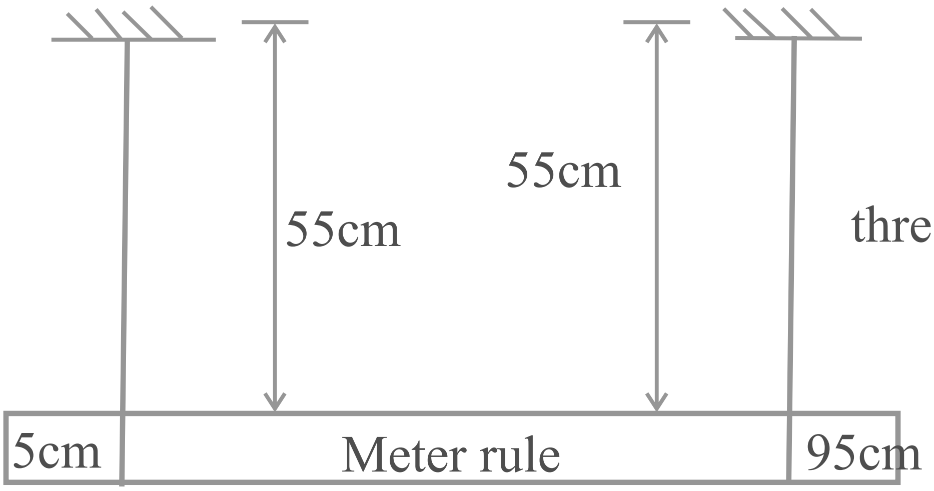
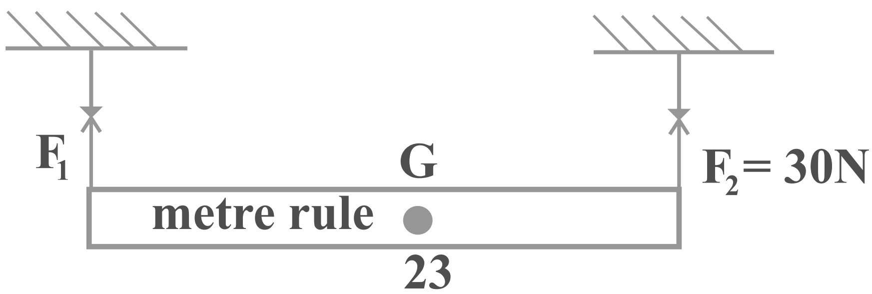
WASSCE JUNE (Class Activities 10)



(a)Adjust the metre rule and the supports so that the loops of the thread are at the 5.0cm marks and 95.0cm mark threads are always vertical as shown in the diagram. Oscillate the ends of the rule in opposite directions so that it rotates in a horizontal plane and determine the time t for 20 oscillations. Hence calculate the period T. Records the distance L between the loops. Repeat the experiment with the loops at the 10cm and 90cm, 15.0cm and 85.0cm, 20.0cm and 80.0cm, 25.0cm and 75cm marks. Determine T and record L in each case. Plot a graph with 1/T on the vertical axis and L on the horizontal axis. Deduce from your graph the value of L when T = 1.5s.
State two precautions you took to obtain accurate results.

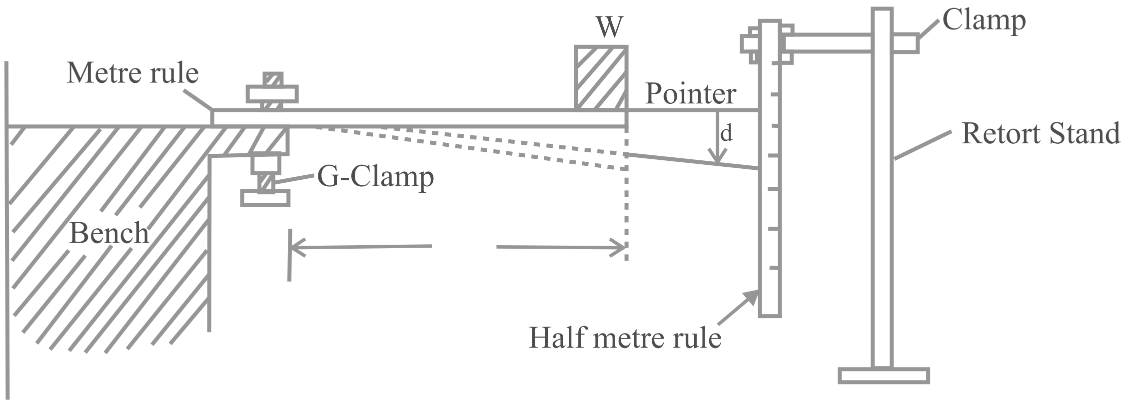
(b)(i) Explain what is meant by a couple and define the moment of a couple.
(ii) The diagram below shows a uniform metre rule is equilibrium under the action of the forces shown. If F_2 = 30N, calculate the weight of the rule and F_1.



GRAPH SHEET

SSCE 2001 *(Class Activities 11)*

(a)



(i) Clamp the metre rule to the edge of the bench at 90cm such that the projecting length, *l* from the beach is 90cm. Fasten the weight, W tightly with a rubber band at the free end of the rule.

(ii)Attach the optical pin under W to serve as a pointer.

(iii) Clamp the half-metre rule vertically near the pointer to measure the vertical depression, d of the loaded end of the rule.

(iv)Repeat the experiment with *l* = 80cm, 70cm and 60cm in each case determine d.

(v) Evaluate log *l* and log d.

(vi)Tabulate your results.

(vii) Plot a graph with log d as the ordinate and log *l* as the abscissa.

(viii)Determine the slope of your graph.

(ix) State two precautions you took to ensure accurate results.

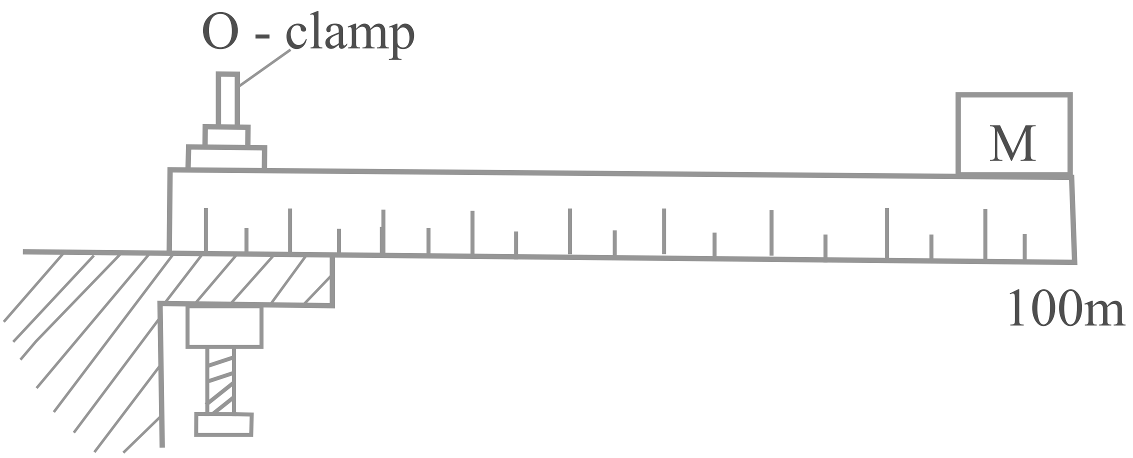
(b)(i) State the conditions of equilibrium when a body is acted upon by a number of parallel forces.

(ii)Using your graph, determine the depression d, when *l* = 65cm.

(iii) A body of mass 2.5kg is acted upon by a force of 20N. Calculate its acceleration.

GRAPH SHEET

WASSCE JUNE 1989 *(Class Activities 12)*



(a)Clamp the uniform meter rule supplied to the edge of the bench such that 90cm of the rule projects from the edge and the rule is capable of performing vertical oscillation as shown above.
With M = 50g foxed to the free end of the rule, deflect the rule so that it performs vertical oscillation and determine the time for 20 oscillations. Calculate the period T of oscillation. Evaluate T^2. Repeat the experiment for values of M = 100, 150, 200 and 150g. Determine the corresponding values of t, T and T^2 in each case. Tabulate your readings. Plot a graph of T against M starting both axes from the origin (0,0). Determine the slope and the intercept I of the graph.
State two precautions you took to obtain accurate results.

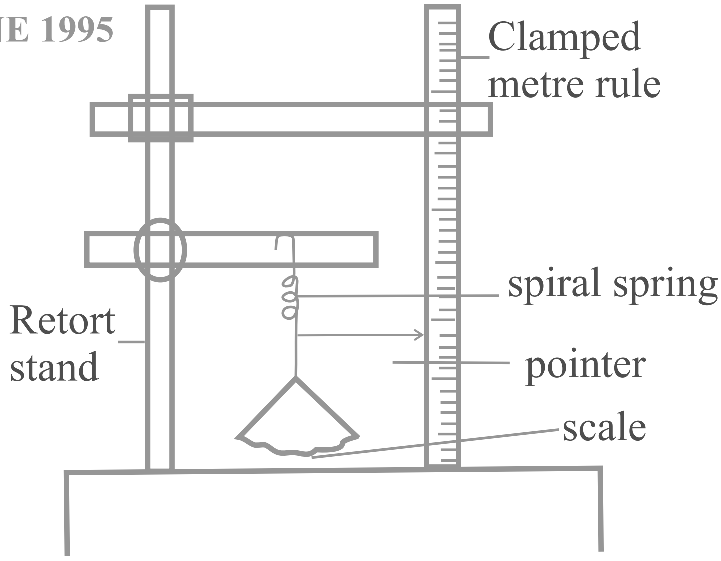
(b)(i) Define the moment of a force about a point
(ii) If R is the reaction form the bench m the mass of the meter rule and **M** the mass of the attached load, draw a force-diagram of the arrangement when the rule is in equilibrium and write down an equation relating R, m and M together, [Take g as the acceleration due to gravity].

