport
 - E. Session
22. If you're having problems running a DOS program in a Windows 95 DOS window, what should you do? _____
- A. Try running it in DOS mode.
 - B. Get a newer program that runs in Windows
 - C. Call the software program's technical support for help
 - D. Add more virtual memory to motherboard
23. Which of the following is not a function of HIMEM.SYS? _____
- A. To create the HMA
 - B. To manage the extended memory
 - C. To load TSRs in HMA
 - D. To support expanded memory drivers
24. The first 640 KB of RAM in DOS is called _____ Memory.
- A. Virtual
 - B. Conventional
 - C. Shadow
 - D. Expanded
25. Which of these can be found in the CONFIG.SYS file? _____
- A. Device=
 - B. Files
 - C. Echo
 - D. Buffers

26. To view the current system resources in Windows 3.x, access the _____
- A. System Monitor
 - B. "About Program Manager" icon under Control panel
 - C. "About Program Manager" entry under the HELP menu
 - D. Device Manager
27. In window 3.x, what can you use the 386 Enhance icon to change? _____
- A. Printer drivers
 - B. Virtual Memory settings
 - C. Task-scheduling for multitasking
 - D. IRQ assignments
28. What is the correct order in which these files load to start DOS? _____
- A. CONFIG. SYS, AUTOEXEC BAT, COMMAND.COM
 - B. COMMAND. COM, CONFIG.SYS, AUTOEXEC.BAT
 - C. AUTOEXEC.BAT, COMMAND.COM CONFIG.SYS
 - D. CONFIG.SYS, COMMAND .COM, AUTOEXEC.BAT
29. MSD can help with which of the following?
- A. Which COM ports are being used.
 - B. IRQ assignments
 - C. I/O addresses
 - D. Detect CPU failure due to overheating
30. To change your printer information from one output port to another in DOS, type _____
- A. MODE/S
 - B. PRN/R
 - C. REDIR
 - D. PORT/R

ANSWERS

- | | | |
|------------|-------|----------------|
| 1. B | 11. B | 21. A |
| 2. A and C | 12. B | 22. A |
| 3. D | 13. C | 23. B |
| 4. C | 14. C | 24. B |
| 5. C | 15. B | 25. A, B and D |
| 6. A | 16. C | 26. C |
| 7. A | 17. C | 27. B, C |
| 8. C | 18. B | 28. D |
| 9. C | 19. B | 29. A, B and C |
| 10. D | 20. A | 30. C |

YOU NEED THIS BOOK ALSO



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AVAILABLE AT THE LISTED BOOKSHOPS

SOME OF THE BOOKSHOPS WHERE YOU CAN GET THIS BOOK

LAGOS STATE

YABA OUTLET

| | ADDRESS | TEL. NO. |
|-----|----------------------|-------------|
| 1. | John bright bookshop | 08032227924 |
| 2. | Okeyson Book Shop | 08035835758 |
| 3. | EPP Bookshop | 08038075521 |
| 4. | Abiodun Boookshop | 08033452468 |
| 5. | Abikoye Bookshop | 08023134606 |
| 6. | Stanza Bookshop | 01-4763426 |
| 7. | Chijin Bookshop | 08023128062 |
| 8. | UNILAG Bookshop | |
| 9. | God's Time Bookshop | |
| 10. | Singapore Bookshop | 08034082790 |
| 11. | Infinity Bookshop | |
| 12. | Sunny Bookshop | |
| 13. | Okwytex Bookshop | |
| 14. | Fenco Bookshop | |

OJUELEGBA OUTLET

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|----|--------------------|-------------|
| 1. | Anderson Book Shop | 08023042307 |
| 2. | Uche Dio Bookshop | 08034917255 |

IKEJA OUTLET

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|----|-------------------------|-------------|
| 1. | Ski Bookshop | 08056101004 |
| 2. | Trans Atlantic Bookshop | 08034124442 |
| 3. | Nnaji Bookshop | 08023334779 |
| 4. | Champion Bookshop | 08034206685 |
| 5. | Emmason Bookshop | |
| 6. | O'vic Bookshop | 08033556152 |
| 7. | Jonex Bookshop | 08033451217 |

OBADORE OUTLET

| | | |
|----|------------------|-------------|
| 1. | Peoples Bookshop | 08057816968 |
|----|------------------|-------------|

