Test 1

1. The stretching of a coil spring is determined by its shear modulus. Why? 1

Ans. When a coil spring is stretched, neither its length nor its volume changes, there is only the change in its shape. Therefore, stretching of coil spring is determined by shear modulus.

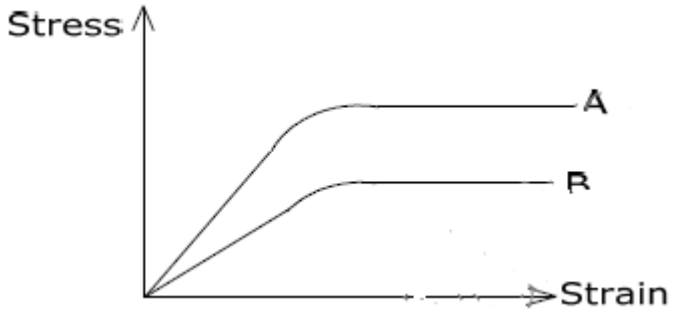
2. The spherical ball contracts in volume by 0.1% when subjected to a uniform normal pressure of 100 atmospheres calculate the bulk modulus of material of ball? 2

Ans. $Normal\ stress = 100\ atmospere = 100 \times 10^5\ Pa$

$$Volumetric\ strain = \frac{\Delta V}{V} = 0.1\% = \frac{0.1}{100} = 10^{-3}$$

$$K = \frac{Normal\ stress}{Volumetric\ strain} = \frac{10^7}{10^{-3}} = 10^{10}\ Nm^{-2}$$

3. In the following stress – strain curve, which has:- 2



(a) Greater Young's Modulus (b) More Ductility (c) More Tensile strength.

Ans. (a) Since young's Modulus is given by the slope of stress – strain graph, Since slop of A is more than that of B, hence it has greater young's Modulus.

(b) Ductility is the extent of plastic deformation and it is greater for A.

(c) Tensile strength is the direct measure of stress required, from by graph, it is greater for A.

4. A cube is subject to a pressure of $5x10^5$ N|m^2. Each side of cube is shortened by 1% find: - 2

(i) the volumetric strain

(ii) the bulk modulus of elasticity of cube.

Ans. $Let\ \ l - initial\ length\ of\ each\ side$

$$V = l^3$$

$$Change\ in\ length = 0.01\%\ of\ l = \frac{1}{100}l$$

$$Final\ length = l - \frac{1}{100}l = \frac{99}{100}l$$

$$Final\ volume = \left(\frac{99}{100}l\right)^3$$

$$\Delta V = \left(\frac{99}{100}l\right)^3 - l^3$$

$$(i) Volumetric\ strain = \frac{\Delta V}{V} = \frac{\left(\frac{99}{100}l\right)^3 - l^3}{l^3} = \frac{-3}{100} = 0.03$$

$$(ii) K = \frac{Normal\ stress}{Volumetric\ strain} = \frac{5 \times 10^5}{0.03} = 1.67 \times 10^7\ Nm^{-2}$$

5. If the potential energy is minimum at $r = r_o = 0.74A^0$, is the force attractive or repulsive at $r = 0.5A^0$; $1.9A^0$ and α? 2

Ans. Since, potential energy is minimum at $r_o = 0.74A^0$, therefore inter-atomic force between two

atoms is zero for $r_o = 0.74A^0$

(a) At $r = 0.5\ A^0$ (Which is less than r_o), the force is repulsive.

(b) At $r = 1.9\ A^0$ (Which is greater than r_o), the force is attractive.

(c) At $r = \alpha$, the force is zero.

6. A hollow shaft is found to be stronger than a solid shaft made of same equal material? Why? 2

Ans. A hollow shaft is found to be stronger than a solid shaft made of equal material because the torque required to produce a given twist in hollow cylinder is greater than that required to produce in solid cylinder of same length and material through same angle.

7. Calculate the work done when a wire of length l and area of cross – section A is made of material of young's Modulus Y is stretched by an amount x? 3

Ans.

8. Water is more elastic than air. Why? 1

Ans. Since volume elasticity is the reciprocal of compressibility and since air is more compressible than water hence water in more elastic than air.

9. Explain :- 3

(a) Elastic Body (b) Plastic Body (c) Elasticity.

Ans. (a) Elastic Body → A body which completely regains its original configuration immediately after the removal of deforming force on it is called elastic body.

(b) Plastic Body → A body which does not regain its original configuration at all on the removal of deforming force, howsoever the deforming force may be is called plastic body.

(c) Elasticity → The property of the body to regain its original configuration, when the deforming forces are removed is called elasticity.

10. The length of a metal is l_1, when the tension in it is T_1 and is l_2 when tension is T_2. Find the original length of wire? 2

Ans. *Let* l – *original length*

A – *Area*

$$\text{Change in length in case } 1 = l_1 - l$$

$$\text{Change in length in case } 2 = l_2 - l$$

$$\text{Now,} \quad Y = \frac{\frac{T}{A}}{\frac{\Delta l}{l}} = \frac{Tl}{A\Delta l}$$

$$Y_1 = \frac{T_1 l}{A(l_1 - l)} \quad (\text{case } 1)$$

$$Y_2 = \frac{T_2 l}{A(l_2 - l)} \quad (\text{case } 2)$$

$$As \quad Y_1 = Y_2$$

$$\frac{T_1 l}{A(l_1 - l)} = \frac{T_2 l}{A(l_2 - l)}$$

$$T_1(l_2 - l) = T_2(l_1 - l)$$

$$T_1 l_2 - T_1 l = T_2 l_1 - T_2 l$$

$$T_2 l - T_1 l = T_2 l_1 - T_1 l_2$$

$$l(T_2 - T_1) = T_2 l_1 - T_1 l_2$$

$$l = \frac{T_2 l_1 - T_1 l_2}{T_2 - T_1}$$