(iii) Explain what is meant by stating that a body is in stable equilibrium.

GRAPH SHEET

(Class Activities 13)

WASSCE JUNE 1995



a) Suspend the given spiral spring vertically as shown in the diagram above. Attach a scale pan and note the position of the pointer on the metre rule. Add a mass m = 70g to the scale pan and note the new position of the pointer. Determine the extension *e* produced.

Repeat the experiment for m = 90, 110, 130 and 150g respectively. In each case determine the extension *e* produce. Ignore the mass of the scale pan and tabulate your readings. If a hanger is used both the masses of the hanger and the added slotted masses should be equal to 70, 90, 110, 130 and 150g.

Plot a graph with *e* on the vertical axis and m on the horizontal axis, starting both axes from the origin (0.0). Determine the slope of the graph and the intercept on the *e* axis. Also, determine the difference in the extension *x* when the mass increased from 100g to 150g.

State two precautions taken to ensure accurate results. With the load of 150g on the scale pan/ hanger, set the spring into small vertical oscillation and determine the time for 10 complete oscillations. Calculate the period T_1 of oscillation.

Repeat the experiment for a load of 100g and determine the corresponding period T_2 of oscillation. Evaluate the expression: $K = \frac{39.5x}{T^2 - T^2}$

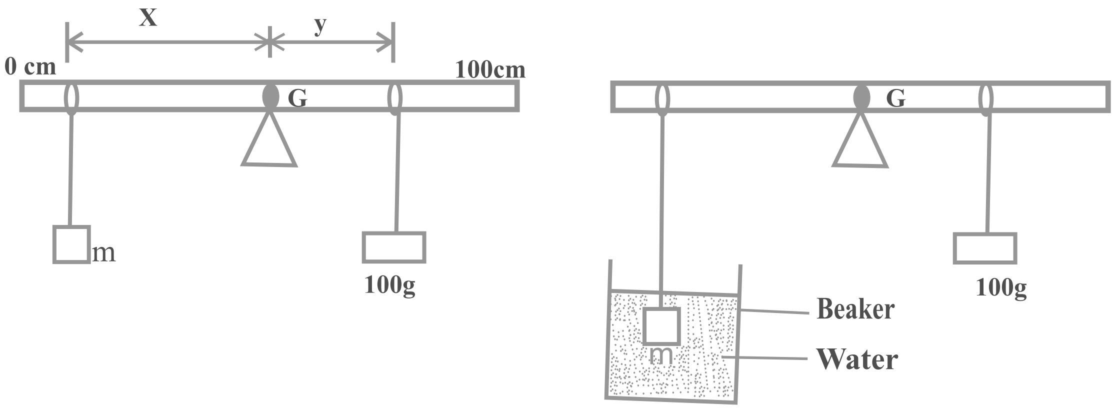
(b)(i) State Hooke's law.

(ii) Deduce the force constant of the spiral spring from the graph. (Take gas $10ms^{-2}$)

(iii) A spiral spring is compressed by 0.3m. Calculate the energy stored in the spring if its force constant is $300Nm^{-1}$

GRAPH SHEET

WASSCE JUNE 2002 *(Class Activities 14)*



Using the diagram above as a guide, carry out the following instructions.

i. Pivot the metre rule, which has been drilled at the 50cm mark, horizontally on the knife edge.

ii. Suspend object marked m at the 10cm mark of the metre rule.

iii. Suspend a 100g mass on the other side of the knife edge and adjust the position of the mass until the metre rule balances horizontally as shown in diagram (i) above.

iv. Read and record distances, X, of ***m*** from pivot and y_1 , of the 100g mass from the pivot.

v. Repeat the procedure for four other positions of ***m*** at the 15, 20, 25 and 30cm marks. In each case keep the position of the knife edge fixed and adjust the position of the 100g mass until the metre rule balances horizontally.

vi. Also repeat the procedure with ***m*** completely immersed in water contained in a beaker and suspend at the 10, 15, 20, 25 and 30cm marks of the metre rule respectively. In each case, adjust the position of the 100g mass until the metre rule balances horizontally, then read and record the new distance y_2 of the 100g mass from the pivot.

vii. Evaluate $y_1 - y_2$ in each case. Tabulate your readings.

viii. Plot a graph of y_1 on the vertical axis against $y_1 - y_2$ on the horizontal axis.

ix. Determine the slope of the graph

x. State two precautions taken to ensure accurate results.

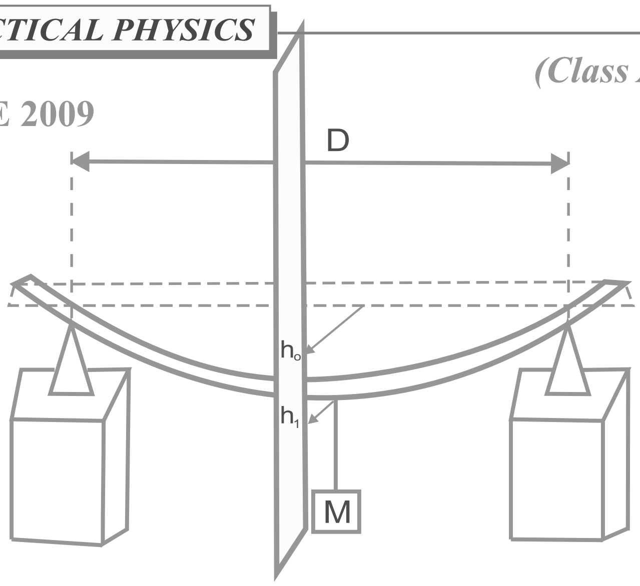
(b)i. Explain what is meant by the centre of gravity of a body and state how it is related the stability of the body.

ii. State the conditions of equilibrium for a body acted by a number of co-planar parallel forces.

GRAPH SHEET

(Class Activities 15)

WASSCE JUNE 2009



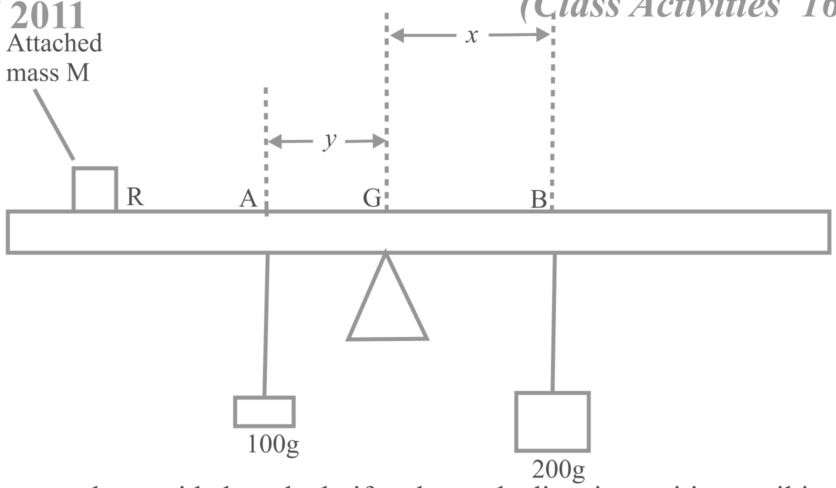
You are provided with two metre rule, two knife edges, optical pin, a known mass and other necessary apparatus.

1. Affix the optical pin at the 50cm mark of one of the meter rules supplied, with a cellotape plasticine.
2. Place the rule horizontally on the knife edges such that the knife edges are at the 17.5cm and 82.5cm marks. Record the distance D between the knife edges.
3. Mount the other metre rule vertically with the retort stand and clamp and place it close to the pin to measure the depressions of the metre rule when the weight M is suspended at its mid point.
4. Read and record the position h_o of the pointer on the vertically mounted metre rule, with no weight suspended on the horizontal metre rule.
5. Suspend M at the midpoint of the metre rule.
6. Read and record the new position of the pointer h_1
7. Determine the depression of the metre rule $H = h_1 - h_o$ Evaluate log H and log D.
8. Repeat the procedure with the knife edges set at 20.0 cm and 80.0cm; 22.5 cm and 77.5cm and 25.0cm and 75.0cm marks. Each time read and record the distance D and h_1
   1. Evaluate the depressions H in each case and log H and log D. Tabulate your readings.
   2. Plot a graph of log H on the vertical axis and log D on the horizontal axis.
   3. Determine the slope s, of the graph.
   4. State two precautions taken to ensure accurate results.

(b)(i) Define moment of a force about a point.
An object of mass 60g is suspended at the 16cm mark of a uniform metre rule.
The metre rule is adjusted on a pivot until it balances horizontally at the 38cm mark.
Determine the mass of the metre rule.

GRAPH SHEET

NECO JULY 2011 *(Class Activities 16)*



(i) Suspend the metre rule provided on the knife-edge and adjust its position until it balances horizontally.

(ii)Read and record the point of balance G of the metre rule. Keep the knife-edge at point G adhesive throughout the experiment.

(iii) Fix the object labelled M at a point R, the 10cm mark of the metre rule, using an adhesive.

(iv)Suspend the 200g mass at point B, the 65cm mark of the metre rule and record the length GB = x.

(v)On the other side of G, suspend the 100g mass and adjust its position until the metre rule balances horizontally as shown in the diagram above.

(vi)Read and record the position A of the 100g mass on the metre rule.

(vii) Record the length AG = y.

(viii) Evaluate Z = 2.5y.

(ix)Repeat the procedure, keeping the knife-edge at G, with the 200g mass suspended at the 67.5, 70, 72.5 and 77.5cm marks respectively. In each case, record the position A, distance x and the corresponding value of y. Also evaluate Z. Tabulate your readings.