EJIGBO OUTLET

| | | |
|----|------------------|-------------|
| 1. | Qualite Bookshop | 08023304819 |
|----|------------------|-------------|

AGEGE OUTLET

| | | |
|----|------------------|-------------|
| 1. | U.Bosco Bookshop | 08033531388 |
|----|------------------|-------------|

MUSHIN OUTLET

| | | |
|----|----------------------------------|-------------|
| 1. | Jamganza Bookshop | 08050867191 |
| 2. | Kolawole Bookshop | |
| 3. | Hymarco Bookshop | 08055011049 |
| 4. | Endurance International Bookshop | 08033728922 |
| 5. | Samex Bookshop | 08069151485 |
| 6. | Obi-Sam Bookshop | 08024055366 |

ISOLO OUTLET

| | | |
|----|---------------------|-------------|
| 1. | Confidence Bookshop | 08037245604 |
|----|---------------------|-------------|

LAGOS ISLAND OUTLET

| | | | |
|----|-------------------|---------------------------------|-------------|
| 1. | CSS Bookshop | Lagos Island CMS B/Stop, Lagos. | |
| 2. | Ben-Marv Bookshop | Lily Shop LB 1-3; 41 Marina | 08023090243 |

IKOTUN EGBE OUTLET

| | | | |
|----|----------------------|------------------------------------|-------------|
| 1. | Joint Heirs Bookshop | Opposite Ikotun Main Market Ikotun | 08037211009 |
| 2. | Refereniss Bookshop | Ikotun main market | 08055821342 |
| 3. | John Best Bookshop | shop 52 Irepodun Mkt | 08056109546 |

MILE2 / FESTAC OUTLET

| | | | |
|----|-------------------|--|-------------|
| 1. | FIB Bookshop | 33B, Agboju market | 08056636191 |
| 2. | St Joe Bookshop | Agboju main market | |
| 3. | A.C Bookshop | 9, Agboju main market | |
| 4. | Chukwudi Bookshop | Agboju main market | |
| 5. | Famous Bookshop | Agboju main market | 08030731222 |
| 6. | Janio Bookshop | G, Close, 22 Road, Opp. Texaco Filling Station, Festac Town. | |

VICTORIA ISLAND / IKOYI

| | | | |
|----|-------------------|--|--|
| 1. | Nu metro Bookshop | Sliverbird Galleria, 133, Ahmadu Bello way | |
| 2. | Bookworm | Unit 6, Eko Hoel Shopping Complex | |

IYANA IPAJA OUTLET

| | | | |
|----|----------------------|--|-------------|
| 1. | Ambra Royal Bookshop | Opp Round about Iyana Ipaja Main Market | 08082140021 |
| 2. | Wed Bookshop | 4 Jones Str, Opp Oja B/stop Off Ipaja-Ayobo Rd Ipaja Lagos | 08035374610 |
| 3. | Denco Bookshop | 49 New Ipaja Road Iyana-Ipaja Lagos | 08066527007 |
| 4. | St-Anthony Bookshop | 25 old Ipaja Rd Iyana-Ipaja | 08034840258 |

LASU OUTLETS

| | | | |
|----|-------------------|---|-------------|
| 1. | Summit Bookshop | 10, Kemberi Road, Okokomaiko Lagos. | 08034711045 |
| 2. | Paul Bookshop | Opposite LASU Gate | 08037475990 |
| 3. | Everyday Bookshop | Km 40/42 Badagry Express Okokomaiko, Lagos. | |

OYINGBO OUTLET

| | | | |
|----|-----------------|--|-------------|
| 1. | Comedy Bookshop | 27 Murtala/Mohammed Way Oyingbo Bus/stop | 08033369243 |
| 2. | Amarco Bookshop | 25 M/Mohammed Way OyingboBus-stop | 08062469584 |

ILUPEJU OUTLET

| | | | |
|---|--------------|--|----------------------------|
| 1 | JOF Bookshop | Shop 1 L.S.D.P.C.Shopping Mall,beside UBA Plc along ilupeju Industrial Estate Oshodi | 08035793384
08036793528 |
|---|--------------|--|----------------------------|

