PHYSICS

BOOKS - MARVEL PHYSICS (HINGLISH)

ELASTICITY

Multiple Choice Questions

1. Which one of the following substances is not elastic ?

A. Iron

B. Copper

C. Brass

D. Modelling clay

Answer: D

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2. Which one of the following substances is not plastic ?

A. Butter

B. Iron

C. Plasticine

D. Wax

Answer: B

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3. If the potential energy is minimum for two atoms at $r_0 = 0.75\text{Å}$. This is the equilibrium distance. Then,

A. the force is attractive at = r = 0.5 Å

B. the force is attractive at = r = 0.75 Å

C. the force is repulsive at r = 0.5 Å

D. the force is repulsive at r = 0.75 Å

Answer: C

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4. If the length of a wire is reduced to half, then it can hold the.....load

A. $\frac{W}{2}$

B. $\frac{W}{4}$

C. 2W

D. W

Answer: D

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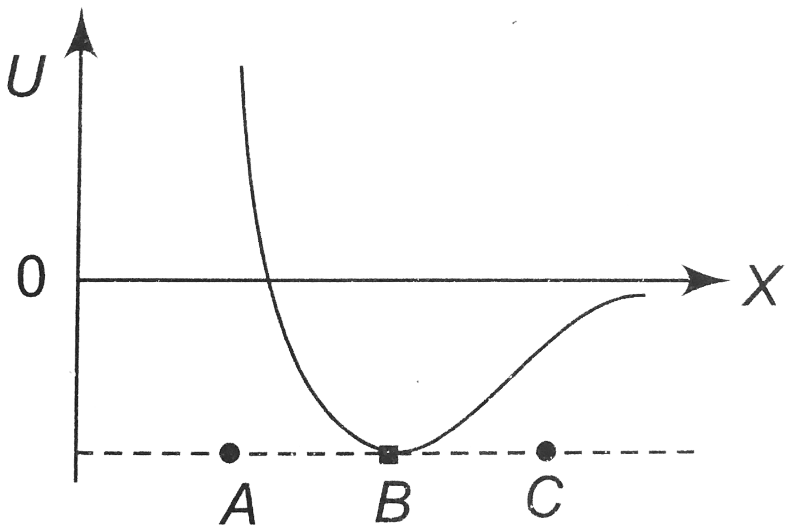
5. 

The potential energy U between two molecules as a function of the distance X between them has been shown in the figure. The two molecules are

A. attracted when X lies between B and C and are repelled when X lies between A and B

B. attracted when they reach B

C. repelled when they reach B

D. attracted when X lies between A and B and are repelled when X lies between B and C

Answer: A

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6. A Copper wire and steel of the same diameter and length are connected end to end and a force is applied, which stretches their combined length by 1 cm. The two wires will have

A. the same stress and strain

B. the same strain but different stresses

C. different stresses and strains

D. the same stress but different strains

Answer: D

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7. A spring is stretched by applying a load to its free end. The strain produced in the spring is

A. elastic strain

B. bulk strain

C. tensile strain

D. shearing strain

Answer: C

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8. A force of 400 kg. weight can break a wire. The force required to break a wire of double the area of cross-section will be

A. 500 kg wt

B. 250 kg wt

C. 1000 kg wt

D. 750 kg wt

Answer: B

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9. A cable that can support a load of 800 N is cut into two equal parts. The maximum load that can be supported by either part is

A. 200 kg wt

B. 100 kg wt

C. 400 kg wt

D. 800 kg wt

Answer: C

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10. A and B are two wires. The radius of A is twice that of B. They are stretched by the some load. The the stress on B is

A. equal to that of A

B. two times that of A

C. four times that of A

D. half that of A

Answer: C

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11. An external force of 20 N acts normally on a rectangular plate of length 20 cm and breadth 10 cm. What is the maximum stress produced in the plate ?

A. $100N/m^2$

B. $500N/m^2$

C. $1000N/m^2$

D. $2000N/m^2$

Answer: C

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12. An external force of 20 N acts at an angle of 60°, with the normal to the surface of a square plate having each side of length 20 cm. What is the stress produced in the plate ?

A. $100N/m^2$

B. $150N/m^2$

C. $200N/m^2$

D. $250N/m^2$

Answer: D

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13. A steel wire $2m$ long is suspended from the ceiling. When a mass is hung at its lower end, the increase in length recorded is $1cm$. Determine the strain in the wire.

A. 1 cm

B. $1.5cm$

C. 2cm

D. $0.5cm$

Answer: B

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14. When a certain pressure is applied to a liquid of volume 5000 cc, its volume decreases by 50 cc. In this case the volume strain is

A. 0.1

B. 0.5

C. 0.01

D. 5

Answer: C

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15. The breaking stress of a wire depends on

A. the material of the wire

B. radius of the wire

C. length of the wire

D. shape of cross section of the wire

Answer: A

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16. One end of steel wire is fixed ti ceiling of an elevator moving up with an acceleration $2m/s^2$ amd a load of 10 kg hangs from other end. Area of cross- section of the wire is $2cm^2$ .The longitudinal strain in the wire is $(g = 10m/s^2 \text{ and } Y = 2 \times 10^{11} Nm^2)$.

A. $8 \times 10^6 N/m^2$

B. $16 \times 10^6 N/m^2$

C. $20 \times 10^6 N/m^2$

D. $32 \times 10^6 N/m^2$

Answer: D

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17. A body of mass 500 g is fastened to one end of a steel wire of length 2m and area of cross-section $2mm^2$. If the breaking stress of the wire is $1.25 \times 10^7 N/m^2$, 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

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18. A body of mass 1 kg is attached to one end of a wire and rotated in a horizontal circle of diameter 40 cm with a constant speed of 2m/s. What is the area of cross-section of the wire if the stress developed in the wire is $5 \times 10^6 N/m^2$?

A. $2mm^2$

B. $3mm^2$

C. $4mm^2$

D. $5mm^2$

Answer: C

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19. Shearing strain is expressed by

A. Deforming force

B. Shape of the body

C. Angle of shear

D. Change in volume of the body

Answer: C

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20. 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

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21. A copper wire of negligible mass, $1m$ length and cross-sectional area $10^{-6}m^2$ is kept on a smooth horizontal table with one end fixed. A ball of mass $1kg$ is attached to the other end. The wire and the ball are rotating with an angular velocity of $20rad/s$. If the elongation in the wire is $10^{-3}m$.

a. Find the Young's modulus of the wire (in terms of $\times 10^{11}N/m^2$).

b. If for the same wire as stated above, the angular velocity is increased to $100rad/s$ and the wire breaks down, find the breaking stress (in terms of $\times 10^{10}N/m^2$).

A. $10^9N/m^2$

B. $10^{10}N/m^2$

C. $3 \times 10^{10} N/m^2$

D. $2 \times 10^{9} N/m^2$

Answer: B

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22. A metal rod of Young's modules Y and coefficient of thermal expansion α is held at its two ends such that its length remains constant. If its temperature is raised by $t^{\circ} C$, the linear stress developed in it is

A. $S_T = Y \propto d\theta$

B. $S_T = \dfrac{Y d\theta}{\alpha}$

C. $S_T = \dfrac{\alpha}{Y d\theta}$

D. $\dfrac{d\theta}{Y\alpha}$

Answer: A

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23. Strain has

A. no units but only dimensions

B. only units but no dimensions

C. no units, no dimensions but a constant value

D. no units, no dimensions but a variable value

Answer: D

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24. Which one of the following quantities has not been expressed in proper units?

A. $\frac{\text{Stress}}{\text{Strain}} = Nm^{-2}$

B. Surface tension $= Nm^{-1}$

C. Energy $= kgms^{-1}$

D. Pressure $= Nm^{-2}$

Answer: C

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25. A wire can support a load Mg without breaking. It is cut into two equal parts. The maximum load that each part an support is

A. 3kg

B. 6kg

C. 9 kg

D. 27 kg

Answer: C

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26. A rope 1 cm in diameter breaks, if the tension in it exceeds 500 N. The maximum tension that may be given to similar rope of diameter 3 cm is

A. 2000 N

B. 1000 N

C. 500 N

D. 250 N

Answer: A

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27. The breaking stress of a cylindrical rod is $10^6 N/m^2$. If the maximum possible height of the rod is 10 m, then the density of the material of the rod is [use $g = 10 m/s^2$]

A. $10^3 kg/m^3$

B. $2 \times 10^3 kg/m^3$

C. $10^4 kg/m^3$

D. $2 \times 10^4 kg/m^3$

Answer: C

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28. One end of uniform wire of length L and of weight W is attached rigidly to a point in the roof and a weight W_1 is suspended from its lower end. If s is the area of cross section of the wire, the stress in the wire at a height $(3L/4)$ from its lower end is

A. $\dfrac{(W_1 + W)}{S}$

B. $\dfrac{W_1}{S}$

C. $\dfrac{\left(W_1 + \frac{3W}{4}\right)}{S}$

D. $\dfrac{\left(W_1 + \frac{W}{4}\right)}{S}$

Answer: C

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29. The temperature of a wire of length 1 metre and area of cross-section $1 cm^2$ is increased from $0^\circ C$ to $100^\circ C$. If the rod is not allowed to increased in length, the force required will be $(\alpha = 10^{-5} / .^\circ C \text{ and } Y = 10^{11} N / m^2)$

A. $10^9 N$

B. $10^5 N$

C. $10^4 N$

D. $10^3 N$

Answer: C

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30. A substance breaks down by a stress of $10^6 Nm^{-2}$. If the density of the material of the wire is $3 \times 10^3 kgm^{-3}$, then the length of the wire of the substance which will break under its own weight when suspended vertically is

A. $30.0m$

B. $33.3m$

C. $66.6m$

D. $60.0m$

Answer: B

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31. In brass the velocity of longitudinal wave is 100 times the velocity of transverse wave if $Y = 1 \times 10^{11} N/m^2$, then stress in the wire is

A. $10^7 N/m^2$

B. $10^8 N/m^2$

C. $10^9 N/m^2$

D. $10^{10} N/m^2$

Answer: A

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32. What is the thermal stress developed inside a tooth cavity filled with copper when hot tea at temperature of $57^\circ C$ is drunk? You can take body (tooth) temperature to be $37^\circ C$ and $\alpha_{Cu} = 1.7 \times 10^{-5} / ^\circ C$ and bulk modulus for copper $= 14 \times 10^{10} N/m^2$.

