ELASTICITY

Questions on Elasticity, Paper 1

1. If the work done in stretching a wire by 1 mm is 2 J, the work necessary for stretching another wire of the same material but with double the radius of cross-section and half the length by 1 mm is in joules **(EAMCET 91)**

(a) 16 (b) 8

(c) 4 (d) $\frac{1}{4}$

Answer: (a)

2. To compress a liquid by 10% of its original volume, the pressure required is 2×10^5 N/m^2. the bulk modulus of the liquid is

(a) 2×10^4 N/m^2 (b) 2×10^5 N/m^2

(c) 2×10^7 N/m^2 (d) 2×10^6 N/m^2

Answer: (d)

3. The modulus of elasticity is dimensionally equivalent to

(a) Strain (b) Stress

(c) Surface tension (d) Poisson's ratio

Answer: (b)

4. If by applying a force, the shape of a body is changed, then the corresponding stress is known as

(a) Tensile stress (b) Bulk stress

(c) Shearing stress (d) Compressive stress

Answer: (c)

5. When the tension in a metal wire is T_1, its length is L_1 and when the tension is T_2, its length is L_2. its unscratched length is

(a) $\frac{L_1 + L_2}{2}$ (b) $\frac{T_2L_1 \quad T_1L_2}{T_2 \quad T_1}$

(c) $\sqrt{\frac{L_1L_2}{2}}$ (d) $\frac{L_1T_2 + L_2T_1}{T_1 + T_2}$

Answer: (b)

6. A solid sphere of radius R made of a material of bulk modulus K is completely immersed in a liquid in a cylindrical container. A mass less piston of area A floats on the surface of the liquid. When a mass M is placed on the piston to compress the liquid, the fractional change in the radius of the sphere, $\left(\frac{dR}{R}\right)$ is given by

(IIT 88)

(a) $\frac{Mg}{KA}$ (b) $\frac{Mg}{2KA}$

(c) $\frac{Mg}{3K\,A}$ (d) $\frac{Mg}{4KA}$

Answer: (c)

7. A body of mass 500 g is fastened to one end of a steel wire of length 2 m and area of cross-section 2 mm^2. if the breaking stress of he wire is 1.25×10^7 N/m^2, then the maximum angular velocity with which the body can be rotated in a horizontal circle is

(a) 2 rad/s (b) 3 rad/s

(c) 4 rad/s (d) 5 rad/s

Answer: (d)

8. A copper wire and a steel wire having the same cross-section area are fastened end to end stretched by a force F. the lengths of copper and steel wires are in the ratio of 2:1 and their moduli of elasticity are in the ratio of 1:2. What is the ratio $(\frac{e_c}{e_s})$ of their extensions?

(a) 1:2 (b) 4:1

(c) 2:1 (d) 1:4

Answer: (b)

9. The bulk modulus of a gas is 6×10^3 N/m^2. the additional pressure needed to reduce the volume of the gas by 10% is

(a) 300 N/m^2 (b) 400 N/m^2

(c) 1000 N/m^2 (d) 600 N/m^2

Answer: (d)

10. According to Horke's law of elasticity, within elastic limits, if the stress is increased, the ratio of stress to strain

(a) Increases (b) Decreases

(c) Becomes zero (d) Remains constant

Answer: (d)

11. Two wires have the same material and length, but their masses are in the ration of 4:3. If they are stretched by the same force, their elongations will be in the ratio of

(a) 2:3 (b) 3:4

(c) 4:3 (d) 9:16

Answer: (b)

12. The symbols, Y, K and η represent the Young's modulus, bulk modulus and rigidity modulus of the material of a body. If $\eta = 3K$, then

(a) $Y = 2.5K$ (b) $Y = 3.5K$

(c) $Y = 4.5K$ (d) $Y = \frac{9}{5}K$

Answer: (c)

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13. The energy stored per init volume of a strained wire is
(MHT-CET-1999)
(a) $\frac{1}{2} \times (\text{load}) \times (\text{extension})$
(b) $\frac{1}{2} \frac{y}{(\text{strain})^2}$
(c) $\frac{1}{2} y(\text{strain})^2$
(d) stress × strain
Answer: (c)