ONIPANU OUTLET

| | | |
|------------------------|--|-------------|
| Bright Future Bookshop | Shop 4 Abraham Adesanya Shopping Complex | 08023377316 |
|------------------------|--|-------------|

AJEGUNLE OUTLET

| | | | |
|-----|---------------------|--|--------------------------|
| 1. | Peterson Bookshop | 10, Bale Street, Ajegunle | 08082145385 |
| 2. | Nwabu Bookshop | 16, Bale Street, Ajegunle | 08034987058 |
| 3. | Garvik Bookshop | 10, Ijora Ajegunle Apapa | 08023063525 |
| 4. | Right way Bookshop | 14, Bale Street Ajegunle | 08033237119 |
| 5. | Tomason Bookshop | 90, Kirikiri Road , Wilmer B/Stop, Olodi-Apapa | |
| 6. | Don-Chuks Bookshop | 9, Bale Str. Ajegunle Lagos | 08023004858, 08066560550 |
| 7. | Ubah-Lexan Bookshop | 10 Bale Street Ajegunle Lagos | 08033929112 |
| 8. | Nedphil Bookshop | Ajegunle | 08037161157 |
| 9. | System Bookshop | Ajegunle | 08062289428 |
| 10. | Sunny Bookshop | Ajegunle | 08033464237 |

OKOTA OUTLET

1. Michens Bookshop Okota Roundabout by Ago Junction, Okota Isolo 08033473619

OGBA OUTLET

1. People Bookshop 54, Ijaiye Road, Ogba Lagos. 08023830250
2. Brich and Son's Bookshop 60, Ijaiye Road Ogba
3. Innoma Bookshop 11, Ijaiye Road, opp NUJ WAEC 08058477682

EGBEDA OUTLET

1. Learner's Bookshop 2A Idimu Road Egbeda Beside Triangle Fast food 08023064269
2. Ik Bookshop 18 Idimu Road, Egbeda 08033973801
3. Chubest Bookshop 4 Akonwojo Rd Egbeda Lagos 08033578323

KETU OUTLET

1. Calvary Bookshop Ikosi Ketu 08032093289

IKORODU OUTLET

1. IEC Office 653, Ikorodu Road, Opp. Mobile Filling Station Mile 12, Lagos. 08033438062
2. Steven Education Bookshop 26, Allison Street opp United High School 08033445405
3. Royal Bookshop 19 Allison Street Junction 08035612553
4. CNN Bookshop 12 Isele Street Behind Conoil Filling Station 08030651780
5. Friendship Bookshop 1 Lagos Road opp AP filling Station 08037180109

OSHODI OUTLET

1. Blessed fortune Bookshop Shop 202, Kairo oshodi Road 08037215157
2. God's love Bookshop Shop 58, no 3 Oshodi Road
3. Oyison Bookshop Shop 8, 13, Oshodi Road

OJODU OUTLET

1. Chikwe Bookshop 1, Obafalabi Street, Ojodu Lagos

OGUN STATE

SANGO OTA OUTLET

1. Covenant University Bookshop Cana Land Ota, Ogun State 08034623459
2. Peace Bookshop 14 Idiroko Road Sango Otta 08025124366
3. Kenis Moore Bookshop Shop 7, Caroline Plaza Opp. Police Station 08052151314
4. Omolola Bookshop 26, Lagos Abeokuta Motor Road Opp. Police Station
5. Rehoboth Bookshop Shop 25, Taibra Plaza Beside Ebenezer African Church
6. Stuzieh Bookshop 08055462781
7. Goodness Bookshop 08055609721