A. $1.3 \times 10^7 N/m^2$

B. $1.4 \times 10^7 N/m^2$

C. $1.9 \times 10^7 N / m^2$

D. $1.1 \times 10^7 N / m^2$

Answer: B

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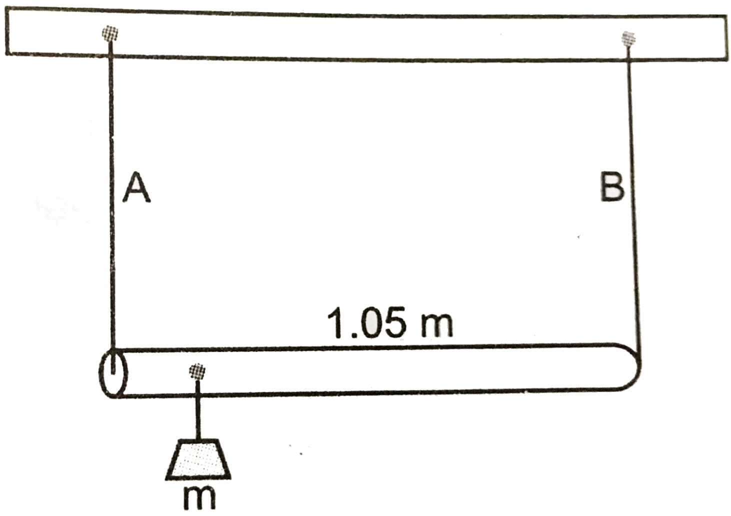
33. A rod of length 1.05 m having negliaible mass is supported at its ends by two wires of steel (wire A) and aluminium (wire B) of equal lengths as shown in fig. The cross-sectional area of wire A and B are $1mm^2$ and $2mm^2$, respectively . At what point along the rod should a mass m be suspended in order to produce (a) equal stresses and (b) equal strains in both steel and aluminium wires. Given,

$Y_{steel} = 2 \times 10^{11} Nm^{-2}$ and $Y - (aluminium) = 7.0 \times 10^{10} N^{-2}$



A. mass m should be suspended close to the wire A

B. mass m should be suspended close to the wire B

C. mass m should be suspended at the middle of the wires

D. mass m should be suspended from a point at a distance of

1/10 from the wire A

Answer: B

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34. Modulus of rigidity of a liquid

A. one

B. infinity

C. zero

D. a very large number

Answer: C

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35. The modulus of elasticity of a perfectly rigid body is

A. zero

B. infinity

C. unity

D. a negative number

Answer: B

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36. According to Hooke's law of elasticity, if stress is increaed, the ratio of stress to strain

A. is increased

B. is decreased

C. is zero

D. remains constant

Answer: D

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37. The change in volume per unit original volume, per unit increase in pressure is called

A. Bulk modulus

B. Volume coefficient

C. Compressibility

D. Poisson's ratio

Answer: C

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38. What will be the stress required to double the length of a wire of Young's modulus Y?

A. $\frac{Y}{2}$

B. 2Y

C. 3Y

D. Y

Answer: D

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39. For an incompressible liquid, the bulk modulus is

A. zero

B. constant

C. a small number

D. infinity

Answer: D

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40. Theoretically Poisson's ratio (σ) lies between -1 and 0.5.

If value of σ is negative, it implies that when a wire is stretched, its

A. diameter will increase

B. diameter will decrease

C. diameter will not change

D. diameter may increase or decrease

Answer: A

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41. When the deforming force applied on a body is changed rapidly or if it is applied for a very long time, the body loses its property of elasticity temporarily. This temporary loss of elasticity is called

A. elastic relaxation

B. elastic fatigue

C. plastic deformation

D. permanent set

Answer: B

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42. A wire is progressively loaded slightly beyond the elastic limit and then the load is completely removed. It is found that a small strain remains in the wire. This small strain is known as

A. elastic fatigue

B. permanent set

C. yielding of the wire

D. shearing strain

Answer: B

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43. 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's

B. becomes four time

C. remains unchanged

D. becomes half

Answer: C

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44. When impurities are added to an elastic substance, its elasticity

A. increases

B. decreases

C. becomes zero

D. may increase or decrease

Answer: D

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45. The bulk modulus of water is $2 \times 10^9 N / m^2$. The pressure required to reduce the given volume of water by 1% is given by

A. $2 \times 10^7 N / m^2$

B. $10^7 N / m^2$

C. $0.5 \times 10^7 N / m^2$

D. $15 \times 10^6 N / m^2$

Answer: A

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46. Two wires have diameters in the ratio $2 : 1$, lengths in the ratio $4 : 3$ and Young's modulus in the ratio $5 : 3$. The ratio of

elongations produced in the wires when subjected to the same stretching force is

A. 1.5

B. 3

C. 4.5

D. 6

Answer: C

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47. In steel, the Young's modulus and the strain at the breaking point are $2 \times 10^{11} Nm^{-2}$ and 0.15 respectively the stress at the break point for steel is

A. $2 \times 10^{10} N / m^2$

B. $1.5 \times 10^{10} N / m^2$

C. $3 \times 10^{10} N / m^2$

D. $5 \times 10^{10} N / m^2$

Answer: C

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48. A spherical ball contracts in volume by 0.001% when it is' subjected to a pressure of 100 atmosphere Calculate its bulk modulus.

A. $0.2 \times 10^{5} N / m^2$

B. $0.02 \times 10^{7} N / m^2$

C. $50 \times 10^{7} N / m^2$

D. $50 \times 10^{9} N / m^2$

Answer: D

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49. The temperature of a wire of length 1 metre and area of cross-section $1cm^2$ is increased from $0^\circ C$ to $100^\circ C$. If the rod is not allowed to increased in length, the force required will be $\left(\alpha = 10^{-5} / .^\circ C \text{ and } Y = 10^{11} N / m^2\right)$

A. $4 \times 10^5 N$

B. $3 \times 10^5 N$

C. $6 \times 10^4 N$

D. $2 \times 10^6 N$

Answer: A

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50. On applying a stress of $20 \times 10^8 N/m^2$ the length of a perfectly elastic wire is doubled. It Young's modulus will be

A. $20 \times 10^8 N/m^2$

B. $30 \times 10^8 N/m^2$

C. $10 \times 10^8 N/m^2$

D. $5 \times 10^8 N/m^2$

Answer: A

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51. A wire suspended vertically from one of its ends is stretched by attaching a weight of 20 N to its lower end. If its length changes by 1% and if the Young's modulus of the material of the wire is $2 \times 10^{11} N/m^2$, then the area of cross section of the wire is

A. $1 mm^2$

B. $10^{-1} mm^2$

C. $10^{-2} mm^2$

D. $10^{-3} mm^2$

Answer: C

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52. The area of cross section of a steel wire $(Y = 2.0 \times 10^{11} N/m^2)$ is $0.1 cm^2$. The force required to double is length will be

A. $2 \times 10^{10} N$

B. $2 \times 10^{12} N$

C. $2 \times 10^{11} N$

D. $2 \times 10^{6} N$

Answer: D

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53. A cube of side 40 cm has its upper face displaced by 0.1 mm by a tangential force of 8 Kn. The shearing modulus of cube is :-

A. $10 N / m^2$

B. $100 N / m^2$

C. $500 N / m^2$

D. $1000 N / m^2$

Answer: D

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54. Find the change in volume of a lead block of volume 2 m^3 Which is subjected to pressure of 20 atm. (Take, 1 atm $= 1.013 \times 10^5 N/m^2$ and bulk modulus $= 8 \times 10^9 N/m^2$)

A. $3 \times 10^8 N/m^2$

B. $5 \times 10^7 N/m^2$

C. $6 \times 10^8 N/m^2$

D. $8 \times 10^8 N/m^2$

Answer: C

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55. The extension of a wire by the application of a load is 2 mm. The extension in a wire of the same material and same length but half the radius by the same load is

A. 4 mm

B. 6 mm

C. 8 mm

D. 12 mm

Answer: C

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56. when a weight of 10 kg is suspended from a copper wire of length 3m and diameter 0.4 mm. Its length increases by 2.4 cm. If the diameter of the wire is doubled then the extension in its length will be

A. 4.8cm

B. 0.6cm

C. 2.4cm

D. 1.2cm

Answer: B

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57. Two wires made from the same material have their lengths L and 2L and the radii 2r and r respectively. If they are stretched by the same force, their extensions are e_1 and e_2. The ratio $\frac{e_1}{e_2}$ is

A. $1:8$

B. $8:1$

C. $1:4$

D. $2:1$

Answer: A

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58. A metal plate has the dimensions $10cm \times 10cm \times 1mm$. One of its faces having larger area is fixed and a tangential force is applied to the opposite larger face. If the lateral displacement between the two surfaces is $1.2 \times 10^{-3}mm$, and the modulus of rigidity of the metal is $5 \times 10^{10}N/m^2$, then the tangential force is

A. 2×10^5N

B. $4 \times 10^5 N$

C. $6 \times 10^5 N$

D. $8 \times 10^5 N$

Answer: C

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59. The bulk modulus of a liquid is $2 \times 10^{10} N/m^2$. What is the percentage decrease in the volume of the liquid, when the pressure is increased by 20 atmosphere?

