Questions on Elasticity, Paper 2

1. Shearing strain is given by
   (a) Deforming force
   (b) Shape of shear
   (c) Angle of shear
   (d) Change in volume of the body
   Answer: (c)

2. If a wire having initial diameter of 2 mm produced the longitudinal strain of 0.1%, then the final diameter of wire will be ($\sigma = 0.5$) **(MHT-CET-2005)**
   (a) 2.002 mm (b) 1.998 mm
   (c) 1.999 mm (d) 2.001 mm
   Answer: (c)

3. A wire of length L and radius r is suspended from rigid support. Mass M can be applied to its free end, elongation in it is l, then Young's modulus is **(MHT-CET 2005)**
   (a) $\frac{MgL}{\pi r^2 l}$ (b) $\frac{Mgl}{\pi r^2 L}$
   (c) $\frac{\pi r^2 L}{Mgl}$ (d) All of these
   Answer: (a)

4. Young's modulus of a wire is Y, strain energy per unit volume is E then its strain is given by **(MHT-CET 2006)**
   (a) $\sqrt{\frac{Y}{2E}}$ (b) $\sqrt{\frac{2E}{Y}}$
   (c) $\sqrt{\frac{E}{Y}}$ (d) 2EY
   Answer: (c)

5. The force constant of a wire is K and that of another wire of the same material is 2K. when both the wires are stretched by the same force, then the work done is
   (a) $W_2 = W_1$ (b) $W_2 = 0.5\ W_1$
   (c) $W_2 = 2W_1$ (d) $W_2 = 2W_1^2$
   Answer: (b)

6. Two wires A and B are of the same length. The diameters are in the ratio 1:2 and the Young's modulus are in ratio 2:1. if they are pulled by the same force, then their elongations will be in ratio **(MHT-CET-2004)**
   (a) 4:1 (b) 1:4
   (c) 1:2 (d) 2:1
   Answer: (d)

7. An iron bar of length 'l' m and cross section 'A' m^2 is pulled by a force of 'F' Newton from both ends so as to produce and elongation in meters. Which of the following statement statements is correct **(NCERT 76)**
   (a) Elongation is inversely proportional to length l
   (b) Elongation is directly proportional to cross section A
   (c) Elongation is inversely proportional to A
   (d) Elongation is directly proportional to Young's modulus
   Answer: (c)

8. The ratio of the change in dimension at right angles to the applied force to the initial dimension is known as
   (a) Young's modulus (b) Poisson's ratio
   (c) Lateral strain (d) Shearing strain
   Answer: (c)

9. Which of the following is dimensionless quantity? **(MHT-CET-1999)**
   (a) Stress (b) Young's modulus
   (c) Strain (d) Pressure
   Answer: (c)

10. If M = mass of wire, ρ = density of wire, R = radius of wire, r = change in radius, L = original length of wire and l = change in length, the Poisson's ratio is given by **(MHT-CET-2004)**
    (a) $\frac{Mr\rho}{\pi R^3 l}$ (b) $\frac{Mr\rho}{\pi R^3 l\rho}$
    (c) $\frac{Mr}{\pi R^3 \rho l}$ (d) $\frac{Mr\rho}{\pi r^3 l}$
    Answer: (c)

11. A wire of length L, radius r, when stretched with a force F, changes in length l. what will be the change in length in a wire of same material having length 2 L, radius 2 r and stretched by a force of 2 F **(MPPMT 80, 96)**
    (a) $\frac{l}{2}$ (b) 2l
    (c) 3l (d) 4l
    Answer: (b)

12. The energy per unit volume of a stretched wire is, **(MNR 81, NCERT 81)**
    (a) $\frac{1}{2}$ load $\times$ extension (b) Stress $\times$ strain
    (c) Load $\times$ extension (d) $\frac{1}{2}$ Stress $\times$ strain
    Answer: (d)

ELASTICITY

13. A steel ring of radius r and cross sectional area A is fitted onto a wooden disc of radius R(R > r). If the Young's modulus of steel is Y, then the force with which the steel ring is expanded is, **(Andhra 86)**

(a) $AY(\frac{R}{r})$ (b) $\frac{AY(R - r)}{r}$

(c) $\frac{Y}{A}\frac{(R - r)}{r}$ (d) $\frac{Yr}{AR}$

Answer: (b)