ABEOKUTA OUTLET

1. FolaBookshop 16, Ibara Road, Opp 1st Bank

IJEBU-ODE OUTLET

1. Ogunde Bookshop 12 Folagbade Street

SAGAMU OUTLET

1. Ola Oluwa Bookshop B1/11,3 Elega Street Ijokun
2. Owolewa Bookshop K1/3, Ijokun Street Sagamu

EDO STATE

BENIN OUTLETS

| | | | |
|-----|--------------------------|------------------------------|-------------|
| 1. | Goodman Bookshop | 1 Mission, Road, Benin City | 08034045925 |
| 2. | Aideyan Bookshop | 13, Mission Road, Benin City | 08080754155 |
| 3. | A.C Bookshop | 1, Mission Road. Benin | 08050939847 |
| 4. | Thimos and Bros Bookshop | 11, Mission Road, Benin City | 08052483392 |
| 5. | UNIBEN Bookshop | University of Benin | |
| 6. | A. A Jomos Bookshop | 3, Mission Road, Benin City | 08027631249 |
| 7. | CAS Bookshop | 3, Mission Road, Benin City | |
| 8. | Cen Brown Bookshop | Mission Road, Benin City | 08035881879 |
| 9. | UNICAN Bookshop | Mission Road, Benin City | |
| 10. | Ken Jones Bookshop | 3, Mission Road, Benin City | |
| 11. | Uncle Chris B/Shop | No 2, Ibiwe Street | 08033827661 |
| 12. | O.Z. Venture Bookshop | 216 Mission Road Benin City | 08068054558 |
| 13. | A.C. Bookshop | 1 Mission Road Benin-city | 08050939847 |
| 14. | Sunny Bookshop | 216 Mission Road Benin City | 08051618613 |
| 15. | Uwangu Bookshop | 2 Mission Rd Benin-city | |
| 16. | I.K. General Bookshop | 21 Ibiwe Street | |
| 17. | Feco Bookshop | Ibiwe Street Benin-city | |

DELTA STATE

WARRI OUTLET

| | | | |
|----|----------------------|--|-------------|
| 1. | Anuka Bookshop | 1, Robert Road, Warri Sapele | 08052241630 |
| 2. | Raf and Law Bookshop | 55, Warri Sapele Road, Warri | 08023282271 |
| 3. | Pofors Bookshop | 55, Warri Sapele Road, Warri | 08035750542 |
| 4. | Simko Bookshop | 49, Warri Sapele Road. | 08028929775 |
| 5. | Aloy Bookshop | 63, Warri Sapele Road, opp Warri main market | |

SAPELE OUTLETS

| | | | |
|----|--------------------|--|-------------|
| 1. | Delta Bookshop | 53A, Okpe Road, Sapele Delta State | 08035810906 |
| 2. | Pekason Bookshop | 57, Akintola Road, Sapele Delta State | 054-340147 |
| 3. | Fadamo Bookshop | 11, PH2 Main Market Sapele Delta State | 08063978230 |
| 4. | Iketson Bookshop | 70, Okpe Road | |
| 5. | God's own Bookshop | 34, Market Road, Sapele Delta State | |

ASABA OUTLET

| | | | |
|----|------------|--|--------------------------|
| 1. | Mr. Alfred | 63 Opp. D.L.A. Road Along Ibusa Rd Asaba | 08023863561, 08037757707 |
| 2. | Mr. Moses | 11, Madam Okada Str, Ezene Ave. Asaba | 08023160851 |

UGHELI OUTLET

| | | |
|----|----------------|--------------------------|
| 1. | C.K Bookshop | 52, Market Road Ugheli |
| 2. | Innoh Bookshop | 36, Old Lagos/Asaba Road |

AGBOR OUTLET

| | | | |
|----|------------------------|--|-------------|
| 1. | St Judex Bookshop | Opp. Catholic Church Agbor | 08034357438 |
| 2. | All Saint Bookshop | 19 Lagos/Asaba Road Opposite Str. John Ang Church. | 08037723644 |
| 3. | God-Time Bookshop | 147 Lagos/Asaba Road Opp Filling Station Agbor. | 08054857264 |
| 4. | United Modern Bookshop | Along Lagos/Asaba Road Agbor | |
| 5. | Standard Bookshop | Along Lagos/Asaba Road Agbor. | |
| 6. | Ambi Bookshop | Opp. Anglican Church Lagos Asaba Road | |