(one atmosphere $= 10^5 N/m^2$)

A. 0.0001

B. 0.0002

C. 0.0003

D. 0.0005

Answer: A

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60. A tangential force of $2100N$ is applied on a surface area $3 \times 10^{-6} m^2$ which is $0.1m$ form fixed surface. The force produces a shift of $7m$ of upper surface with respect to bottom. Calcualte the modulus of rigidity fo the material.

A. $10^9 N/m^2$

B. $10^{10} N/m^2$

C. $10^{11} N/m^2$

D. $5 \times 10^{10} N/m^2$

Answer: B

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61. A wire having Young's modulus $1.2 \times 10^{11} N/m^2$ is subjected to the stress of $2.4 \times 10^7 N/m^2$. If the length of the wire is 10m, the extension produced in it is

A. 2mm

B. 1mm

C. 3mm

D. 0.5mm

Answer: A

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62. An aluminium wire and a steel wire of the same length and cross section are joined end to end. The composite wire is hung from a rigid support and the load is suspended at the free end. If $Y_{AL} = 7 \times 10^{10} N/m^2$ and $Y_{\text{steel}} = 7 \times 10^{11} N/m^2$, the ratio of elongation of aluminium and steel wires is

A. $\frac{e_A}{e_S} = 5$

B. $\frac{e_A}{e_S} = 8$

C. $\frac{e_A}{e_S} = 10$

D. $\frac{e_A}{e_S} = 2.5$

Answer: C

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63. When a steel wire is subject to a stress of $3.8 \times 10^5 N/m^2$, its length is increased by 2 part in a million. The Young's modulus jof steel is

A. $6.4 \times 10^{11} N/m^2$

B. $10^{12} N/m^2$

C. $1.6 \times 10^{10} N/m^2$

D. $1.9 \times 10^{11} N/m^2$

Answer: D

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64. When a steel wire is subject to a stress of $3.8 \times 10^5 N/m^2$, its length is increased by 2 part in a million. The Young's modulus jof steel is

A. $19 \times 10^{11} N/m^2$

B. $9.5 \times 10^{11} N/m^2$

C. $3.8 \times 10^{11} N/m^2$

D. $1.9 \times 10^{11} N/m^2$

Answer: D

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65. A steel wire of length 20 cm and uniform cross-sectional area of $1mm^2$ is tied rigidly at both the ends at $45^\circ C$. If the temperature of the wire is decreased to $20^\circ C$, then the change in the tension of the wire will be

[Y for steel $= 2 \times 10^{11Nm^{-2}}$, the coefficient of linear expansion for steel $= 1.1 \times 10^{-5} / .^\circ \mathbb{C}^{-1}$]

A. 22N

B. 32N

C. 55N

D. 60N

Answer: C

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66. A wire having a diameter of 3mm is stretched by an external force, to produce a longitudinal strain of 3×10^{-3}. If the Poisson's ratio of the wire is 0.4, the change in the diameter is

A. $1.8 \times 10^{-3} mm$

B. $3.6 \times 10^{-3} mm$

C. $5 \times 10^{-3} mm$

D. $8 \times 10^{-3} mm$

Answer: B

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67. For a wire, the longitudinal strain is 20×10^{-3} and the lateral strain is 5×10^{-3}, then the Poisson's ratio of its material is

A. 0.25

B. 0.2

C. 0.15

D. 0.01

Answer: A

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68. The increase in length of a wire on stretching is 0.04%. If its Poisson's ratio is 0.5, the diameter is reduced by

A. 0.0001

B. 0.0005

C. 0.0004

D. 0.0002

Answer: D

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69. A 3m long steel wire is stretched to increase its length by 0.3cm. Poisson's ratio for steel is 0.25. What is the lateral strain produced in the wire?

A. 2.5×10^{-4}

B. 1.25×10^{-4}

C. 5×10^{-4}

D. 7.5×10^{-4}

Answer: A

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70. The compressibility of water is 4×10^{-5} per unit atmospheric pressure. The decrease in volume of 100 cubic centimetre of water under a pressure of 100 atmosphere will be

A. 0.1cc

B. 0.2cc

C. 0.3cc

D. 0.4cc

Answer: D

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71. Young's modulus of steel is Y and its rigidity modulus is η. A piece of steel of cross-sectional area A, is stretched into a wire of length L and area of cross-section $\frac{A}{4}$, In wire case

A. Y increases and η decreases

B. Y decreases and η increases

C. Both y and η do not change

D. Both Y and η are increased

Answer: C

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72. Y is the Young's modulus of the material of a wire of length L and cross-sectional area A. It is stretched through a length l. What is the force constant of the wire?

A. YA/L

B. YA/l

C. YL/A

D. Yl/A

Answer: A

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73. A ball falling in a lake of depth 200m shown 0.1% decrease in its volume at the bottom .What is the bulk modulus of the materialof the ball

A. $19.6 \times 10^6 N / m^2$

B. $19.6 \times 10^8 N / m^2$

C. $9.8 \times 10^3 N / m^2$

D. $19.6 \times 10^3 N / m^2$

Answer: B

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74. Within elastic limit, slope of the graph of bulk strain against bulk stress gives the

A. Poisson's ratio

B. Compressibility

C. Extension or compression

D. Modulus of elasticity

Answer: B

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75. Two wires have the same material and length, but their masses are in the ratio 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

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76. The Poisson's ratio of the material of a wire is 0.25. If it is stretched by a force F, the longitudinal strain produced in the wire is 5×10^{-4}. What is the percentage increase in its volume?

A. 0.2

B. 2.5×10^{-2}

C. Zero

D. 1.25×10^{-6}

Answer: C

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77. The symbols, Y,K and η represent the Young's modulus, bulk modulus and rigidty 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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78. A copper wire and a steel wire having the same cross-sectional area are fastened end to end and stretched by a fore F. The lengths of cpper 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

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

A. $2 \times 10^4 N/m^2$

B. $2 \times 10^5 N/m^2$

C. $2 \times 10^7 N/m^2$

D. $2 \times 10^6 N/m^2$

Answer: D

Watch Video Solution

80. The bulk modulus of a gas is $6 \times 10^3 N/m^2$. 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

Watch Video Solution

81. Two steel wires of the same radius have their lengths in the ratio of $1:2$. If they are stretched by the same force, then the strains produced in the two wires will be in the ratio of

A. $1:2$

B. $2:1$

C. $1:1$

D. $1:4$

Answer: C

Watch Video Solution

82. A rubber cord of cross sectional area $1mm^2$ and unstretched length 10cm is stretched to 12cm 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. $25N$

B. $50N$

C. $100N$

D. $200N$

Answer: C

Watch Video Solution

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

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

Watch Video Solution

84. A wire is stretched through 2mm by a certain load. The extension produced in a wire of the same material with double the length and radius with the same load will be

A. 2mm

B. 4mm

C. 1mm

D. 0.5mm

Answer: D

Watch Video Solution

85. Which one is the correct relation between the elastic constants Y, K and η ?

A. $Y = \frac{9K\eta}{3K + \eta}$

B. $Y = \frac{3K\eta}{3\eta + K}$

C. $Y = \frac{3K + \eta}{K\eta}$

D. $Y = \frac{K\eta}{K + 3\eta}$

Answer: A

Watch Video Solution

86. The compressibility of water is $6 \times 10^{-10} m^2 / N$. If one litre of water is subjected to a pressure of $4 \times 10^7 N / m^2$, then the decrease in volume will be

A. 10 mL

B. 15 mL

C. 20 mL

D. 24 mL

Answer: D

Watch Video Solution

87. When the length of a wire is increased by 5%, its radius decreases by 1%. The Poission's ratio for the material of the wire is

A. 0.1

B. 0.3

C. 0.75

D. 0.2

Answer: D

Watch Video Solution

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

A. $7.14 \times 10^{-3} m^2$

B. $7.14 \times 10^{-4} m^2$

C. $7.14 \times 10^{-6} m^2$

D. $7.14 \times 10^{-5} m^2$

Answer: B

Watch Video Solution

89. The Young's modulus of a wire of length L and radius r is Y newton/m^2. If the length of the wire is dooubled and the radius is reduced to $\frac{r}{2}$, its Young's modulus will be

A. $\frac{Y}{2}$

B. 2Y

C. $\frac{3}{2}Y$

D. Y

Answer: D

Watch Video Solution

90. When a liquid of volume 4 litre is subjected to an additional pressure of $5 \times 10^7 N/m^2$, the change in the volume of the liquid is found to be 4 ml. In this case, the Bulk modulus of the liquid is

A. $2.5 \times 10^{10} N/m^2$

B. $5 \times 10^{10} N/m^2$

C. $7.5 \times 10^{10} N/m^2$

D. $10^{11} N/m^2$

Answer: B

Watch Video Solution

91. A wire can be broken by applying a load of 15 kg wt. The force required to break the wire of the same length and material but of twice the diameter of the wire will be

A. 30 kg wt.

B. 45 kg wt.

C. 60 kg wt.

D. 80 kg wt.

Answer: C

Watch Video Solution

92. For a given material, the Young's modulus is 2.4 times its modulus of rigidity. What is the value of its Poisson's ratio ?