(x)Plot a graph of Z on the vertical axis and x on the horizontal axis, starting both axes from the origin (0,0).

(xi) Determine the slope S of the graph and the intercept C_1 and C_2 on the vertical and horizontal axes respectively.

(xii)Evaluate K = 10S

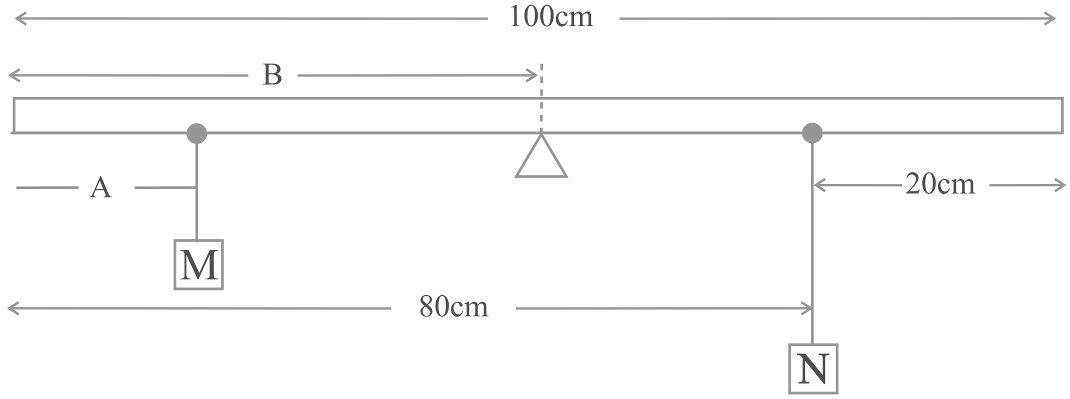
(xiii) State two precautions taken to ensure accurate results.

(b)(i) Define the *moment of a couple*.

(ii)State the conditions necessary to maintain the metre rule, in the experiment above, in equilibrium.

GRAPH SHEET

MAY/JUNE 2008 *(Class Activities 17)*



(a)You are provided with a uniform metre rule, a knife edge, some masses and other necessary apparatus.

(i) Determine and record the centre of gravity of the metre rule.

(ii)Fix the 100g mass marked N at a point Y, the 80cm mark of the rule using an adhesive.

(iii) Suspend another 100g mass marked M at X, a distance A = 10cm from the 0cm mark of the rule.

(iv)Balance the arrangement horizontally on the knife edge as shown in the diagram above.

(v)Measure and record the distance B of the knife edge from the 0cm mark of the rule.

(vi)Repeat the procedure for four other values A = 15, 20, 25 and 30cm.

(vii) Measure and record the corresponding values of B in each case. Tabulate your readings.

(viii) Plot a graph of B on the vertical axis against A on the horizontal axis.

(ix)Determine the slope, s, of the graph. Also determine the intercept, c, on the vertical axis.

(x)Evaluate (A) = $k_1 = \frac{1-2s}{s}\ 100$; (B) = $k_2 = \frac{2c}{s}\ 160$.

(xi)State two precautions taken to obtain accurate results.

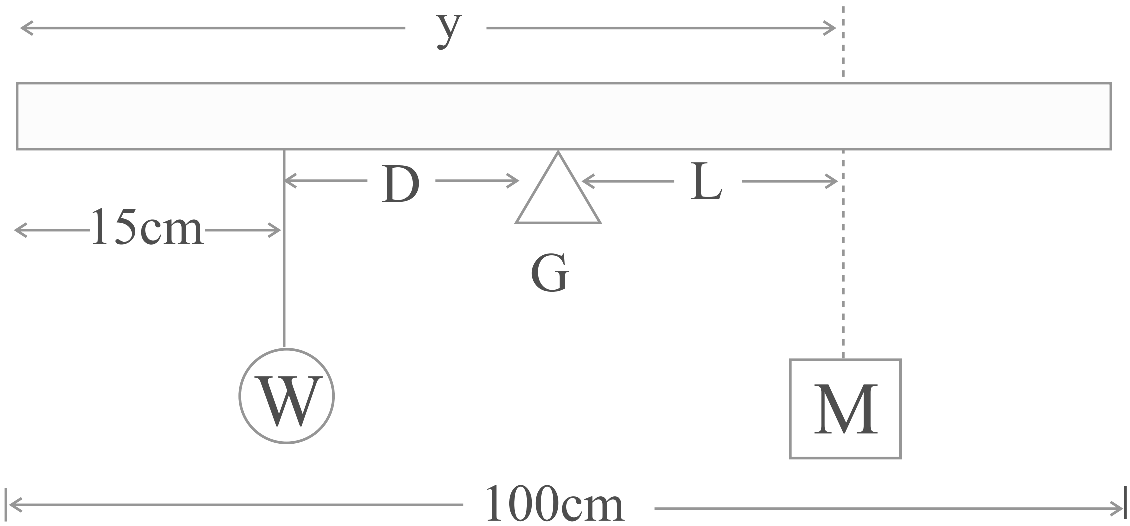
(b)(i) Define moment of a force about a point.

(ii)State two conditions under which a rigid body at rest remains in equilibrium when acted upon by the non-parallel coplanar forces.

GRAPH SHEET

MAY/JUNE 2008

(Class Activities 18)



M = 20g, 30g, 40g, 50g & 60g.

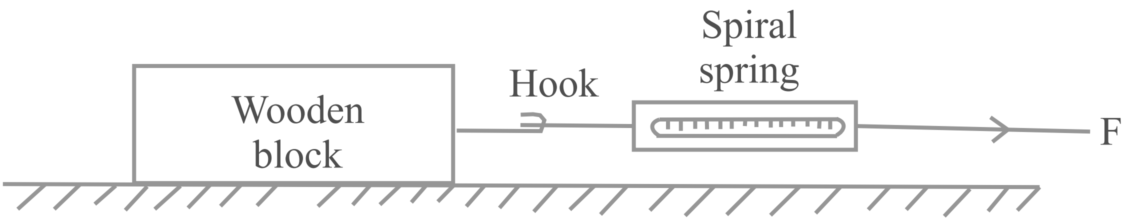
1. (a)You are provided with a uniform metre rule, a knife edge, masses and other necessary apparatus.
   - (i) Suspend the metre rule horizontally on the knife edge. Read and record the point of balance G of the metre rule. Keep the knife edge at this point throughout the experiment.
   - (ii)Using the thread provided, suspend the object labeled W at the 15cm of the metre rule.
   - (iii) Suspend a mass M = 20g on the other side of G adjust the position of the mass until the metre rule balances horizontally again.
   - (iv)Read and record the position Y of the mass M on the metre rule.
   - (v)Determine and record the distance L between the mass and G. Also determine and record the distance D between W and G.
   - (vi)Repeat the procedure for four values of M = 30, 40, 50 and 60g. In each case, ensure that W is kept constant at the 15cm mark and the knife edge at G.
   - (vii) Evaluate L in each case. Tabulate your readings.
   - (viii) Plot a graph of M on the vertical axis against L on the horizontal axis.
   - (ix)Determine the slope s, of the graph. Evaluate $\frac{s}{D}$

   (b)State two precautions taken to obtain accurate results
   - (i) State the principles of moments.
   - (ii)Define centre of gravity.

GRAPH SHEET

WASSCE JUNE 2011 *(Class Activities 19)*

(a)



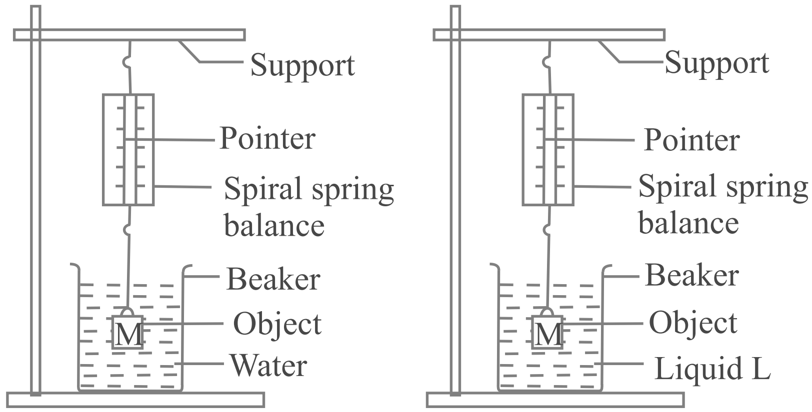
You are provided with a wooden block to which a hook is fixed; set of masses, spring balance and other necessary materials.
Using the diagram above as a guide, carry out the following instructions.

(i) Record the mass $\mathbf{m_0}$ indicated on the wooden block.
(ii)Place the block on the table.
(iii) Attach the spring balance to the hook.
(iv) Pull the spring balance horizontally with a gradual increase in force until the block just starts to move. Record the spring balance reading **F**.
(v) Repeat the procedure by placing in turn mass m = 200, 400, 600 and 800g on top of the block. In each case, read and record the corresponding value of **F**.
(vi)Evaluate $\mathbf{M} = \mathbf{m_0} + \mathbf{m}$ and $\mathbf{R} = \frac{\mathbf{M}}{100}$ in each case.
(vii) Tabulate your readings.
(viii) Plot a graph with **F** on the vertical axis and **R** on the horizontal axis.
(ix)Determine the slope, ***s***, of the graph.
(x) State two precautions taken to ensure accurate results.

(b)(i) Define *coefficient of static friction*.
(ii)A block of wood of mass 0.5kg is pulled horizontally on a table by a force of 2.5N.
Calculate the coefficient of static friction between the two surfaces. ($g = 10ms^{-2}$)

GRAPH SHEET

WASSCE JUNE 2012 *(Class Activities 20)*



Study the diagrams above and use them as guides in carrying out the following instructions.