ABUJA

| | | | |
|-----|----------------------------|---|--------------------------|
| 1. | CSS Bookshop | Garki Abuja | |
| 2. | Community Bookshop | Abuja | |
| 3. | Mic Mac Bookshop | Garki Shopping Complex Abuja | |
| 4. | Amaz Bookshop | Horizo Plaza Wuse Zone 5 Abuja | 08053233514, 08044181343 |
| 5. | Odusote Bookshop | Wuse Zone 5 | 095-238239 |
| 6. | Academy Bookshop | Blk A2, Shop 3 Wuse Modern Market, Abuja | 08033141540 |
| 7. | Galaxy Bookshop | Blk II Shop 113 Wuse Modern Market, Abuja | 08053282403 |
| 8. | B. A. Continental Nig. Ltd | Blk II Shop 120 Wuse Modern Market, Abuja | 08033138878 |
| 9. | Roundtex Investment | Blk 7, Shop 75 Wuse Modern Market, Abuja | 08023257688 |
| 10. | Freddo Bookshop | Blk A, Shop 4 Wuse Modern Market, Abuja | 08027094628 |
| 11. | B.K.L Bookshop | i. Law School Road Bwari F.C. T. Abuja
ii. Opposite University of Abuja Gwagwalada F.C.T | |

ENUGU STATE

| | | | |
|----|-------------------------|--|-------------|
| 1. | IEC Office | 102, Nike Resort Way, Trans Ekulu Enugu. | 08035511469 |
| 2. | Ample Learning Bookshop | Ogbete Main Market Enugu | 08035451360 |

AKWA IBOM STATE

| | | | |
|----|-------------------|-------------------------------|--------------------------|
| 1. | Bonimac Nig. Ent. | 61, Wellington Bassey Way Uyo | 08036733381, 08026257559 |
|----|-------------------|-------------------------------|--------------------------|

ABIA STATE

ABA OUTLETS

| | | | |
|----|-------------------|----------------|--------------------------|
| 1. | Uche Ben Bookshop | Ariaria Market | 08059811092, 08037268259 |
| 2. | Charles Bookshop | Ariaria Market | 08033173940 |

UMUAHIA OUTLETS

| | | | |
|----|-----------------------|-----------------------------------|-------------|
| 1. | Ebony Central Booksho | 1, Club Road, Umuahia, Abia State | 08020618605 |
|----|-----------------------|-----------------------------------|-------------|

TARABA STATE

JALINGO OUTLETS

| | | | |
|----|---------------------|----------------------------------|-------------|
| 1. | O .T.C Bookshop | 168 Palace Way Jalingo | 08065848299 |
| 2. | Freedom Bookshop | 158 Palace Way Jalingo | 08037329578 |
| 3. | E.O.U Bookshop | No. 82 Barde Way opp TTV Jalingo | 08037329578 |
| 4. | Shalom Bookshop | 93 Barde Way Jalingo | |
| 5. | Standard Bookshop | 118 Palace Way Jalingo | |
| 6. | Love House Resource | 42 Donga Rd Opp NUT Jalingo | 08034795325 |

RIVERS STATE

PORT HARCOURT OUTLETS

| | | | |
|----|----------------------|------------------------------|--------------------------|
| 1. | IEC Office | 278, Aba Road, Port Harcourt | 08056034784, 08039202264 |
| 2. | St. Patrick Bookshop | Mile 1, Port Harcourt | |
| 3. | Okigbo Bookshop | Mile 1, Port Harcourt | |
| 4. | Emma Bros Bookshop | Mile 1, Port Harcourt | |
| 5. | Hymas Bookshop | Mile 3, Port Harcourt | |
| 6. | Uniport Bookshop | Uniport Port Harcourt | |

KANO STATE

| | | | |
|----|--------------------|---|----------------------------|
| 1. | Central Bookshop | Kano Sabo | |
| 2. | Zamani Bookshop | 84 Church Road Sabo Gari Kano | 08037043327 |
| 3. | Chrisking Ventures | 3 Bompai Str opp Central Hotel By Photo Palace. | 08034082215
08059770368 |

KADUNA STATE

| | | | |
|----|------------------|-----------------------------|--|
| 1. | Central Bookshop | Sabongari Kaduna | |
| 2. | Kola Bookshop | 7, Parki Road, P2 Sabongari | |

PLATEAU STATE

JOS OUTLETS

| | | | |
|----|----------------------|--|----------------------------|
| 1. | Central Bookshop | 24, Rwang Pam Street, | 08037199146 |
| 2. | Nuba Modern Bookshop | 16 Rwang Pam Str, Jos | 073-453607, 073-452923 |
| 3. | Eminent Bookshop | 29 Ahmadu Pam Street Jos | 08036358606 |
| 4. | A. Achison Bookshop | 23 Ahmadu Bello Way opp Modern Bookshop Rwang Pam Street Jos | 08037171357
08030877246 |
| 5. | Edwin | Jos | 08065342880 |
| 6. | Anason Bookshop | 46, Church Street, and 34, Langtang Street | |