A. 0.5

B. 0.4

C. 0.2

D. 0.3

Answer: C

Watch Video Solution

93. Two wires A and B are of the same material. Their lengths are in the ratio 1 : 2 and the diameter are in the ratio 2 : 1. If they are pulled by the same force, then increase in length will be in the ratio

A. $1:2$

B. $2:1$

C. $1:4$

D. $4:1$

Answer: B

Watch Video Solution

94. The longitudinal extension of any elastic material is very small. In order to have an appreciable change, the material must be in the form of

A. short thin wire

B. thin block of any cross-section

C. long thin wire

D. thick block of any cross-section

Answer: C

Watch Video Solution

95. If a gas is heated at constant pressure, its isothermal compressibility

A. decreases linearly with temperature

B. increases linearly with temperature

C. decreases linearly with temperature

D. remains constant

Answer: D

Watch Video Solution

96. When a wire is stretched, the increase in its length is 0.02%. What is the percentage decrease in its diameter if its Poisson's ratio is 0.3 ?

A. 0.005

B. 0.006

C. 0.002

D. 0.001

Answer: B

Watch Video Solution

97. When compared with solids and liquids, the gases have

A. maximum Young's modulus (Y)

B. maximum modulus of rigidity (η)

C. minimum bulk modulus of elasticity

D. maximum bulk modulus of elasticity

Answer: C

Watch Video Solution

98. The ratio of lengths of two rods A and B of same material is $1:2$ and the ratio of their radii is $2:1$, then the ratio of modulus of rigidity of A and B will be

A. $1:1$

B. $8:1$

C. $16:1$

D. $4:1$

Answer: A

Watch Video Solution

99. The isothermal bulk modulus of a gas at atmospheric pressure is

A. $2.026 \times 10^5 N/m^2$

B. $1.013 \times 10^7 N/m^2$

C. 1 mm of Hg

D. $1.013 \times 10^5 N/m^2$

Answer: D

Watch Video Solution

100. What is the force requiredto stretch a steel wire of $1 cm^2$ cross-section to 1.1 times its length ? $(Y = 2 \times 10^{11} N/m^2)$

A. $2 \times 10^3 N$

B. $2 \times 10^{-6} N$

C. $2 \times 10^{-7} N$

D. $2 \times 10^6 N$

Answer: D

Watch Video Solution

101. For silver, Young's modulus is $7.25 \times 10^{10} N/m^2$ and Bulk modulus is $11 \times 10^{10} N/m^2$. What is its Poisson's ratio ?

A. 0.5

B. -1

C. 0.25

D. 0.39

Answer: D

Watch Video Solution

102. If young's modulus of iron be $2 \times 10^{11} Nm^{-2}$ and interatomic distance be $3 \times 10^{-10} m^{-2}$, the intertomic force constant will be (in N/m)

A. 180 N/m

B. 60 N/m

C. 120 N/m

D. 30 N/m

Answer: B

Watch Video Solution

103. What is the correct relation between young's modulus (Y), modulus is rigidity (η) and poisson ratio (σ) ?

A. $Y = 2\eta(1 + \sigma)$

B. $Y = \eta(1 - 2\sigma)$

C. $Y = 2\eta(1 + 2\sigma)$

D. $Y = 2\eta(1 - \sigma)$

Answer: A

Watch Video Solution

104. The extension of a wire by the application of load is $3mm$. The extension in a wire of the same material and length but half the radius by the same load is

A. 12 mm

B. 0.75 mm

C. 15 mm

D. 6 mm

Answer: A

Watch Video Solution

105. One litre of a gas, kept at a pressure of 75 cm. of mercury is compressed isothermally. If its volume becomes $750cm^3$, then the bulk stress is

$\left(g = 10m/s^2, e_{\text{mercury}} = 13.6g/c.c\right]$

A. $1.4 \times 10^5 N/m^2$

B. $2 \times 10^6 N/m^2$

C. $3.4 \times 10^6 N/^2$

D. $5.4 \times 10^6 N/m^2$

Answer: C

Watch Video Solution

106. Which one of the following statements is correct ?

A. Shearing stress is possible in liquids but not in gases

B. Elastomers are class of solids that do not obey Hooke's law

C. Elastic limit is the property of material of body whereas elasticity is the property of a body

D. Bulk modulus of most of the solid material is zero

Answer: B

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107. The approximate depth of an ocean is 2700 m. The compressibility of water is $45.4 \times 10^{-11} Pa^{-1}$ and density of water is $10^3 kg/m^3$. What fractional compression of water will be obtained at the bottom of the ocean ?

A. 1.0×10^{-2}

B. 1.2×10^{-2}

C. 1.4×10^{-2}

D. 0.8×10^{-2}

Answer: B

Watch Video Solution

108. The bulk modulus of a liquid is $6 \times 10^3 N/m^2$. What is the additional pressure required to reduce the volume of the liquid by 10% ?

A. $1200 N/m^2$

B. $600 N/m^2$

C. $2400 N/m^2$

D. $1600 N/m^2$

Answer: B

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Watch Video Solution

109. Which one is the correct relation between the elastic constants Y, K and η ?

A. $\frac{9}{Y}=\frac{1}{\eta}+\frac{1}{3K}$

B. $\frac{3}{Y}=\frac{1}{3\eta}+\frac{1}{K}$

C. $\frac{3}{Y}=\frac{1}{\eta}+\frac{1}{3K}$

D. $\frac{3}{Y}=\frac{3}{\eta}+\frac{1}{3K}$

Answer: C

Watch Video Solution

110. The increase in pressure in kPa requried to decrease 200 litre volume of a liquid by 0.004% is (bulk modulus of the liquif = 2100 Mpa)

A. 84

B. 92.4

C. 8.4

D. 168

Answer: A

Watch Video Solution

111. Two wire of the same material and length stretched by the same force. If the ratio of the radii of the two wires is n : 1 then the ratio of their elongations is

A. $n^2 : 1$

B. $1 : n^2$

C. $1 : n$

D. $n : 1$

Answer: B

Watch Video Solution

112. A steel wire of length 20 cm and uniform cross-section $1mm^2$ is tied rigidly at both the ends. If the temperature of the wire is altered from $40^\circ C$ to $20^\circ C$, the change in tension. [Given coefficient of linear expansion of steel is $1.1 \times 10^5 .^\circ C^{-1}$ and Young's modulus for steel is $2.0 \times 10^{11} Nm^{-2}$]

A. 10 N

B. 20 N

C. 40 N

D. 60 N

Answer: C

Watch Video Solution

113. The density of a uniform steel wire of mass $1.6 \times 10^{-2} kg$, and length 2.5 m is $8 \times 10^3 kg / m^3$. When it is loaded by 8kg, it elongates by 1.25 mm. If $g = 10m / s^2$, then the Young's modulus of the material of the wire is

A. $1.5 \times 10^{11} N / m^2$

B. $2 \times 10^{11} N / m^2$

C. $1.75 \times 10^{11} N / m^2$

D. $1.5 \times 10^{12} N / m^2$

Answer: B

Watch Video Solution

114. An aluminium rod has a breaking strain 0.2%. The minimum cross-sectional area of the rod in m^2 in order to support a load of $10^4 N$ is fi (Young's modulus is $7 \times 10^9 Nm^{-2}$)

A. $1.4 \times 10^{-3} m^2$

B. $7.1 \times 10^{-4} m^2$

C. $1 \times 10^{-2} m^2$

D. $3.5 \times 10^{-3} m^2$

Answer: B

Watch Video Solution

115. There is no change in the volume of a wire due to change in its length on stretching. The poisson's ratio of the material of the wire is

A. 0.500

B. -0.50

C. $+0.25$

D. -0.25

Answer: A

Watch Video Solution

116. The Young's modulii of brass ans steel are in the ratio of $1:2$. A brass wire and a steel wire of the same length are extended by the same amount under the same deforming force. If r_B and r_S are the radii of brass and steel wires respectively, then