(I) Using the spring balance provided, determine the weight of object of mass **M** = 50.0g in air. Record this weight is W_1.

(ii) Determine the weight of the object when it is completely immersed in water contained in a beaker as shown in the diagram above. Record the weight as W_2.

(iii) Determine the weight of the object when it is completely immersed in the liquid labelled **L**. Record the weight as W_3.

(iv) Evaluate $U = (W_1 - W_2)$ and $V = (W_1 - W_3)$

(v) Repeat the procedure with the objects of masses M = 100g, 150g, 200g and 250g

(vi) In each case evaluate $U = (W_1 - W_2)$ and $V = (W_1 - W_3)$.

(vii) Tabulate your readings.

(viii) Plot a graph with V on the vertical axis and U on the horizontal axis.

(ix) Determine the slope, s, of the graph.

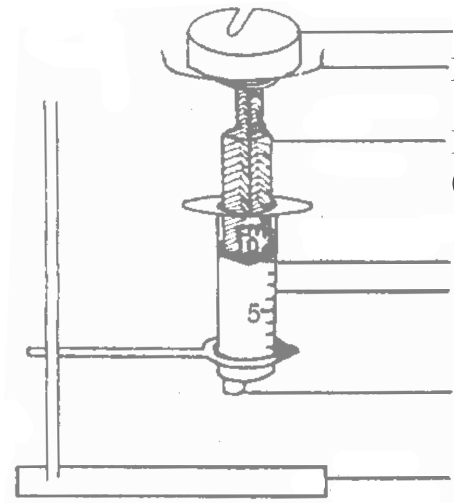
(x) State **two** precautions taken to ensure accurate results.

b(I) State Archimedes' principle

(ii) A piece of brass of mass 20.0g is hung on a spring balance from a rigid support and completely immersed in kerosene of density 8.0×10^2 kgm^{-3}. Determine the reading on the spring balance. ($g = 10$ ms^{-2}, density of brass = 8.0×10^2 kgm^{-3})

GRAPH SHEET

WASSCE JUNE 2012 *(Class Activities 21)*



You are provided with a syringe, a petri-dish firmly attached to the base of the movable piston (plunger) of the syringe, a set of weights and other necessary apparatus.

(I) Pull the piston of the syringe upward until it can no longer move. Read and record this position of the piston on the graduated mark on the syringe as V_o.

(ii) Clamp the syringe and ensure that it is vertical.

(iii) Place a mass **M** = 500g gently at the centre of the petri-dish.

(iv) Read and record the new position of the piston as V.

(v) Evaluate V^{-1}

(vi) Repeat the procedure for four other values of M = 1000g, 1500g, 2000g and 2500g.

(vii) Tabulate your readings.

(viii) Plot a graph with V^{-1} on the vertical axis and **M** on the horizontal axis, starting both axis, starting both axes from the origin (0,0).

(ix) Determine the slope, s, of the graph.

(x) Evaluate $k = s^{-1}$

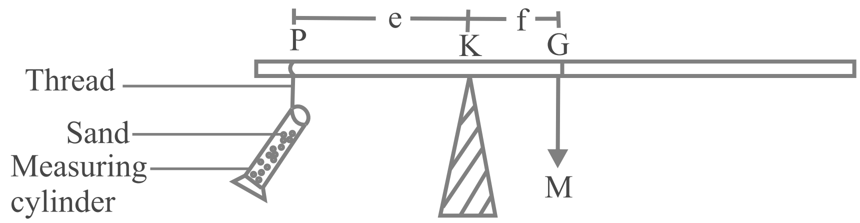
(xi) State two precautions taken to ensure accurate results.

b(I) When a weight is placed on the petri-dish which quantities of the gas in the syringe ($\propto$) increases; (β) decreases?

(ii) What is responsible for the pressure exerted by a gas in a closed vessel?

GRAPH SHEET

WASSCE JUNE 2013 *(Class Activities 22)*



You are provided with a uniform metre rule of mass M indicated on its reverse side, a knife edge, a graduated measuring cylinder of known mass,m1 marked on it and other necessary apparatus.

(I) Read and record the values of **M** and m_1.

(ii) Balance the metre rule horizontally on the knife edge. Read and record the balance point as G.

(iii) Tie a loop of thread round the neck if the measuring cylinder.

(iv) Fill the cylinder with the sand provided to the $2cm^3$ mark. Record the volume, V, of the sand.

(v) Hang the cylinder at the 2cm mark of the metre rule and adjust the position of the knife edge until the rule balances horizontally.

(vi) Read and record the new balance position **K**.

(vii) Determine the values of e and f

(viii) Determine the mass, m_2 of the sand in the measuring cylinder.

Hint: $M_2 = \left(\frac{M \times f}{e}\right) - M_1$

(ix) Repeat the procedure by filling the measuring cylinder to the mark V = 4, 6, 8 and $10cm^3$. In each case, ensure that the measuring cylinder is kept constant at the 2cm mark on the metre rule

(x) Tabulate your readings

(xi) Plot a graph with m2 on the vertical axis and V on the horizontal axis

(xii) Determine the slope, s, of the graph

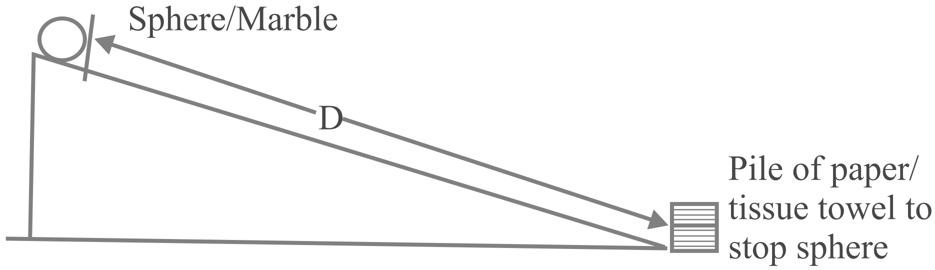
(xiii) State two precautions taken to ensure accurate results.

b(I) Determine the mass of $7.5cm^3$ of the sand using your graph.

(ii) A gold coin of mass 102.0g has uniform cross-sectional area of $10.0cm^2$. Calculate its thickness. [Density of gold = $19.3g\ cm^{-3}$]

GRAPH SHEET

WASSCE JUNE 2014 *(Class Activities 23)*



You are provided with a grooved inclined plane, a solid sphere, stopwatch and other necessary materials.

(I) Place the pile of paper towels at the tail end of the inclined plane to stop the sphere from rolling off the table.

(ii) Release the sphere from a point at distance **D** = 140cm from the tail end of the inclined plane.

(iii) Determine the average time t taken by the sphere to cover this distance.

(iv) Evaluate $\mathbf{W} = \frac{\mathbf{D}}{\mathbf{t}}$

(v) Calculate $\mathbf{V} = \mathbf{2W}$

(vi) Repeat the procedure for four other values of D = 120cm, 100cm, 80cm and 60cm respectively.

(vii) Tabulate your readings.

(viii) Plot a graph with **V** on the vertical axis and **t** on the horizontal axis.

(ix) Determine the slope, s, of the graph.

(x) What is the significance of s?

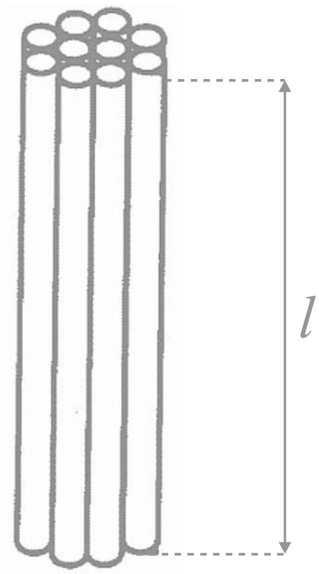
(xi) State two precautions taken to obtain accurate results.

b(i) Write the equation for the velocity ratio of an inclined plane, giving the meanings of the symbols used.

(ii) An object of mass 5kg is placed on a plane inclined at an angle of 30^o to the horizontal. Calculate the force on the object perpendicular to the plane when the object is at rest. [$g = 10ms^{-2}$]

GRAPH SHEET

CAMBRIDGE Oct/Nov. 2006 *(Class Activities 24)*



In this experiment you are to determine the density of a type of wood. Record your observations.

You are provided with a bundle of wooden rods. You have access to a balance.

Carry out the following instructions, referring to the above diagram.

(a) Measure and record the mass *m* of the bundle of wooden rods.

(b) Measure and record, in cm, the lengths of a sufficient number of the rods to enable the average length to be calculated.

(c) Calculate the average length *l*. Show your working.

(d) Use the metre rule and the piece of string provided to determine the circumference *c*, in cm, of the bundle of rods.

(e) Calculate the volume *V* of the bundle of rods using the equation

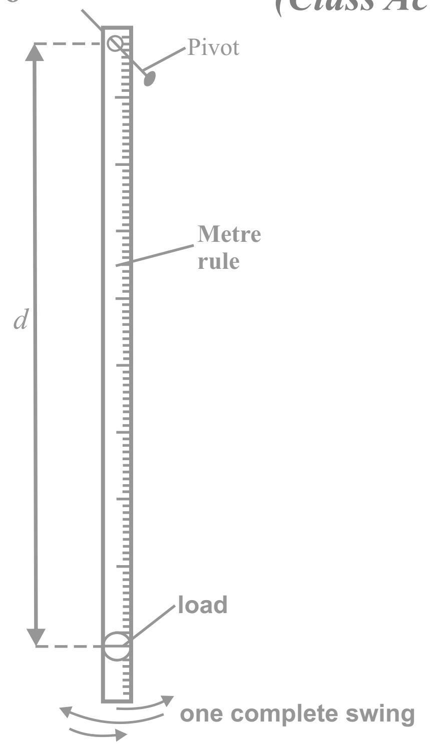
$$V = \frac{c^2 l}{4p}$$

(f) The equation used in (**e**) assumes that the bundle is a solid cylinder. However there are air gaps between the rods. Consider your value of the volume *V* of the bundle of rods and estimate the total volume V_r of the rods themselves.