14. A wire suspended vertically from one of its ends is stretched by attaching a weight of 100N to its lower end. What is the elastic potential energy stored in the wire, if the weight stretches the wire by 1.5 mm?
(a) 5×10^{-2} J (b) 10^{-3} J
(c) 2.5×10^{-3} J (d) 7.5×10^{-2} J
Answer: (d)

15. One end of a steel wire of area of cross-section 3 mm^2 is attached to the ceiling of an elevator moving up with an acceleration of 2.2 m/s^2. if a load of 8 kg is attached at its free end, then the stress developed in the wire will be
(a) 8×10^6 N/m^2 (b) 16×10^6 N/m^2
(c) 20×10^6 N/m^2 (d) 32×10^6 N/m^2
Answer: (d)

16. A body of mass 1 kg is attached to one end of a wire and rotated in horizontal circle of diameter 40 cm with a constant speed of 2 m/s. what is the area of cross-section of the wire if the stress developed in the wire is 5×10^6 N/m^2?
(a) 2 mm^2 (b) 3 mm^2
(c) 4 mm^2 (d) 5 mm^2
Answer: (c)

17. A rubber cord of cross sectional area 1 mm^2 and unstretched length 10 cm is stretched to 12 cm and then released to project a stone of mass 5 gram.
If Y for rubber = $5 \times 10^8 N/m^2$, then the tension in the rubber cord is
(a) 25 N (b) 50 N
(c) 100 N (d) 200 N
Answer: (c)

18. A wire of length 'L' and cross-sectional area A is mad of a material of Young's modulus Y. if the wire is stretched by an amount x then work done is **(MP PMT 87, 88)**
(a) F × x (b) $\frac{1}{2}(F \times L)$
(c) $\frac{1}{2} \frac{YA}{L} x^2$ (d) $\frac{YA}{L} x$
Answer: (c)

19. The following four wires of length L and the radius r are made of same material. Which of these will have the largest extension when the same tension is applied. **(CPMT 90)**
(a) L = 50 cm, r = 0.25 mm
(b) L = 100 cm, r = 0.5 mm
(c) L = 200 cm, r = 1 mm
(d) L = 3000 cm, r = 1.5 mm
Answer: (d)

20. In an experiment to determine the Young's modulus of the material of a wire, the length of the wire and the suspended mass are doubled. Then the Young's modulus of the wire
(a) Becomes double (b) Becomes four time
(c) Remain unchanged (d) Becomes half
Answer: (c)

21. Which one of he following does not affect the elasticity of a substance?
(a) Hammering
(b) Adding impurity in the substance
(c) Changing the dimensions
(d) Change of temperature
Answer: (c)

22. Strain energy per unit volume is given by
(MHT-CET-2003)
(a) $\frac{1}{2} \times \frac{(\text{stress})^2}{y}$ (b) $\frac{1}{2} \times (\text{stress})^2 y$
(c) $\frac{1}{2} \times \frac{\text{strain}}{\text{stress}}$ (d) $\frac{1}{2} F\ l$
Answer: (a)

23. The compressibility of water is 4×10^{-5} per unit atmospheric pressure. 100cc of water is subjected to a change of pressure of 100 atmospheres. The change in the volume will be **(MPT MP 90)**
(a) 4×10^{-5} cc (b) 4×10^{-2} cc
(c) 4×10^{-4} cc (d) 4×10^{-1} cc
Answer: (d)

24. The bulk modulus of a fluid is inversely proportional to the
(a) Change in pressure (b) Volume of the fluid
(c) Density of the fluid (d) Change in its volume
Answer: (d)

25. Under the action of load F_1, the length of a string is L_1 and that under F_2, is L_2. the original length of the wire is **(MHT-CET-2007)**
(a) $[L_1F_1 - L_2F_2] / [F_1 + F_2]$
(b) $[L_1F_2 - L_2F_1] / [F_1 - F_2]$
(c) $[L_1F_2 - L_2F_1] / [F_2 - F_1]$
(d) $[L_1F_2 - L_2F_1] / [F_1 + F_2]$
Answer: (c)