A. $r_S = \frac{r_B}{2}$

B. $r_S = \frac{r_B}{\sqrt{2}}$

C. $r_S = \sqrt{2} r_B$

D. $r_S = 2 r_B$

Answer: B

Watch Video Solution

117. When the tension in a metal wire is T_1, its length is I_1. When the tension is T_2, its length is I_2. The natural length of wire is

A. $\frac{L_1 + L_2}{2}$

B. $\frac{T_2 L_1 - T_1 L_2}{T_2 - T_1}$

C. $\sqrt{\frac{L_1 L_2}{2}}$

D. $\frac{L_1 T_2 + L_2 T_1}{T_1 + T_2}$

Answer: B

Watch Video Solution

118. The presssure of a medium is changed from $1.01 \times 10^5 Pa$ to $1.165 \times 10^5 Pa$ and change in volume is 10% keeping temperature constant . The bulk modulus of the medium is

(a) $204.8 \times 10^5 Pa$ (b) $102.4 \times 10^5 Pa$ (c) $5.12 \times 10^5 Pa$

(d) $1.55 \times 10^5 Pa$

A. $20.4 \times 10^5 Pa$

B. $10.2 \times 10^5 Pa$

C. $5.2 \times 10^5 Pa$

D. $1.55 \times 10^5 Pa$

Answer: D

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119. For a metal $Y = 1.1 \times 10^{10} N/m^2$ and Bulk modulus is $K = 11 \times 10^{10} N/m^2$ then Poisson's ratio is (nearly)

A. 0.25

B. 0.30

C. 0.35

D. 0.4

Answer: D

Watch Video Solution

120. Which statement is true for a metal

A. $Y = \eta$

B. $Y < 1/\eta$

C. $Y < \eta$

D. $Y > \eta$

Answer: D

Watch Video Solution

121. If a wire having initial diameter of 2 mm produced the longitudinal strain of 0.1%, then the final diameter of wire will be $(\sigma = 0.5)$

A. 1.999 mm

B. 1.990 mm

C. 2.001 mm

D. 2.010 mm

Answer: A

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122. Four wires of the same material but having different lentghs and radii are subjected to same load. Which of the following combinations of length L and radius r will have the heighest elongation ?

A. L = 200 cm, r = 2mm

B. L = 300cm, r = 3mm

C. L = 400 cm, r = 4mm

D. L = 100 cm, r = 1mm

Answer: D

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123. Two wires are made of the same material and have the same volume. However, wire 1 has cross-sectional area A and wire 2 has cross-sectional area $3A$. If the length of wire 1 increases by $\triangle x$ on applying force 1 newton, how much force is needed to stretch wire 2 by the same amount?

A. F

B. 4F

C. 6F

D. 9F

Answer: D

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124. an elastic spring has a length l_1 when tension in it is 4N. Its length is l_2 when tension in it is 5N. What will be its length when tension in it is 9N?

A. $4l_1 - 5l_2$

B. $5l_2 - 4l_1$

C. $9l_1 - 9l_2$

D. $l_1 + l_2$

Answer: B

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125. A wire of length L and radius r is loaded with a weigth Mg. If y and σ denote the Youngs modulus and Poisson's ratio of the material of the wire respectively. Then the decreases in the radius of the wire is given by

A. $\Delta r = \frac{\sigma \pi r}{MgY}$

B. $\Delta r = \frac{Mgr}{\pi \sigma Y}$

C. $\Delta r = \frac{Mg\sigma}{\pi r Y}$

D. $\Delta r = \frac{MgY}{\pi r \sigma}$

Answer: C

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126. The bulk modulus of elasticity of the material of a metal sphere is $2 \times 10^{11} N/m^2$. In open air, atmospheric pressure of $10^5 N/m^2$ acts on it. What is the fractional change in its volume if it is kept in a vacuum chamber ?

A. 2×10^{-7}

B. 3×10^{-7}

C. 4×10^{-7}

D. 5×10^{-7}

Answer: D

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127. An Indian rubber cord L metre long and area of cross-section A metre^2 is suspended vertically. Density of rubber is D kg/metre^2. If the wire extends by l metre under its own weight, then extension l is

A. $\frac{\rho g L^2}{2y}$

B. $\frac{2Y}{\rho g L^2}$

C. $\dfrac{2\rho g L}{Y}$

D. $\dfrac{\rho^2 g^2 L}{Y^2}$

Answer: A

Watch Video Solution

128. For a constant hydraulic pressure on an object, the fractional change in the object's volume $\left(\dfrac{\Delta V}{V}\right)$ and its compressibility $\left(\dfrac{1}{K}\right)$ are related as

A. $\dfrac{\Delta V}{V} \propto K$

B. $\dfrac{\Delta V}{V} \propto K^2$

C. $\dfrac{\Delta V}{V} \propto \dfrac{1}{K}$

D. $\dfrac{\Delta V}{V} \propto \dfrac{1}{K^2}$

Answer: C

Watch Video Solution

129. The bulk modulus of rubber is $9.1 \times 10^8 N/m^2$. To what depth a rubber ball be taken in a lake so that its volume is decreased by 0.1% ?

A. 550 m

B. 350 m

C. 273 m

D. 183 m

Answer: D

Watch Video Solution

130. If stress-strain relation for volametric change is in the from $\frac{\Delta V}{V_0} = KP$ where P is applied uniform pressure, then K stands for

A. Young's modulus

B. Bulk modulus

C. Shear modulus

D. Compressibility

Answer: D

Watch Video Solution

131. A fixed volume of iron is drawn into a wire of length L. the extension x produced in this wire by a constant force f is proportional to

A. $\frac{1}{L}$

B. L^2

C. L

D. $\frac{1}{L^2}$

Answer: B

Watch Video Solution

132. The ratio of two specific heats of has C_p / C_v for argon is 1.6 and for hydrogen is 1.4. Adiabatic elasticity of argon at pressure P is E Adiabatic elasticity of hydrogen will also be equal to E at the pressure

A. 1.4 P

B. $\frac{8}{7}P$

C. P

D. $\frac{7}{8}P$

Answer: B

Watch Video Solution

133. The lower surface of a cube is fixed. On its upper surface, force is applied at an angle of 30° from its surface. The change will be the type

A. Size

B. Shape and Size

C. Shape

D. None

Answer: B

Watch Video Solution

134. The pressure applied from all direction on a cube is P. How much its temperature should be raised to maintain the original volume ? The volume elasticity of the cube is β and the coefficient of volume expansion is α

A. $\frac{P\alpha}{\beta}$

B. $\frac{\alpha\beta}{P}$

C. $\frac{P}{\alpha\beta}$

D. $\frac{P\beta}{\alpha}$

Answer: C

Watch Video Solution

135. The Young's modulus of the material of a wire is $6 \times 10^{12} N / m^2$ and there is no transverse strain in it.then it modulus of rigidity will be

A. $10^{12} N / m^2$

B. $3 \times 10^{12} N / m^2$

C. $2 \times 10^{12} N / m^2$

D. None of the above

Answer: B

Watch Video Solution

136. If the Young's modulus of the material is 3 times its modulus of rigidity then its bulk modulus of elasticity will be

A. Infinity

B. $3 \times 10^{10} N / m^2$

C. $2 \times 10^{10} N / m^2$

D. Zero

Answer: A

Watch Video Solution

137. 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, then poisson's ratio is given by

A. $\frac{Mr}{\pi R^2 l \rho}$

B. $\frac{Mr}{\pi R^3 l \rho}$

C. $\frac{Mr\rho}{\pi r^3 l}$

D. $\frac{Mr\rho}{\pi r^2 l}$

Answer: B

Watch Video Solution

138. The length of an elastic wire is x under a tension of 5 N. Its length is y when the tension is 7 N. If the tension becomes 9 N then the length of the wire will be

A. $2y - x$

B. $7x - 5y$

C. $7x + 5y$

D. $2y + x$

Answer: A

Watch Video Solution

139. A wire elongates by l mm when a load W is hanged from it. If the wire goes over a pulley and two weights W each are hung at the two ends, the elongation of the wire will be (in mm)

A. zero

B. $\frac{l}{2}$

C. l

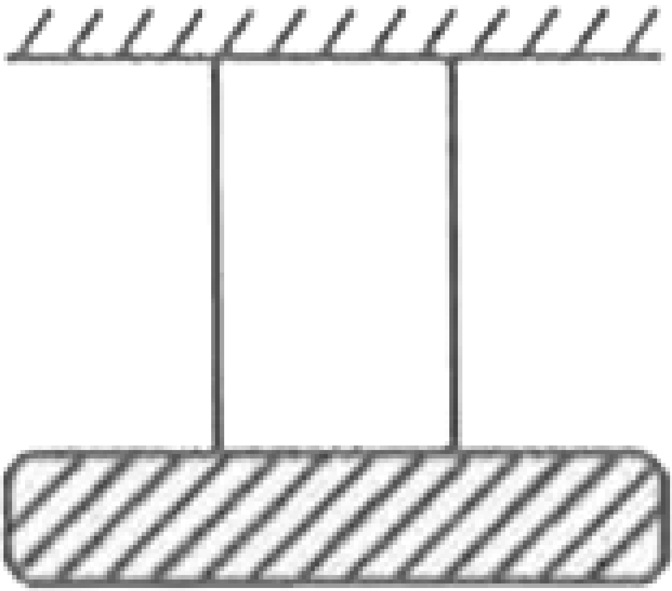
D. 2l

Answer: C

Watch Video Solution

140. Two wires of equal lengths and cross-sectiona are suspended as shown in the figure. Their Young's moduli are Y_1 and Y_2

respectively.