(g) Calculate the density *d* of the wood using the equation

$$d = \frac{m}{V_r}$$

CAMBRIDGE Oct/Nov. 2006 *(Class Activities 25)*



In this experiment you are to investigate the swing of a loaded metre rule. Record all your observations Carry out the following instructions referring to the figure above. The loaded metre rule has been set up for you.

(a)Adjust the position of the load attached to the metre rule so that its centre is 90.0cm from the pivot.

(b)Displace the rule a small distance to one side and allow it to swing. Measure and record the time *t* taken for 10 complete swings. A complete swing is shown in the figure above

(c)Calculate the time *T* taken for one complete swing.

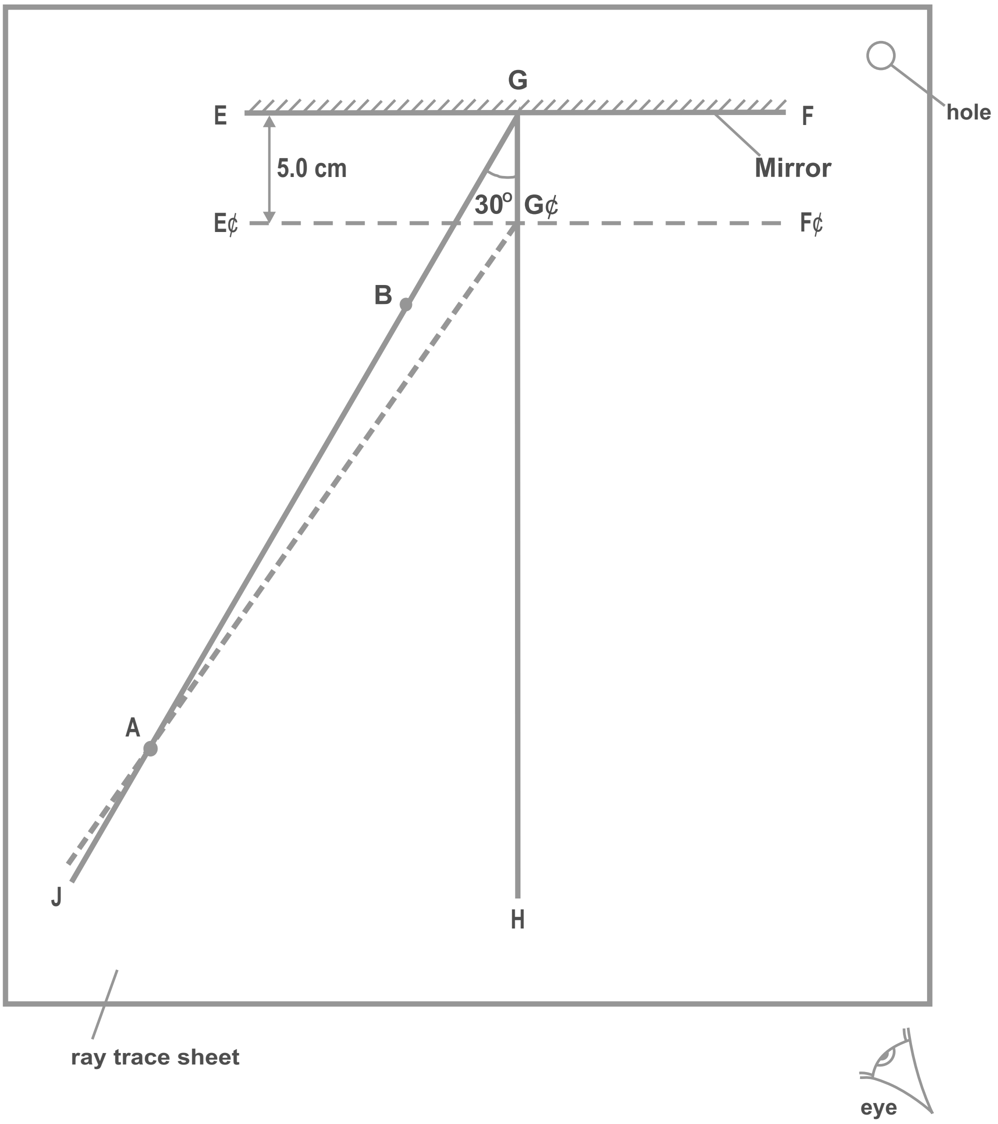
(d)Repeat steps (**a**) - (**c**) to obtain a total of five sets of readings. Use values of d of 85.0cm, 80.0cm**,** 75.0cm and 70.0cm.

(e)plot a graph of T/s (y-axis) against d/cm (*x*-axis).

(f) A student suggests that *T* is proportional to *d*. State whether your results supports this suggestion and give a reason for your answer.

(g)Suggest one way that you could improve the accuracy of your results. (You are **not** asked to carry out any additional experimental work.)

CAMBRIDGE Oct/Nov. 2006 *(Class Activities 26)*



In this experiment you are to investigate reflection in a plane mirror. Record all your observations. Carry out the following instructions referring to the diagram above

(a)Draw a straight line **EF** across the ray trace sheet, about 5cm from the top of the sheet.

(b)Draw a normal **GH** to line **EF** so that point **G** is approximately at the centre of line **EF**.

(c)Draw a line **GJ** at an angle of 30° to the normal as shown above

(d)Mark a point **A** on line **GJ** so that the distance **AG** is 11.5cm.

(e)Place the ray trace sheet on the pin board. Place the mirror so that its front surface stands along the line **EF**.

(f) Push a pin P_1 into the surface at point **A**.

(g)Push another pin P_2 into the surface at a point on **GJ** closer to the mirror. Label this point **B**.

(h)View the images of the pins P_1 and P_2 from the direction indicated in the figure above. Push two pins P_3 and P_4 into the surface between your eye and the mirror so that P_3, P_4 and the images of P_1 and P_2 appear exactly one behind the other.

(i) Mark the positions of pins P_3 and P_4 on the ray trace sheet with letters **C** and **D**. Remove the pins and the mirror. Using a rule, draw a line joining **C** and **D** and continue this line to meet the line **EF**.

(j) Measure and record the angle of reflection r_1 between lines **GH** and **CD**.

(k)Draw a line **E¢F¢** that is parallel to and 5.0cm below line **EF**. (See diagram above.) Label the point **G¢** where the normal crosses line **E¢F¢**.

(l) Draw a line from **G¢** through the point **A**. (See diagram above)

(m) Place the ray trace sheet on the pin board. Place the mirror so that its front surface stands along line **E¢F**.

(n)Push a pin P_1 into the surface at point **A**.

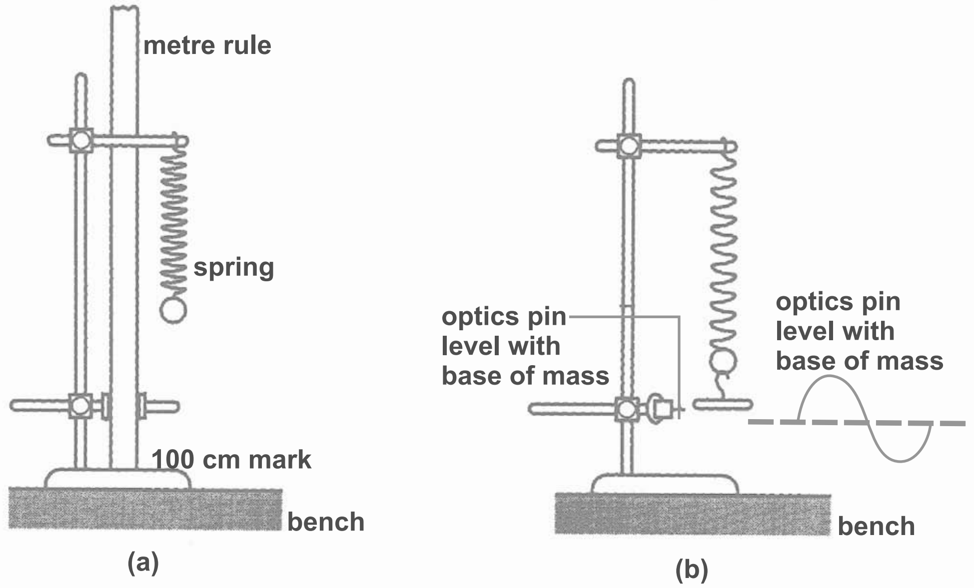
(o)Push another pin P_2 into the surface on line **AG¢** closer to the mirror. Label this point **B¢**.

(p)Repeat steps **(h)** and **(i)**, marking the pin positions **C¢** and **D¢**. Draw a line joining **C¢** and **D¢** that continues to meet the line **E¢F¢**.

(q)Measure and record the angle of reflection r_2 between lines **GH** and **C¢D¢**.

(r) State whether it is best to view the tops, bases or central parts of the pins in order to obtain accurate results for this experiment. Give a reason for your answer.

CAMBRIDGE Oct/Nov. 2006 *(Class Activities 27)*



In this experiment, you will measure the extension of a spring when a mass of 300g is suspended from it. You will also determine the period of oscillation of the mass on the spring. Record your answers on your answer sheet.

(a)Suspend the spring from the clamp, and support a metre rule vertically close to the spring as shown in the figure above

(b)Suspend a mass of 300g from the end of the spring. Take and record measurements to determine the extension e of the spring.

(c)Remove the metre rule and clamp the optics pin in the cork horizontally, level with the base of the mass and to the side, as shown above. Pull the mass down approximately 2cm and release it. The mass will perform vertical oscillations. One complete oscillation of the mass is shown in (b) above. Take and record measurements to determine the period *T* of oscillation of mass.