IMO STATE

| | | | |
|----|---------------------------------|------------------------|--------------------------|
| 1. | Ideal Educational Book Co. Ltd. | 47, Okigwe Road Owerri | 08037065587, 083-2340731 |
|----|---------------------------------|------------------------|--------------------------|

GOMBE STATE

| | | | |
|----|-------------------------|-----------|--------------------------|
| 1. | Alberco Bookshop | Saboline | 08038803748, 08023776659 |
| 2. | Joetex Bookshopq | Sabo Line | 08036057044 |
| 3. | Qualitax Bookshop | Sabo Line | 08028910213 |
| 4. | Chydon Bookshop | Sabo Line | 08036123982 |
| 5. | Sunny Standard Bookshop | Sabo Line | 08036448719 |
| 6. | Call Kenny | Gombe | 08034670444 |

NASSARAWA OUTLETS

KEFFI OUTLET

| | | | |
|----|-----------------|---|-------------|
| 1. | Gabson Bookshop | Abubaka opp Turaki House Keffi | 08065945506 |
| 2. | B.K.L. Bookshop | i. Hassan Sadiq Shopping Complex-Abuja Rd Keffi
ii Suite B 202/203Royal Plaza, Mararaba Keffi. | 08023645554 |
| 3. | Joson Bookshop | | 08035872772 |

BAUCHI STATE

| | | | |
|----|---------------------------|---|-------------|
| 1. | Emma Bookshop | 1, Yandoka Road | 08023539612 |
| 2. | Collinmodern Bookshop | B511, Wunti Street, After gate | 08042695721 |
| 3. | Blessed Bookshop | B258, Wunti Street, opp Bauchi Area Court | 08036083604 |
| 4. | Chibest Bookshop | 259, Wunti Street, Opp Area Court | 08043128299 |
| 5. | Jonny Tex Modern Bookshop | B 267, Wunti Street, Opp upper Area Court | 08036172355 |
| 6. | Mac Annex Bookshop | 20 Yandoka Rd Bauchi | 08023622259 |
| 7. | Sunnytex Bookshop | B329 Wunti Street | 08036087639 |

ADAMAWA STATE

YOLA OUTLETS

- | | | | |
|----|------------------|-------------------------------------|-------------|
| 1. | Cliff Bookshop | 97, Bishop Street Jimeta , Yola | 08033641738 |
| 2. | Elegant Bookshop | 113, Bishop Street way Jimeta, Yola | 08025526508 |

KOGI STATE

- | | | | |
|----|-------------------------------------|---|-------------|
| 1. | Josco United International bookshop | (i) 60 Cantoment Qts opp , UBA Bank along
GBO Lokoja Kogi State
(ii) 24 Murtala Moh'd way opp, CSS Bookshop | 08036126871 |
|----|-------------------------------------|---|-------------|

YOBE STATE

DAMATURU OUTLET

- | | | | |
|----|-----------------|--|-------------|
| 1. | Olinco Bookshop | Maiduguri Road, beside Pama tun Yasasa, Yobe | 08036301725 |
|----|-----------------|--|-------------|

KWARA STATE

ILORIN OUTLET

- | | | | |
|-----|--------------------------|---|---------------------------|
| 1. | Lara Bookshop | Taiwo Road, Ilorin | 08033791053 |
| 2. | Sunshine Bookshop | 182, Taiwo Road | 08035808057 |
| 3. | Learners Bookshop | 2, G. P.O Shopping Complex near NITEL | 08033032810, 080321884633 |
| 4. | Rolex Educational B/shop | 200, Ibrahim Taiwo Road | |
| 5. | Edonichy Bookshop | 3A, Emir Road | |
| 6. | Solomon Bookshop | Ogo Oluwa Shopping Complex Sulu Gambari Road | |
| 7. | Uni ilorin Bookshop | Ilorin | |
| 8. | C.N Bookshop | 3A, Emir Road | |
| 9. | Big Joe Bookshop | (i) 71, Ibrahim Taiwo Road Ilorin
(ii) University of Ilorin, Permanent Site Blk 10 Shop 9 Ilorin | 08035869018 |
| 10. | Romanzous | 69, Taiwo Road Ilorin, Off Fire Bridge | 08036757694 |