A. $Y_1 + Y_2$

B. $\dfrac{Y_1 + Y_2}{2}$

C. $\sqrt{Y_1 Y_2}$

D. $\dfrac{Y_1 Y_2}{Y_1 + Y_2}$

Answer: B

View Text Solution

141. A metal wire of negligible mass, length 1 m and cross-sectional area $10^{-6} m^2$ is kept on a smooth horizontal table with one end fixed on the table. A ball of mass 2kg is attached to the other end of the wire. When the wire and the ball are rotated with angular velocity of 20 rad/s, it is found that the wire is elongated by $10^{-3} m$. If the Young's modulus of the metal is $n \times 10^{11} N/m^2$, then the value of n is

A. 6

B. 8

C. 9

D. 10

Answer: B

Watch Video Solution

142. Steel wire of length 'L' at $40^{\circ} C$ is suspended from the ceiling and then a mass 'm' is hung from its free end. The wire is cooled down from $40^{\circ} C \rightarrow 30^{\circ} C$ to regain its original length 'L'. The coefficient of linear thermal expansion of the steel is $10^{-5} / {}^{\circ} C$, Young's modulus of steel is $10^{11} N / m^2$ and radius of the wire is 1mm. Assume that $L > \; >$ diameter of the wire. Then the value of 'm' in kg is nearly

A. 2 kg

B. 3 kg

C. 4 kg

D. 5 kg

Answer: B

Watch Video Solution

143. To what depth must a rubber ball be taken in deep sea so that its volume is decreases by 0.1% (The bulk modulus of rubber is $9.8 \times 10^8 N/m$, and the density of sea water is $10^3 kg/m^3$)

A. 50

B. 100 m

C. 150 m

D. 200 m

Answer: B

Watch Video Solution

144. A rigid bar of mass M is supported symmetrically by three wires each of length l. Those at each end are of copper and the middle one is of iron. What is the ratio of their diameters $\frac{D_{\text{copper}}}{D_{\text{iron}}}$ if each wire is to have same tension?

A. $\frac{Y_{\text{copper}}}{Y_{\text{iron}}}$

B. $\sqrt{\frac{Y_{\text{copper}}}{Y_{\text{iron}}}}$

C. $\frac{Y_{\text{iron}}^2}{Y_{\text{copper}}^2}$

D. $\frac{Y_{\text{iron}}}{Y_{\text{copper}}}$

Answer: B

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145. Two wires 'A' and 'B' of the same material have radii in the ratio $2:1$ and lengths in the ratio $4:1$. The ratio of the normal forces required to produce the same change in the lengths of these two wires is

A. $1:2$

B. $1:1$

C. $2:1$

D. $1:4$

Answer: B

Watch Video Solution

146. The Young's modulus of a rubber string 8 cm long and density $1.5kg/m^3$ is $5 \times 10^8 N/m^2$ is suspended on the ceiling in a room. The increase in length due to its own weight will be-

A. $9.6 \times 10^{-5}m$

B. $9.6 \times 10^{-3}m$

C. $9.6m$

D. $9.6 \times 10^{-7} m$

Answer: D

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147. For a body its elastic potential energy is equal to

A. $\frac{1}{2} \times \text{stress} \times \text{strain}$

B. $\frac{1}{2} \times \text{stress} \times \text{strain} \times \text{volume of the body}$

C. $\frac{1}{2} \times \text{stress} \times \text{strain} \times \text{area of the body}$

D. $\frac{1}{2} \times \text{stress} \times \text{strain} \times \text{volume of the body}$

Answer: B

Watch Video Solution

148. Two springs of force constants K and 2K are stretched by the same force. If E_1 and E_2 are the potential energies stored in them respectively then

A. $E_1 = E_2$

B. $E_1 = 2E_2$

C. $E_1 = \frac{E_2}{2}$

D. $E_1 = \frac{E_2}{4}$

Answer: B

Watch Video Solution

149. A wire of length L and area of cross section A is made of a material of Young's modulus Y. If it is stretched by an amount x, the work done is given by

A. $\frac{2YAx^2}{L}$

B. $\frac{YAx^2}{L}$

C. $\frac{1}{2}\frac{YAx^2}{L}$

D. $\frac{1}{2}\frac{YAx}{L}$

Answer: C

Watch Video Solution

150. When a wire is stretched by a force the strain produced in the wire is 2×10^{-4}. If the energy stored per unit volume of the wire is $4 \times 10^4 \text{joule}/m^3$ then the Young's modulus of the material of the wire will be,

A. $1 \times 10^{12} N/m^2$

B. $1.5 \times 10^{12} N/m^2$

C. $2 \times 10^{12} N / m^2$

D. $2.5 \times 10^{12} N / m^2$

Answer: C

Watch Video Solution

151. A long spring is stretched by 2 cm and its potential energy is U. IF the spring is stretched by 10 cm. its potential energy will be

A. 5 V

B. 25 V

C. $\frac{V}{25}$

D. $\frac{V}{5}$

Answer: B

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152. When the load on a wire is slowly increased from $3kgwt$ to $5kgwt$, the elongation increases from 0.61 to $1.02mm$. The work done during the extension of wire is

A. 16 J

B. 1.6 J

C. 0.16 J

D. 0.016 J

Answer: D

Watch Video Solution

153. If x is the strain produced in a wire having the Young's modulus Y, then the strain energy per unit volume is

A. $\frac{1}{2}Yx$

B. Yx^2

C. $\frac{1}{2}Yx^2$

D. $\frac{x^2}{Y}$

Answer: C

Watch Video Solution

154. A weight Mg is attached to the free end of a wire suspended from a rigid support. The wire is extended by l. The ratio of the elastic potential energy stored in the stretched wire to the work done by the weight Mg is

A. $1:1$

B. $1:2$

C. $1:3$

D. $2:1$

Answer: A

Watch Video Solution

155. For an elastic stretched wire, the ratio of its elastic potential energy and the energy density of the wire is equal to

A. stress in the wire

B. Young's modulus of the material of the wire

C. strain in the wire

D. volume of the wire

Answer: D

Watch Video Solution

156. Two identical wires, one of copper and the other os steel are of the same length. They are equally stretched. If $Y_{\text{steel}} > Y_{\text{copper}}$ then in stretching

A. more work is done is stretching the copper wire

B. more work is done in stretching the steel wire

C. equal work is done on both the wires, as they are equally stretched

D. less work is done in stretching the steel wire

Answer: B

Watch Video Solution

157. A wire suspended vertically from one of its ends is stretched by attaching a weight of 100 N 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. $5 \times 10^{-2} J$

B. $10^{-3} J$

C. $2.5 \times 10^{-3} J$

D. $7.5 \times 10^{-2} J$

Answer: D

Watch Video Solution

158. 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 relation between the works done in the two cases is

A. $W_2 = W_1$

B. $W_2 = 0.5W_1$

C. $W_2 = 2W_1$

D. $W_2 = 2W_1^2$

Answer: B

Watch Video Solution

159. When a long spring is stretched by 2cm, its potential energy is U. If the spring is stretched by 10cm, the potential energy stored in it will be

A. E

B. 5E

C. 25E

D. $\frac{25}{2}E$

Answer: C

Watch Video Solution

160. The energy stored per unit volume in copper wire, which produces longitudinal strain of 0.1% is

$(Y = 1.1 \times 10^{11} N/m^2)$

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

Watch Video Solution

161. When the load on a wire is increased slowly from 4 to 8 kg, the elongation increases from 1.00 mm to 1.6 mm. If $g = 10 m/s^2$, then the work done during the extention of the wire is

A. $2.2 \times 10^{-2} J$

B. $4.4 \times 10^{-2} J$

C. $8.8 \times 10^{-3} J$

D. $1.1 \times 10^{-3} J$

Answer: B

Watch Video Solution

162. A long wire hangs vertically with its upper end clamped. A torque of 6 N-m, applied to its free twists it through an angle of 30°. The potential energy of the twisted wire is

A. 0.57 J

B. 1.57 J

C. 2.5 J

D. 3.5 J

Answer: B

Watch Video Solution

163. Strain energy of a wire is $1.8 \times 10^{-3} J$ and strain energy per unit volume of the same wire under the same conditions is $6 \times 10^{-3} J / m^3$. The volume of the wire will be

A. $0.2 m^3$

B. $0.3 m^3$

C. $1.5 m^3$

D. $0.4 m^3$

Answer: B

Watch Video Solution

164. When a 4kg mass in hung vertically from a light spring that obeys Hooke's low, the spring stretches by 2 cm. The work that should be done by an external agent in stretching this spring by 5 cm will be (use $g = 10m/s^2$)

A. 1.5 J

B. 1.75 J

C. 2 J

D. 0.9 J

Answer: D

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165. If the tension on a wire is removed at once, then

A. will decreases slightly

B. will increases slightly

C. will not change

D. may increase or decrease, depending upon the surrounding conditions

Answer: B

Watch Video Solution

166. If a spring extends by x on loading, then the energy stored by the spring is (if T is tension in the spring and K is spring constant)