(d)calculate the acceleration of free fall *g* using

$$g = \frac{4\pi^2 e}{T^2}$$

CAMBRIDGE Oct/Nov. 2001 *(Class Activities 28)*

A chemical known as polyacrylamide can be obtained in the form of small off-white granules. The size of the granules is between 0.5 mm and 2 mm.

When immersed in water, the chemical absorbs water but does not dissolve. Each tiny piece of the substance swells up becomes a piece of transparent gel. The manufacturer says that each piece of polyacrylamide absorbs 400 times its own mass of water.
If this figure were correct, then 1 g of the substance would absorb 400g of water.

A student attempts to check the manufacturer's claim and performs the following experiment. Some pieces of the chemical are weighed in a dry container. They are then immersed in drinking water for 2 hours. The surplus water is drained away and the pieces of the gel are put in a dry container and weighed. The mass of the gel and the mass of the dry substance are determined and the ratio

$$R = \frac{\text{mass of gel}}{\text{mass of polyacrylamide}}$$

is calculated. *R* is a measure of the mass of water absorbed by 1g of polyacrylamide. The readings obtained are given in the tables.

Experiment (i) using drinking water.

mass of polyacrylamide		
mass of container/g	mass of container plus polyacrylamide/g	mass of polyacrylamide/g
2.07	2.58	

Mass of gel obtained		
Mass of Container/g	mass of container plus gel/g	mass of gel/g
20.01	67.06	

(a)Complete the third column of the two tables above.

(b)Calculate R for this experiment.

(c)**Experiment (ii)**

The experiment is repeated using drinking water and common salt to make a saturated salt solution.

Experiment (iii)

The experiment is repeated again, this time using purified water. Drinking water contains dissolved substances, some of these are removed when making purified water.

Experiment (iv)

The experiment is repeated again, this time using deionised water. This water is used in car batteries.

For each experiment, the corresponding value of R is determined. The values are given in the table below.

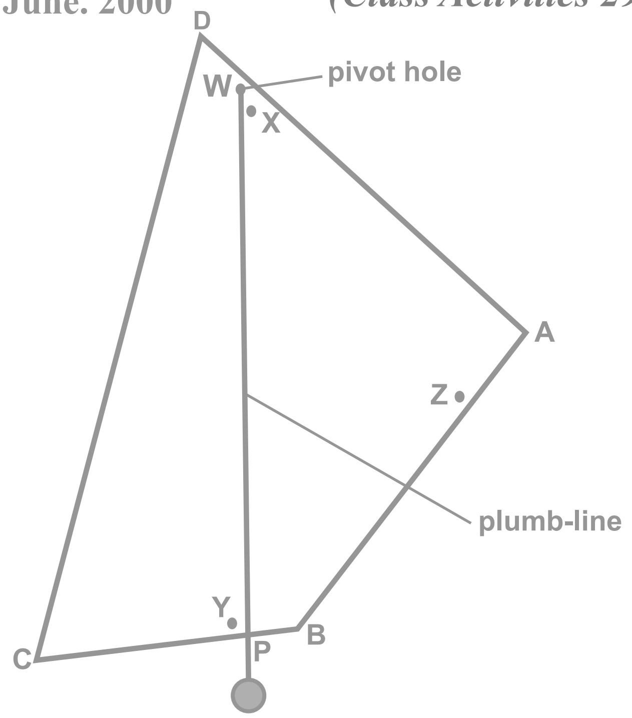
'Water' used	R
Saturated salt solution	22.3
Drinking water	
Purified water	196
Deionised water	301

(i) Complete the table using your answer from **(b)**.

(ii)write a conclusion to this experiment. In your conclusion, draw attention to the factor that increases the amount of water absorbed by 1g of polyacrylamide.

(iii) The manufacturer obtains a value for *R* of 400. Suggest a reason why this value is much higher than the value obtained in this experiment.

CAMBRIDGE May/June. 2000 *(Class Activities 29)*



In order to determine the centre of mass of a card ABCD, the card is hung from a hole near the corner at the point W. A plumb-line is also hung from the same support and the card is marked at a point P, on the line BC, behind the plumb-line.
This is illustrated in the diagram above

The card is removed from the support and a line drawn from W to P.

(a)Explain the following points:

- (i) why the card should move freely on the pivot,
- (ii) the position of your eyes when looking at the plumb-line,
- (iii) why the plumb-line should hang so that it almost touches the card.

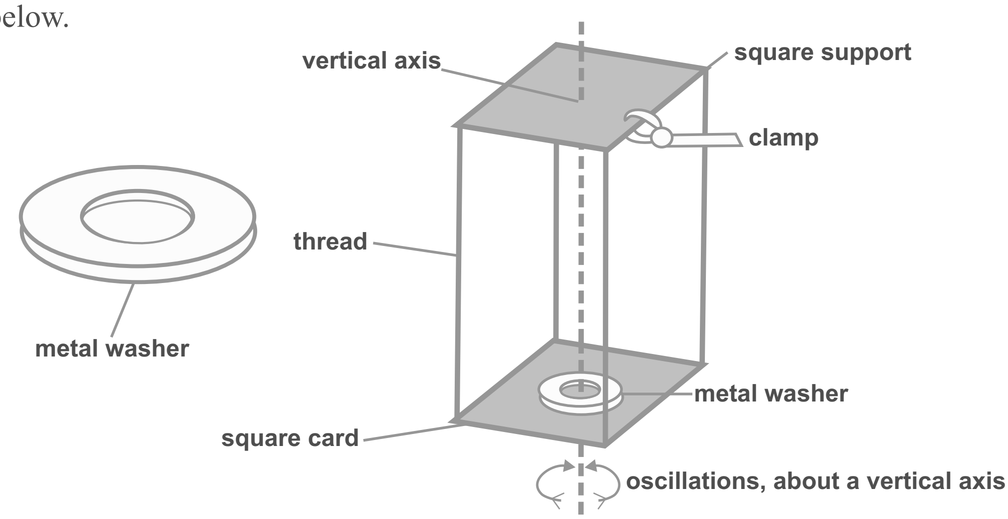
You may draw a diagram if you wish.

(b)In order to locate the position of the centre of mass of the card, the card is hung from a second point and the experiment is repeated.
The card may be hung at point X or point Y or point Z.

Which point would you choose? Give a reason for your choice.

CAMBRIDGE May/June. 2000 *(Class Activities 30)*

A metal washer is placed in the middle of a square card. The card is supported by four vertical threads hanging from a square, held in a clamp, as illustrated in the diagram below.



The lower card is slightly rotated about the vertical axis and , when released, the card begins to oscillate. The time *t* for *N* complete oscillations is determined. The period *T* for one oscillation is calculated. The experiment is repeated with a different number W of washers placed on top of the first. In all, six experiments are performed for *W* = 0, 1, 2, 3, 4 and 5 washers of the same size.

(a)Draw up a carefully labelled table, suitable for your laboratory notebook, in which you could record the values of *W*, *N*, t and *T*.

(b)Below is shown a graph of the period *T* plotted against the number *W* of washers.

(i) when doing the experiment, 40 oscillations are timed. Discuss the reason for timing 40 oscillations. In your answer, you should make some comment about the value of T for W = 5 washers.

(ii) The number W of similar washers is plotted along the x-axis. What other physical property of the washers increases as W increases?

(c)A different set of washers is used in order to repeat the investigation.

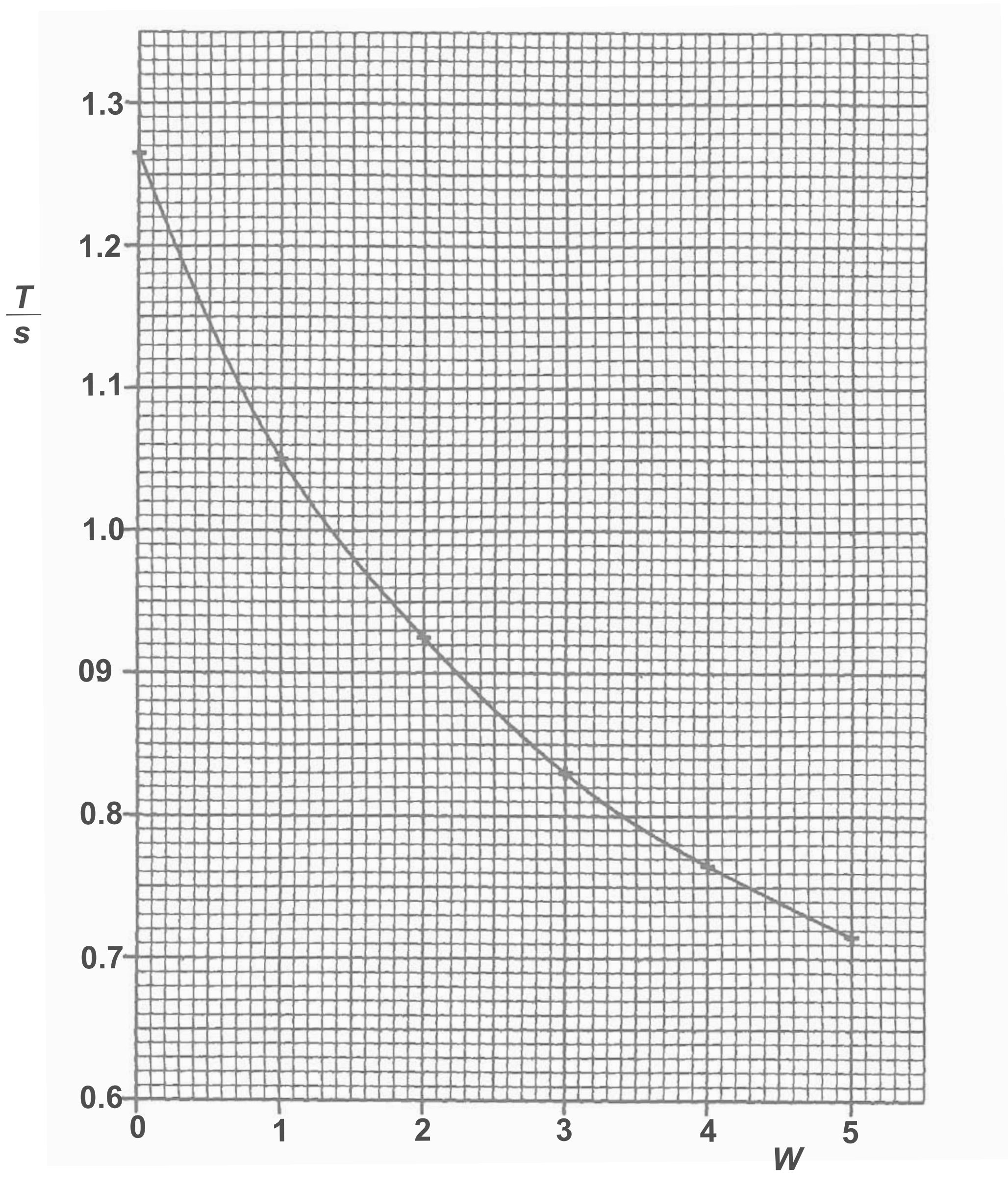
Compared with the first set, the different washers

