CHAPTER 8

Mechanical Properties of Solids

Stress, Strain and Young's Modulus

1. A wire of length L area of cross section A is hanging from a fixed support. The length of the wire changes to L_1 when mass M is suspended from its free end. The expression for Young's modulus is: *(2020)*

a. $\frac{Mg(L_1 - L)}{AL}$ b. $\frac{MgL}{AL_1}$

c. $\frac{MgL}{A(L_1 - L)}$ d. $\frac{MgL_1}{AL}$

2. Two wires are made of the same material and have the same volume. The first wire has cross-sectional area A and the second wire has cross-sectional area 3 A. If the length of the first wire is increased by Δl on applying a force F, how much force is needed to stretch the second wire by the same amount? *(2018)*

a. 4 F b. 6 F

c. 9 F d. F

3. The Young's modulus of steel is twice that of brass. Two wires of same length and of same area of cross section, one of steel and another of brass are suspended from the same roof. If we want the lower ends of the wires to be at the same level, then the weights added to the steel and brass wires must be in the ratio of: *(2015 Re)*

a. 1 : 1 b. 1 : 2

c. 2 : 1 d. 4 : 1

4. Copper of fixed volume V is drawn into wire of length L. When this wire is subjected to a constant force F, the extension produced in the wire is D_1. Which of the following graphs is a straight line? *(2014)*

a. ΔL versus 1/L b. ΔL versus L^2

c. ΔL versus $1/L^2$ d. ΔL versus L^3

5. The following four wires are made of the same material. Which of these will have the largest extension when the same tension is applied? *(2013)*

a. Length = 300 cm, diameter = 3 mm

b. Length = 50 cm, diameter = 0.5 mm

c. Length = 100 cm, diameter = 1 mm

d. Length = 200 cm, diameter = 2 mm

Bulk Modulus and Shear Modulus

6. Given below are two statements : One is labelled as Assertion (A) and the other is labelled as Reason (R)

Assertion (A): The stretching of a spring is determined by the shear modulus of the material of the spring

Reason (R): A coil spring of copper has more tensile strength than a steel spring of same dimensions.

In the light of the above statements, choose the most appropriate answer from the options given below :

[RC] *(2022)*

a. (A) is false but (R) is true

b. Both (A) and (R) are true and (R) is the correct explanation of (A)

c. Both (A) and (R) are true and (R) is not the correct explanation of (A)

d. (A) is true but (R) is false

7. The bulk modulus of a spherical objects is 'B'. If it is subjected to uniform pressure 'P', the fractional decrease in radius is: *(2017-Delhi)*

a. $\frac{B}{3p}$ b. $\frac{3P}{B}$

c. $\frac{P}{3B}$ d. $\frac{P}{B}$

8. The approximate depth of an ocean is 2700 m. The compressibility of water is 45.4×10^{-11} Pa^{-1} and density of water is 10^3 kg/m^3. What fractional compression of water will be obtained at the bottom of the ocean? **[RC]** *(2015)*

a. 1.0×10^{-2} b. 1.2×10^{-2}

c. 1.4×10^{-2} d. 0.8×10^{-2}

Elastic Potential Energy

9. When a block of mass M is suspended by a long wire of length L, the length of the wire becomes (L + *l*). The elastic potential energy stored in the extended wire is: **[RC]** *(2019)*

a. Mg*l* b. MgL

c. $\frac{1}{2}$Mg*l* d. $\frac{1}{2}$MgL

Answer Key

1	2	3	4	5	6	7	8	9
c	c	c	b	b	d	c	b	c