14. In a wire stretched by hanging a weight from its end, the elastic potential energy per unit volume in terms of the longitudinal strain σ and modulus of elasticity Y is, **(PMT 87 MP)**

(a) $\frac{Y\sigma^2}{2}$ (b) $\frac{Y\sigma}{2}$

(c) $\frac{2Y\sigma^2}{2}$ (d) $\frac{Y^2\sigma}{2}$

Answer: (a)

15. Four wires whose lengths and diameter respectively are given below are made of the same material. Which of these will have the largest extension when same tension is applied? **(MHT-CET 2001)**

(a) 0.50 m, 0.50 mm (b) 1.00 mm, 1.00 mm
(c) 2.00 m, 2.00 mm (d) 4.00 m, 4.00 mm

Answer: (a)

16. When a mass of 3.14 kg is attached to free end of a suspended wire of diameter 2 mm then stress produce in it is ($g = 9.8\ m/s^2$) **(MHTCET 2006)**

(a) $9.8 \times 10^{-6}\ N/m^2$ (b) $10^{-6}\ N/m^2$
(c) $18 \times 10^{6}\ N/m^2$ (d) $9.8 \times 10^{6}\ N/m^2$

Answer: (d)

17. In a wire, when the elongation is 2 cm, the energy stored is E. if the wire is stretched by 10 cm, then the energy stored in the wire will be

(a) E (b) 5E

(c) 25E (d) $\frac{25}{2}E$

Answer: (c)

18. A metallic rod breaks when the strain produced in the rod is 0.2%. What should be the are of cross section to support a load of 10^4N, if the Young's modulus of the material of the rod is $7 \times 10^9\ N/m^2$?

(a) $7.15 \times 10^{-4}\ m^2$ (b) $3.15 \times 10^{-5}\ m^2$
(c) $2 \times 10^{3}\ m^2$ (d) $12 \times 10^{-4}\ m^2$

Answer: (a)

19. A wire has Young's modulus Y and coefficient of linear expansionα. If its temperature changes by $d\theta$, then the thermal stress developed in it is given by

(a) $S_T = Y \propto d\theta$ (b) $S_T = \frac{Y\,d\theta}{\alpha}$

(c) $S_T = \frac{\alpha}{Y\,d\theta}$ (d) $\frac{d\theta}{Y\alpha}$

Answer: (a)

20. Which of the following relation is true **(C.P.M.T. 84)**

(a) $3Y = K(1 - \sigma)$ (b) $\sigma = 0.5\ Y\ \eta$

(c) $K = \frac{9Y\eta}{Y + \eta}$ (d) $\sigma = (6K + \eta)\ Y$.

Answer: (b)

21. The dimensional formula for modulus of rigidity is **(MNR 84)**

(a) $[M^1 L^{-1} T^2]$ (b) $[M^1 L^{-1} T^{-2}]$
(c) $[M^1 L^1 T^2]$ (d) $[M^{-1} L^{-2} T^2]$

Answer: (b)

22. On stretching a wire, he elastic energy per unit volume is, **(PMT MP 88)**

(a) $\frac{1}{2}\frac{F}{A}\frac{dl}{L}$ (b) $\frac{1}{2}\frac{FA}{l}$

(c) $\frac{1}{2}\frac{Fl}{A}$ (d) $\frac{1}{2}F.l$

Answer: (a)

23. A thick rubber rope of length L, density ρ and Young's modulus Y is hung from the ceiling of a room. What is the increase in its length due to its own weight?

(a) $\frac{\rho gL^2}{2Y}$ (b) $\frac{2Y}{\rho gL^2}$

(c) $\frac{2\rho gL}{Y}$ (d) $\frac{\rho^2 g^2 L}{Y^2}$

Answer: (a)

24. Out of the following materials, whose elasticity is independent of temperature?

(a) Copper (b) Invar steel
(c) Brass (d) Silver

Answer: (b)

25. What is the energy stored per unit volume in a copper wire, which produces longitudinal strain of 0.1%.
[$Y = 1.1 \times 10^{11}\ N/m^2$]

(a) $11 \times 10^{3}\ J/m^3$ (b) $5.5 \times 10^{3}\ J/m^3$
(c) $11 \times 10^{4}\ J/m^3$ (d) $5.5 \times 10^{4}\ J/m^3$

Answer: (d)