(i) are made of the same material.

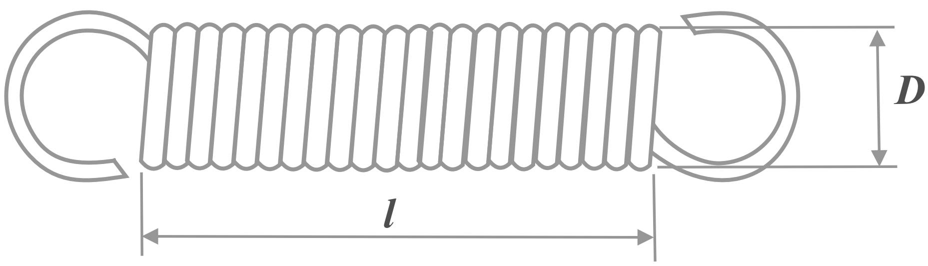
(ii)have the same inner and outer radius.

(iii) are only half as thick.

What is the value of the period *T* when 5 of the new (thinner) washers are on the lower card?


1.3
1.2
T
s
1.1
1.0
09
0.8
0.7
0.6
0
1
2
3
4
5
W

CAMBRIDGE Oct/Nov. 2005 *(Class Activities 31)*



In this experiment you will make some measurements on a steel spring in order to find an approximate value for the density of the material of the spring.
You have been provided with a steel spring, a 30 cm rule and two set squares.
You have access to a balance.

(a)Ensure that the turns of the spring are pushed together and measure the length l of the coiled part of the spring, as shown above. Record the length l on your Answer Booklet.

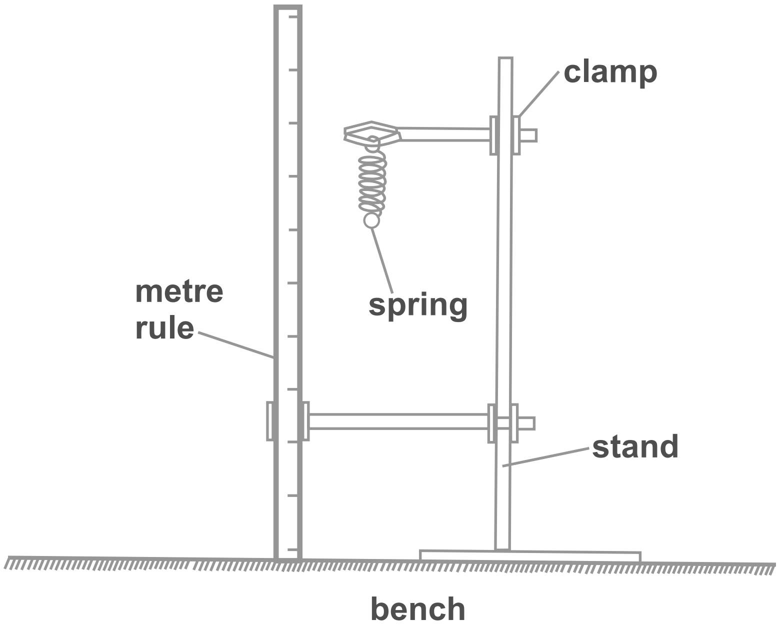
(b)Count the number N of turns in the coiled part of the spring.

(c)Determine the diameter D of the spring.

(d)Use the balance to measure the mass M of the spring. Hence determine an approximate value for the density of the material from which the spring is made, given that

$$\text{approximate density} = \frac{4MN}{\pi^2 l^2 D}$$

CAMBRIDGE Oct/Nov. 2005 *(Class Activities 32)*



In this experiment you will measure the extension of a spring caused by the weight of a mass, when the mass is suspended in air and when the mass is immersed in water. From these measurements you will determine the density of the material of the mass.

You have been provided with a spring, a stand with two clamps, a metre rule, a beaker containing water and a 500g mass.

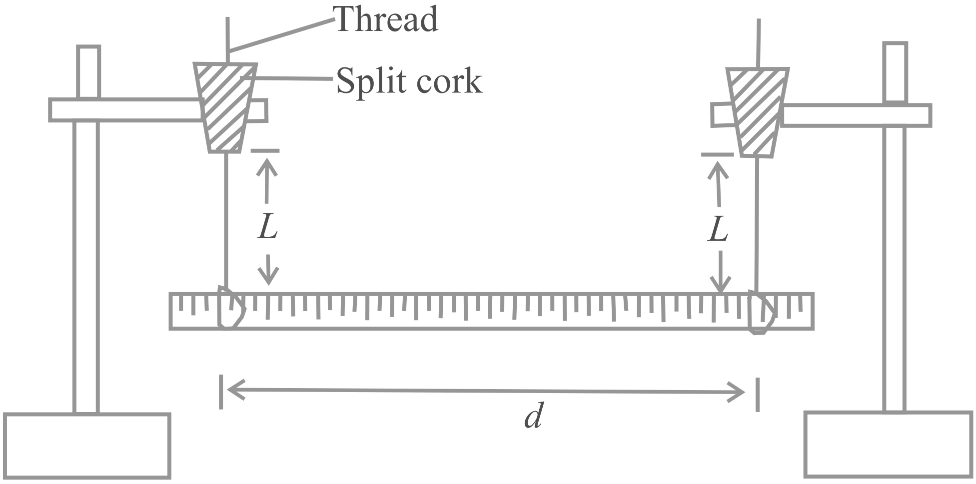
(a)Suspend the spring from the clamp on the stand. Clamp a vertical metre rule close to the spring, as shown above.
Determine the extension e_1 of the spring when the 500g mass is suspended from the spring.
Record your answer on your Answer Booklet. Describe with the aid of a diagram how the extension e_1 was determined.

(b)By carefully raising the beaker under the mass, determine the new extension e^2 of the spring when the 500g mass is completely under water. The mass must not be touching the sides or base of the beaker.

(c)Determine the density P of the material from which the mass is made, given that

$$P = \frac{e_1}{e_1 - e_2} \times 1.00 \text{ g/cm}^3$$

(NECO JULY, 2008) ***(Class Activities 33)***



(i) Tie one end of the strings provided to the uniform metre rule at the 5.0cm mark and one end of the other string to the rule at the 95.0cm mark. Determine the distance *d* between the loops.

(ii) Suspend the rule horizontally, as shown in the diagram above, with its graduated face upwards, ensuring that the strings are vertical and of equal length L = 55.0cm.

(iii) Displace the ends of the rule slightly in opposite directions and release so that the rule performs small angular oscillations in a horizontal plane about a vertical axis through its centre. Determine the time *t* for the rule to complete 20 oscillations. Hence, calculate the period *T* of oscillation. Evaluate T^{1}

(iv) Repeat the procedure with the loops of thread at 10.0 and 90.0cm, 15.0 and 85.0cm, 20.0 and 80.0cm and 25.0 and 75.0cm marks respectively, keeping the strings vertical throughout. In each case, determine and record the corresponding values of *d*, *t* and *T*. Also evaluate T^{-1}. Tabulate your readings.

(v) Plot a graph of d on the vertical axis and T^{-1} on the horizontal axis.

(vi) Determine the slope S of the graph.

(vii) State TWO precautions taken to ensure accurate results.

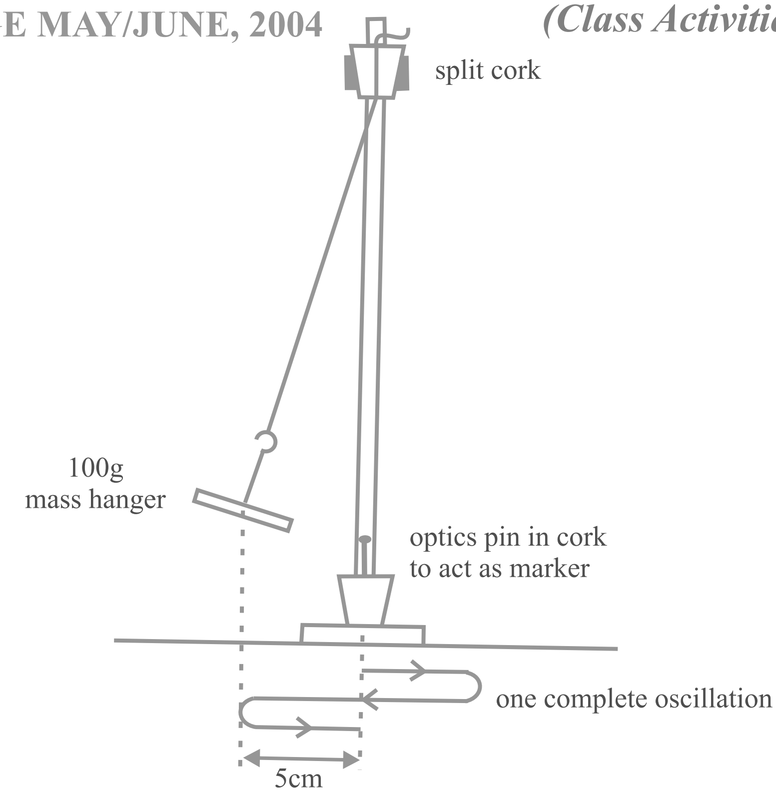
(b) (i) If the mass of the metre rule M = 150g and the length of the thread L = 55cm in the experiment above, use your graph to determine *I*, given that $I = \frac{Mg}{157.95L}(dT)^2$

(Take g = 10ms^{-2})

(ii) What is a couple? State TWO of its applications.