A. $\frac{T^2}{2K}$

B. $\frac{2x}{T^2}$

C. $\frac{2T^2}{K}$

D. $\frac{T^2}{2x}$

Answer: A

Watch Video Solution

167. The spring balance does not read properly after its long use because

A. its plasticity increases

B. its elasticity decreases

C. its elasticity increases

D. its plasticity decreases

Answer: B

Watch Video Solution

168. Which one of the following statements is wrong ?

A. Reciprocal of the bulk modulus of elasticity is known as compressibility

B. Hollow shaft is much stronger than a solid shaft of the same mass and radius

C. Sliding of molecular layers is easier than compression or expansion

D. Elasticity of a material is decreased by hammering and rolling

Answer: D

Watch Video Solution

169. The force constant of a wire is K. What is the work done in increasing the length of the wire by l ?

A. Kl

B. $\frac{1}{2}Kl^2$

C. Kl^2

D. $\frac{K}{2}$

Answer: B

Watch Video Solution

170. If the potential energy of a spring is V on stretching it by $2cm$, then its potential energy when it is stretched by $10cm$ will be

A. $\frac{U}{5}$

B. $\frac{U}{25}$

C. 25 U

D. 5 U

Answer: C

Watch Video Solution

171. When the load applied to stretch a wire is increased from 1kg-wt to 2kg-wt, the extention produced in the wire increases from 0.5 mm to 1mm. The work done in the extenstion of the wire is $\left(g = 10m/s^2\right)$

A. $2.5 \times 10^{-3} J$

B. $1.87 \times 10^{-3} J$

C. $7.5 \times 10^{-3} J$

D. $1.5 \times 10^{-3} J$

Answer: C

Watch Video Solution

172. The weight to the wire in the young's modulus experiment is slowly increased. It is found that the wire started elongating of its own accord. Then on its stress-strain curve, the wire must have gone beyond its

A. Breaking point

B. the elastic limit

C. yield point

D. propportional point

Answer: C

Watch Video Solution

173. There are two identical springs, each of spring constant 240 N/m, one of them is compressed by 10cm and the other is stretched by 10 cm. What is the difference in the potential energies stored in the two springs ?

A. Zero

B. 1.2 J

C. 4 J

D. 12 J

Answer: A

Watch Video Solution

174. When the load applied to stretch a wire is increased from 1kg-wt to 2kg-wt, the extention produced in the wire increases from 0.5 mm to 1mm. The work done in the extenstion of the wire is $(g = 10m / s^2)$

A. $2.5 \times 10^{-3} J$

B. $1.87 \times 10^{-3} J$

C. $7.5 \times 10^{-3} J$

D. $1.5 \times 10^{-3} J$

Answer: C

Watch Video Solution

175. A string of length 'L' and force constant 'K' is stretched to obtain extension $'l'$. It is further stretched to obtain extension $'l'$. The work done in second stretching is

A. $\frac{1}{2}Kl_1(2l+l_1)$

B. $\frac{1}{2}Kl_2^2$

C. $\frac{1}{2}K(l^2+l_1^2)$

D. $\frac{1}{2}K(l_1^2-l^2)$

Answer: A

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176. A wire suspended vertically from one of its ends is stretched by attaching a weight of 200 N to the lower end. The weight stretches the wire by 2mm. The elastic energy stored in the wire is

A. 0.1 J

B. 0.2 J

C. 0.5 J

D. $2.00J$

Answer: B

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177. What is the energy stored per unit volume in a copper wire of uniform cross section and length 1.5 m, when it is stretched to a length of 1.51 m by a stress of $3 \times 10^2 N/m^2$?

A. $0.25J/m^3$

B. $0.5 J / m^3$

C. $0.75 J / m^3$

D. $1 J / m^3$

Answer: D

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178. Two springs of spring constants 1000 N/m and 2000 N/m respectively, are stretched with the same force. The ratio of their potential energies will be

A. $1:2$

B. $1:3$

C. $2:1$

D. $3:1$

Answer: C

Watch Video Solution

179. When a long wire is stretched by 0.25 cm, the energy stored per unit volume is $0.2Jm^{-3}$. When it is stretched by 1 cm, the increases in potential energy per unit volume sotred in the wire is given by

A. $2Jm^{-3}$

B. $3Jm^{-3}$

C. $2.5Jm^{-3}$

D. $4Jm^{-3}$

Answer: B

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180. A wire of uniform cross-sectional area A and young's modulus Y is stretched within the elastic limits. If s is stress in the wire, the elastic energy density stored in the wire in terms of the given parameters is

A. $\frac{8}{2Y}$

B. $\frac{2Y}{s^2}$

C. $\frac{s^2}{2Y}$

D. $\frac{s^2}{Y}$

Answer: C

Watch Video Solution

181. A brass rod of cross-sectional $1cm^2$ and length 0.2 m is compresssed lengthwire by a weight of 5kg. The young's modulus of elasticity of brass is $1 \times 10^{11} N/m^2$ and $g = 10m/\sec^2$. What is the increases in the energy of the rod ?

A. $10^{-5} J$

B. $2.5 \times 10^{-4} J$

C. $2.5 \times 10^{-5} J$

D. $5 \times 10^{-5} J$

Answer: C

Watch Video Solution

182. A metal rod of length 'L', cross-sectional area 'A', Young's modulus 'Y' and coefficient of linear expansion $'\alpha'$ is heated to

$'t'^{\circ}\ C$. The work that can be perfomred by the rod when heated is

A. $\frac{YA\alpha Lt^2}{2}$

B. $\frac{YA\alpha^2 LT^2}{2}$

C. $\frac{YA\alpha^2 L^2 t^2}{2}$

D. $\frac{YA\alpha Lt}{2}$

Answer: B

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183. Factor of safety (f) is defined as

A. $f = \frac{\text{Working stress}}{\text{Breaking stress}}$

B. $f = \frac{\text{Breaking stress}}{\text{Working stress}}$

C. $f = \sqrt{\frac{\text{Breaking stress}}{\text{Working stress}}}$

D. $f = \frac{\text{Breaking stress} + \text{Working stress}}{2}$

Answer: A

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184. Four companies submitted the quotations for building a bridge, with the following values of breaking stress (B_s) and working stress (W_s) expressed in N/m^2

(A) $B_s = 25 \times 10^8, W_s = 15 \times 10^8$

(B) $B_s = 20 \times 10^8, W_s = 15 \times 10^8$

(C) $B_s = 25 \times 10^8, W_s = 12.5 \times 10^8$

(D) $B_s = 25 \times 10^8, W_s = 20 \times 10^8$

To whome the contract should be given, if all of them have quoted the same amount ?

A. B

B. D

C. C

D. A

Answer: B

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185. For finding the maximum height of a mountain on the earth, we have to consider

A. Tensile stress and Poisson's ratio

B. Bulk stress and Poisson's ratio

C. Bulk stress and Shearing stress

D. Shearing stress and Tensile stress

Answer: B

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186. Assuming that shear stress at the base of a mountain is equal to the force per unit area due to its weight. Calculate the maximum possible height of a mountain on the earth if breaking stress of a typical rock is $3 \times 10^{8} Nm^{-3}$ and its density $3 \times 10^{-3} kgm^{-3}$. (Take $g = 10ms^{-2}$)

A. 5 km

B. 6 km

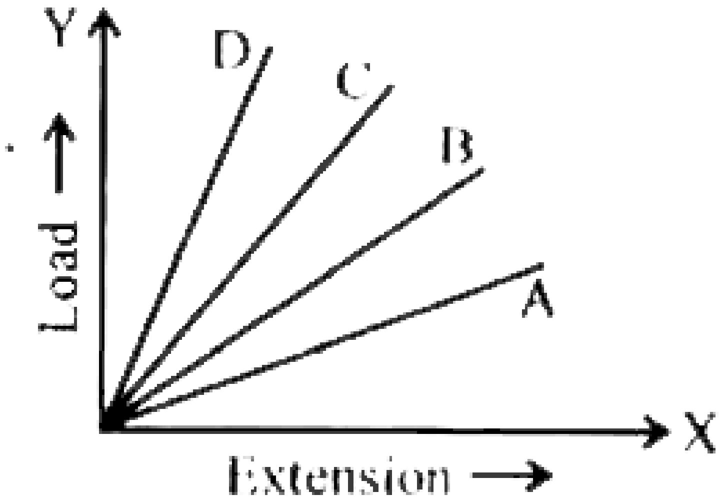
C. 8 km

D. 10 km

Answer: D

Watch Video Solution

187. The load versus elongation graph for four wires of the same length and material is represented by the four times OA, OB, OC and OD as shown in the figure, Which line represents the thinnest wire ?



