Physicsaholics

DPP – Elasticity

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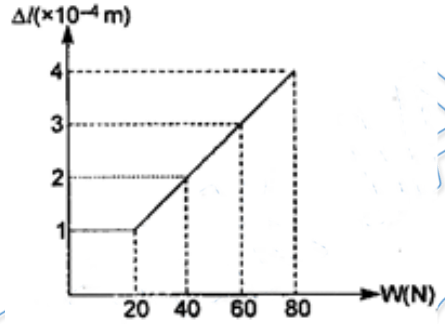
Q 1. The adjacent graph shows the extension (Δl) of a wire of length 1 m suspended from the top of a roof at one end and with a load W connected to the other end. If the cross-sectional area of the wire is 10^{-6} m^2, calculate the Young's modulus of the material of the wire:



(a) 2×10^{11} N/m^2 (b) 2×10^{-11} N/m^2
(c) 3×10^{12} N/m (d) 2×10^{13} N/m^2

Q 2. A constant force F_0 is applied on a string placed over a smooth horizontal uniform elastic string surface as shown in figure. Young's modulus of string is Y and area of cross-section is S. The strain produced in the string in the direction of force is:

(a) $\frac{F_0 Y}{S}$ (b) $\frac{F_0}{SY}$ (c) $\frac{F_0}{2SY}$ (d) $\frac{F_0 Y}{2S}$

Q 3. A uniform rod of mass m and length L has area of cross-section A and young modulus γ. This rod is rotating about its one end with angular velocity ω. Elongation in length of rod is (Gravity is absent)

(a) $\frac{ml^2\omega^2}{3A\gamma}$ (b) $\frac{ml^2\omega^2}{2A\gamma}$ (c) $\frac{ml^2\omega^2}{6A\gamma}$ (d) $\frac{ml^2\omega^2}{4A\gamma}$

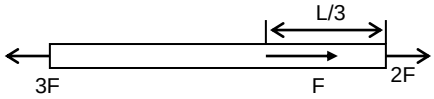
Q 4. If ρ is the density of the material of a wire and σ is breaking stress. The greatest length of the wire that can hang freely without breaking is:

(a) $\frac{2\sigma}{\rho g}$ (b) $\frac{\rho}{\sigma g}$ (c) $\frac{\rho g}{2\sigma}$ (d) $\frac{\sigma}{\rho g}$

Q 5. A uniform rod of length L has a mass per unit length λ and area of cross-section A. The elongation in the rod is l due to its own weight if it is suspended from the ceiling of a room. The Young's modulus of the rod is:

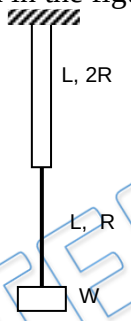
(a) $\frac{2\pi g L^2}{Al}$ (b) $\frac{\lambda g L^2}{2Al}$ (c) $\frac{2\lambda g L}{Al}$ (d) $\frac{\lambda g l^2}{AL}$

Q 6. A uniform slender rod of length L, cross-sectional area A and Young's modulus Y is acted upon by the forces shown in the figure. The elongation of the rod is



(a) 3FL/5AY (b) 2FL/5AY
(c) 3FL/8AY (d) 8FL/3AY

Q 7. Two wires of the same material (Young's modulus Y) and same length L but radii R and 2R respectively are joined end to end and a weight W is suspended from the combination as shown in the figure. The elastic potential energy in the system is

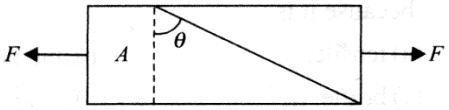


(a) $\frac{3W^2L}{4\pi R^2Y}$ (b) $\frac{3W^2L}{8\pi R^2Y}$
(c) $\frac{5W^2L}{8\pi R^2Y}$ (d) $\frac{W^2L}{\pi R^2Y}$

Q 8. A copper wire of cross – section A is under a tension T. Find the decrease in the cross – section area. Young's modulus is Y and Poisson's ratio is σ.

(a) $\frac{\sigma T}{2AY}$ (b) $\frac{\sigma T}{AY}$ (c) $\frac{2\sigma T}{AY}$ (d) $\frac{4\sigma T}{AY}$

Q 9. A bar of cross – section A is subjected to equal and opposite tensile forces F at its ends. Consider a plane through the bar making an angle θ with a plane at right angle to the bar. Then shearing stress will be maximum if θ



(a) 0° (b) 30° (c) 45° (d) 60°

Q 10. A steel plate has face area 4 cm^2 and thickness 0.5 cm is fixed rigidly at the lower surface. A tangential force of 10 N is applied on the upper surface. Find the lateral displacement of the upper surface with respect to the lower surface. Rigidity modulus of steel = 8.4×10^{10} Nm^{-2}

(a) 1.5 μm (b) 1.5 A° (c) 1.5 nm (d) 1.5 pm

Q 11. A stone of mass m tied to one end of a thread of length *l*. The diameter of the thread is d and it is suspended vertically. The stone is now rotated in a horizontal plane and makes an angle θ with the vertical. Find the increase in length of the wire. Youngs modulus of the wire is Y

(a) $\frac{4mgl}{\pi d^2 Y \cos\theta}$ (b) $\frac{4mgl}{\pi d^2 Y \sin\theta}$

(c) $\frac{4mgl}{\pi d^2 Y}$ (d) $\frac{4mgl}{\pi d^2 Y \sec\theta}$

Q 12. The modulus of elasticity of a gas at constant temperature is (Symbols have their usual meanings)

(a) γP (b) P/γ (c) P (d) P/V

Q 13. A solid sphere of radius R and bulk modulus of elasticity K is kept in a liquid inside a cylindrical container. A massless piston of cross-sectional area A floats on liquid surface. A mass M is put on the piston in order to compress the liquid. The fractional change in the radius of the sphere will be

(a) $\frac{3Mg}{KA}$ (b) $\frac{3Mg}{2KA}$ (c) $\frac{Mg}{KA}$ (d) $\frac{Mg}{3KA}$

Q 14. A cable that can support a load W is cut into two equal parts. The maximum load that can be supported by either part is–

(a) W/4 (b) W/2 (c) W (d) 2 W

Q 15. A uniform rod of mass m and length L has area of cross-section A and young modulus γ. Elastic potential energy of rod if it is suspended from the ceiling of a room, is

(a) $\frac{Lg^2m^2}{6A\gamma}$ (b) $\frac{Lg^2m^2}{3A\gamma}$

(c) $\frac{Lg^2m^2}{2A\gamma}$ (d) $\frac{Lg^2m^2}{A\gamma}$

Answer Key

Q.1 a	**Q.2 c**	**Q.3 a**	**Q.4 d**	**Q.5 b**
Q.6 d	**Q.7 c**	**Q.8 c**	**Q.9 c**	**Q.10 c**
Q.11 a	**Q.12 c**	**Q.13 d**	**Q.14 c**	**Q.15 a**