EKITI STATE

ADO OUTLET

- | | | | |
|----|-------------------------|---------------------------------|-------------|
| 1. | Adusco Bookshop | Opp Ado Main Market Ado | 08035024342 |
| 2. | UNAD Bookshop | Ado | |
| 3. | Hope and Faith Bookshop | Ajilosun Street near Union Bank | 08033578834 |

ONDO STATE

AKURE OUTLETS

- | | | | |
|----|------------------------|------------------------|-------------|
| 1. | Arowolo Bookshop | Oba Adesida Road | 08033503078 |
| 2. | Toyin Bookshop | Oba Adesida Road | 08058112928 |
| 3. | FUTA Bookshop | | |
| 4. | Oyewole Bookshop | Oba Adesida Road | |
| 5. | Gracious Bookshop | OyemAkun Road | |
| 6. | Dim's New Era Bookshop | 26 Oyemekun Road Akure | 08033690619 |
| 7. | Enisco Bookshop | 74 Adesida Road Akure. | 08033906384 |

OWO OUTLET

- | | | | |
|----|-------------------|--------------------|--|
| 1. | Sola Bookshop | 23, Ododasa Street | |
| 2. | Ebenezer Bookshop | Ododasa Street | |

ORE OUTLETS

- | | | | |
|----|----------------------|---|--|
| 1. | Bola Bookshop | Along Total filling station | |
| 2. | Joseph igwe Bookshop | Beside 1st Bank Ore Market | |
| 3. | I.K More Venture | Along Okiti pupa Road Ore | |
| 4. | Muelak Bookshop | 54, Okitipupa Road beside Govt field Ore Ondo State | |

ONDO TOWN

- | | | | |
|-----|------------------|-------|--|
| 1. | Alaafia Bookshop | Odotu | |
| 2., | Beloved Bookshop | Odotu | |

OSUN STATE

OSOGBO OUTLETS

- | | | | |
|----|--------------------------|---------------------------|-------------|
| 1. | Omotoso Bookshop | 127, Station Road | |
| 2. | Sambest Bookshop | 7A, Awolowo Way | 08033931728 |
| 3. | G and P Bookshop | 120, Station Road | |
| 4. | Chuddy Champion Bookshop | 2 Alekuwode Okefia | |
| 5. | Aguns Bookshop | 83, Station Road | |
| 6. | Goodman Bookshop | 51 Alekuwado Str. Oshogbo | 08035019315 |

ILESHA OUTLET

- | | | | |
|----|-----------------|-----------------------------|-------------|
| 1. | Adelad Bookshop | B29 Okesa Street Osun State | 08034735674 |
|----|-----------------|-----------------------------|-------------|

ILE-IFE OUTLET

- | | | | |
|----|----------------|----------|-------------|
| 1. | O.A.U Bookshop | Ile -Ife | 08034071162 |
|----|----------------|----------|-------------|

OGBOMOSO OUTLETS

- | | | | |
|----|-------------------|--|--|
| 1. | Global Bookshop | Opp Nigeria Baptist Theologists Seminary | |
| 2. | Olodo Bookshop | Shop 3, Takie Square | |
| 3. | Okelerin Bookshop | Takie Square | |

OYO STATE

IBADAN OUTLETS

- | | | | |
|----|-------------------------------|---|----------------------------|
| 1. | Odusote Bookshop | Oke-Bola | 08023244573 |
| 2. | O.A.J. Bookshop | Dug be Market | 08056151510 |
| 3. | New Beginning Bookshop | 72, Coop Shopping Arcoda Opp. Afri Bank U.I | |
| 4. | University of Ibadan Bookshop | U.I | |
| 5. | Tunmod Unique Venture | | 08034532123 |
| 6. | Options Bookshop | B1 Gaaf Building, 110/112 Oyo Rd
Close to University of Ibadan Second Gate | 08023254743
08037250434 |

CROSS RIVER STATE

- | | | | |
|----|-----------------------|------------------------|-------------|
| 1. | CRA Superior Bookshop | 1, Hewett Str, Calabar | 08052014358 |
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