GRAPH SHEET

CAMBRIDGE MAY/JUNE, 2004 *(Class Activities 34)*



In this experiment, you will compare the times of oscillation of two pendulums.
You have been provided with a 100g mass hanger suspended from a clamp and stand, two further 100g masses, a stopwatch and a marker to mark the centre of the oscillation.

(a)Place the marker at the centre of the oscillation. Displace the mass hanger about 5cm to the side so that it starts to oscillate from side to side. One complete oscillation of the mass hanger is illustrated above. Determine the time t_1 for 10 complete oscillations of the mass hanger. Record your result.

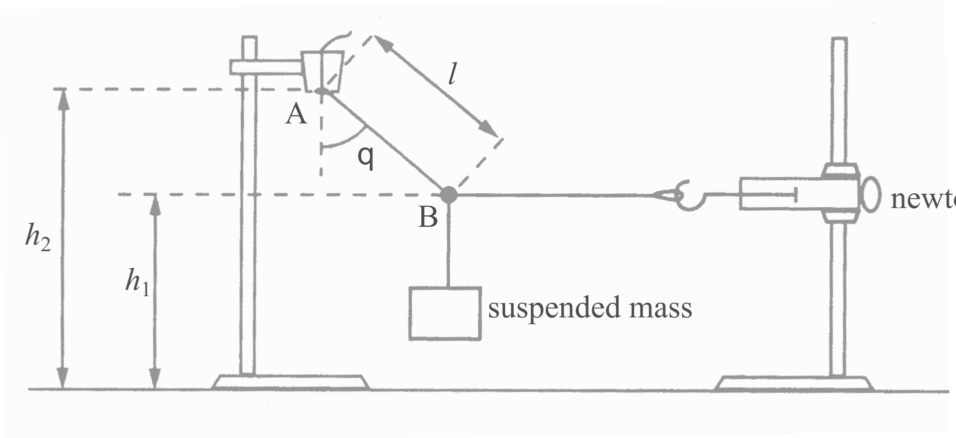
(b)Hence calculate the time T_1 for one complete oscillation.

(c)Without adjusting the length of the string, place the two 100g masses onto the mass hanger so that a total mass of 300g is suspended from the clamp and stand. Repeat part (a) of the experiment in order to determine the time t_2 for 10 complete oscillations of the 300g mass. Hence calculate the time T_2 for one complete oscillation of the 300g mass.

(d)State the likely uncertainty in your measurement of t_1

(e) Write a conclusion based on your results for t_1 , t_2 and the uncertainty.

CAMBRIDGE OCT/NOV. 2004 *(Class Activities 35)*



In this experiment, you will determine the weight of a suspended mass by using vector addition.

You have been provided with a mass suspended from a clamp and stand, a newton meter, a second clamp and stand, a metre rule and a set square.

(a) Attached to your apparatus at point B is a length of string with a loop at the other end, as shown above. Pass the hook of the newton meter through the loop. Clamp the newton meter horizontally. Adjust the height of the newton meter and the separation of the clamps until the apparatus is set up as shown above and the reading on the newton meter is approximately 0.8N. Record the newton meter reading on your answer booklet.

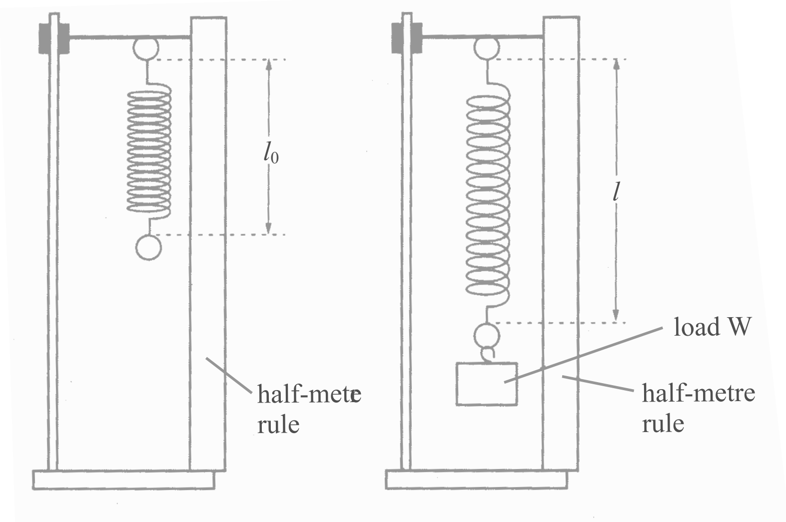
(b) Measure and record the vertical heights h_1 and h_2 shown above. Also measure and record the length l between the two points A and B.

(c) Explain, with the aid of a diagram, how you ensured that the heights measured in (b) were vertical.

(d) Calculate (i) the angle q shown in the diagram, given that $\cos\theta = \dfrac{h_2 - h_1}{l}$

(ii) the weight W of the suspended mass, given that $W = \dfrac{R}{\tan\theta}$

CAMBRIDGE MAY/JUNE 2003 *(Class Activities 36)*



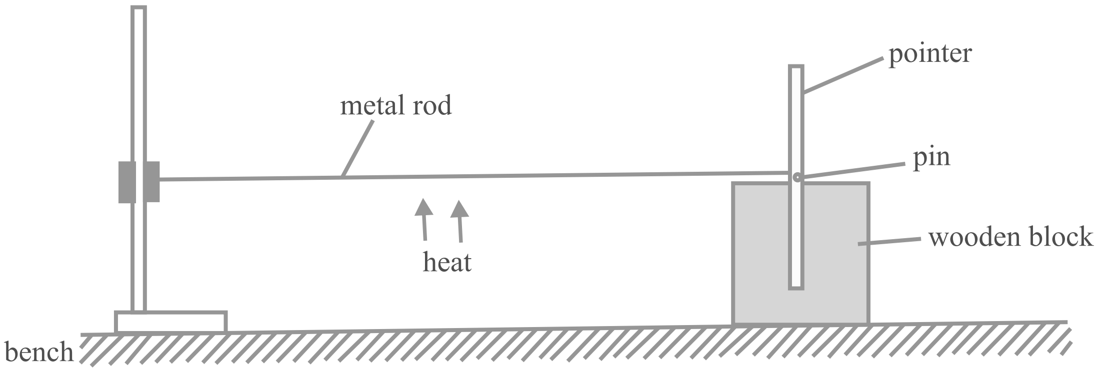
A student carried out an experiment to find the spring constant of a steel spring.
The apparatus is show above.
The student recorded the unstretched length lo of the spring. Then she added loads W to the spring, recording the new length *l* each time. The readings are shown in the table below.

W/N	*l*/mm	*e*/mm
0	30	
1	32	
2	33	
3	36	
4	39	
5	40	
6	42	

l_0= 30mm

(a)Calculate the extension *e* of the spring produced by each load, using the equation
e = (l_0 −l). Record the values of *e* in the table.
(b)Plot the graph of *e*/mm (*y*-axis) against *W*/N (*x*-axis).
(c)Draw the best-fit straight line for the points you have plotted. Calculate the gradient of the line. Show clearly on the graph how you obtained the necessary information.

CAMBRIDGE MAY/JUNE 2003 *(Class Activities 37)*

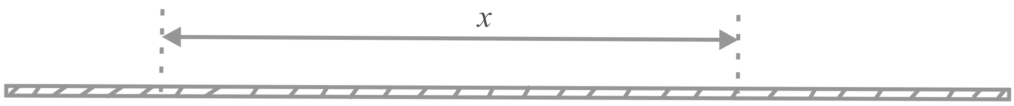


An IGCSE class watched a demonstration experiment to show that a metal rod expands when heated. The apparatus isshown above.

When the rod expands, it rolls the pin which moves the pointer. So a very small expansion movesthe pointer far enough to be seen clearly.

(a)One student wanted to find out how much longer the rod became when heated above room temperature with a Bunsen burner. The rod was 0.750m long at room temperature. To find the circumference of the pin, the student wrapped a piece of string 10 times round the pin, marked the string at the beginning and end of the 10 turns, and then measured the length of the string between the marks.

The figure below shows the string actual size.



(i) Use your rule to measure the distance x between the marks on the string above.

(ii)Calculate the circumference *c* of the pin.

(b)A second student measured the diameter d of the pin using a micrometer screw gauge.

The diameter was 1.20mm. When the rod was heated, the pointer moved through^{o}90.

(i) Calculate the circumference *c* using the equation c = pd.

(ii)Use this value of the circumference to calculate the increase *e* in the length of the rod when heated.

(iii)Calculate the length *l* of the heated rod.

(c)The micrometer screw gauge is a very accurate instrument. Suggest why the string and rule method of finding the circumference, used by the first student, was inaccurate.