NAME: Babatope O.E

SCHOOL:STA

SUBJ ECT :PHYSICS.

CLASS : SS3.

TOPIC: ELASTIC POPERTIES OF SOLID.

YOUNG MODULUS (REVISION).

CONTENTS.

Young modulus: The young modulus of a wire or string is defined as the ratio of the tensile stress to the tensile strain.

Young Modulus= Tensile Stress/ Tensile Strain.

The unit is N/m^2.

Tensile Stress: It is the ratio of the applied force to its cross sectional area.

Tensile stress= Force (f)/ Area(A). Unit is N/m^2.

Tensile Strain: This is the ratio of the extension to that of its original length of the elastic material.

Tensile Strain = extension (e) / original lenth(l). It is unitless.

Example 1: A load 10N diameter 25mm is stretched from 35cm to 40cm. Calculate

i. The tensile stress

ii.The tensile strain

iii.The young modulus

(take π=3.142).

SOLUTION.

Load/ Force=10N.

Original length = 35cm= 35/100 =0.35m.

extension= 40-35=5cm= 5/100=0.05m.

Cross sectional area= $\pi r^2 = \pi d^2/4$.

diameter (d) = 25mm= 25/1000=0.025m.

Using πr^2 , Area= $3.142 \times (0.025)^2/4$.

$= 4.91 \times 10^{-4} m^2$.

i.Tensile stress= Force/ Area

$= 10/(4.91 \times 10^{-4})$

$=2.0366 N/m^{2.}$

ii.Tensile strain= extension/ original length

= 0.05/0.35= 0.143.

iii. Young Modulus= tensile stress/ tensile strain.

= 2.0366/0.143.

$= 142419.58 N/m^2$.

ENERGY STORED IN ELASTIC MATERIALS.

The energy or workdone in an elastic spring or material is given by

W= Average force x extension.

= 1/2Fe.....*

But F= ke (Hooke's law)

Substituting F= ke in equation *, we have

$W=1/2\ ke^2$.

Also, energy can be converted from one form to the other. For example,potential energy of the elatic of a catapult can be converted into kinetic energy of the stone in the catapult.

Potential energy (P.E) = Kinetic energy (K.E).

$mgh = 1/2mv^2$.

$gh=1/2v^2$.

$V= 2gh$.

Example 2: If the force constant in a spring is 0.1N/m and a load of 5N is applied on the spring.What is the energy stored in the spring?

SOLUTION.

Force= 5N, Force constant = 0.1N/m.

e= F/k =5N/0.1

e= 50m

W= 1/2 Fe or 1/2 ke^2

Using ,W= 1/2 × 5 × 50

W= 125J .