A. line OB

B. line OA

C. line OD

D. line OC

Answer: B

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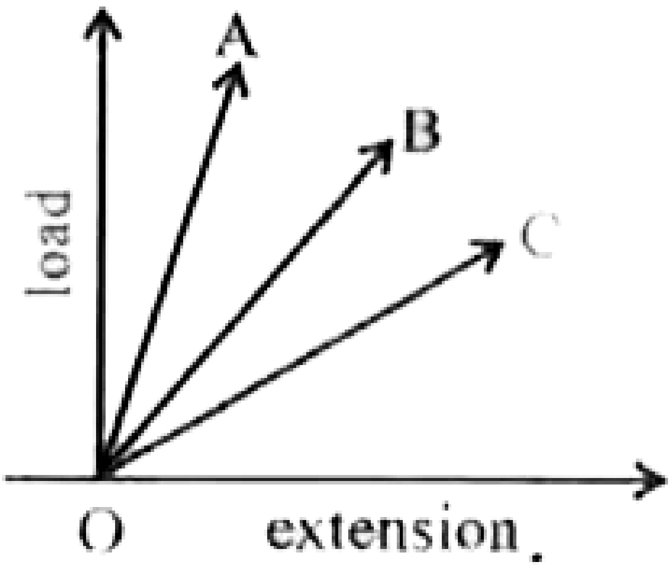
188. Three copper wires A , B and C of the same length are progressively loaded. Their load-extension graphs, within elastic limit, are as shown in the figure. Which wire has the minimum cross-sectional area ?



A. Wire C

B. Wire A

C. Wire B

D. All have equal areas of cross-sectional

Answer: A

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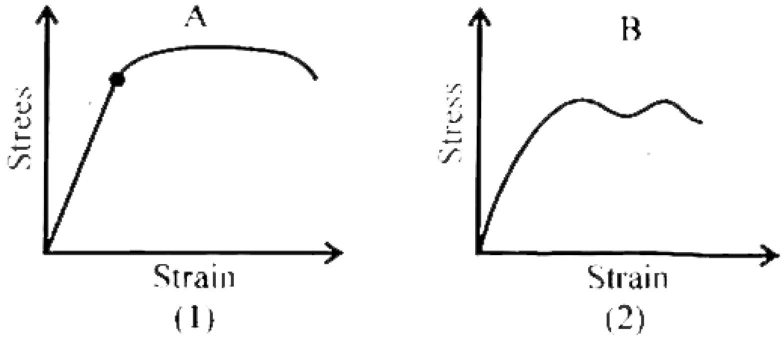
189. The stress-strain graphs for two metals A and B are as shown in the figures (1) and (2).



Then,

A. young's modulus of $B >$ young's modulus of A

B. A is more ductile than B

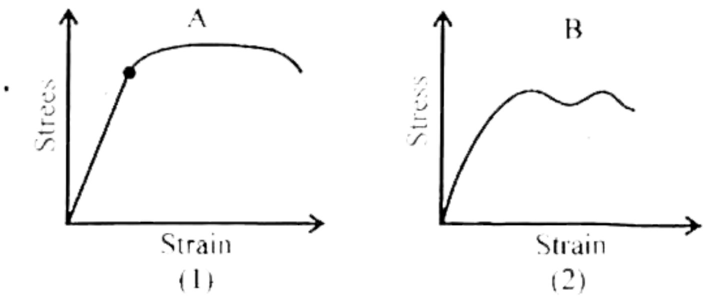
C. B is more ductile than A

D. $Y_A = Y_B$

Answer: B

View Text Solution

190. The stress-strain graphs for two metals A and B are as shown in figures (1) and (2).



Then,

A. young's modulus of $A =$ young's modulus of B

B. A is more brittle than B

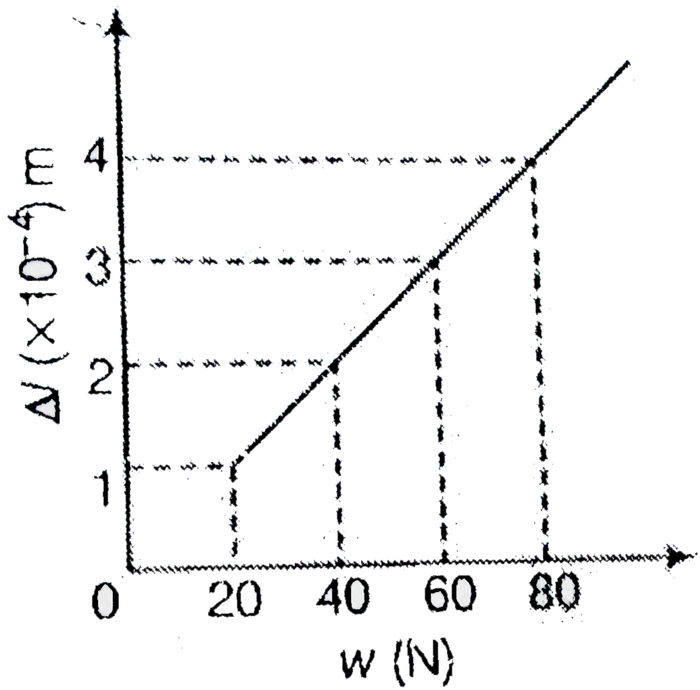
C. B is more brittle than A

D. B is more ductile than A

Answer: C

View Text Solution

191. The adjacent graph shows the extension Δl of a wire of length 1m, suspended from the f top of a roof at one end and with a loaf 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. $2 \times 10^{11} N - m^{-2}$

B. $2 \times 10^{-11} N - m^{-2}$

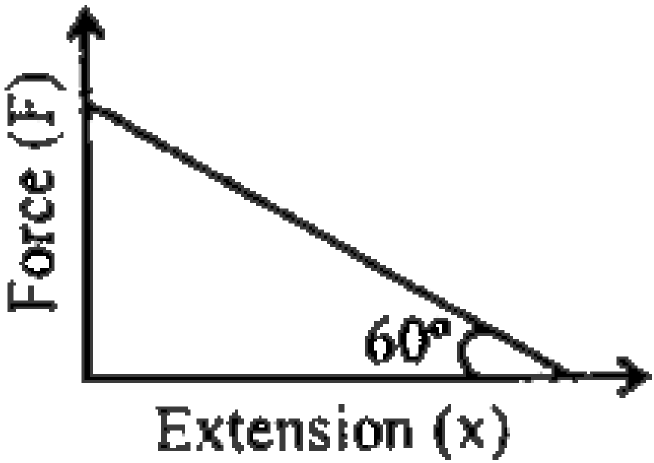
C. $3 \times 10^{12} N - m^{-2}$

D. $2 \times 10^{-12} N - m^{-2}$

Answer: A

Watch Video Solution

192. What is the value of force constant obtained by plotting the graph between the applied force (F) and the extention (x) ?



A. $\frac{1}{2}$

B. $\frac{1}{\sqrt{3}}$

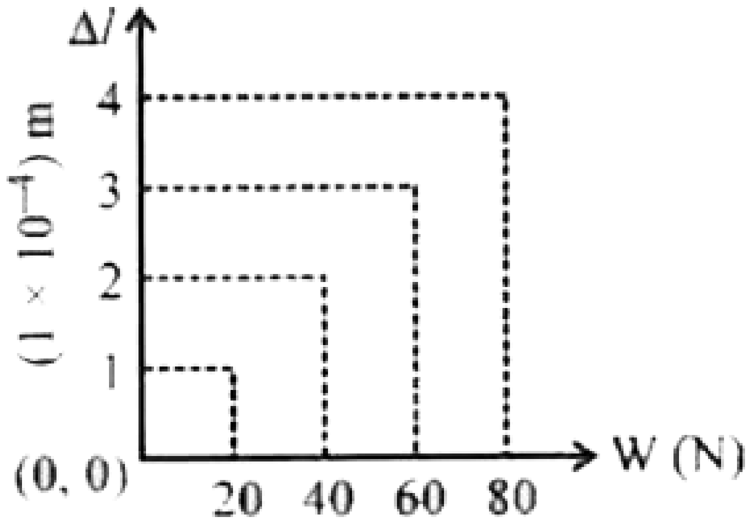
C. $\frac{\sqrt{3}}{2}$

D. $\sqrt{3}$

Answer: D

Watch Video Solution

193. The given graph shows the extention (Δl) of a wire of length 1 m suspended from the top of a roof at one end with a load W connected to the other end. The cross-sectional area of the wire is $10^{-6} m^2$. What is the Young's modulus of the material of the wire ?



A. $3 \times 10^{-12} N / m^2$

B. $2 \times 10^{-13} N / m^2$

C. $2 \times 10^{11} N / m^2$

D. $2 \times 10^{10} N / m^2$

Answer: C

View Text Solution

194. The graph between applied force and change in the length of wire within elastic limit is a

A. straight line with positive slope

B. straight line with negative slope

C. curve with positive slope

D. curve with negative slope

Answer: A

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195. The bucking of a beam is found to be more if

A. the breadth of the beam is large

B. the beam material has large value of Young's modulus

C. the length of the beam is small

D. the depth of the beam is small

Answer: D

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196. The ratio of diameters of two wires of the same material and same length is n : 1. If the same load is applied to both the wires then the increase in the length of the thin wire is $(n > 1)$

A. n^{14} times

B. $n^{1/2}$ times

C. n times

D. n^{2} times

Answer: D

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197. Young's modulus of material of wire is 'Y' and strain energy per unit volume is 'E', then the strain

A. $\sqrt{\frac{Y}{2E}}$

B. $\sqrt{\frac{E}{Y}}$

C. $\sqrt{\frac{2E}{Y}}$

D. $\sqrt{2EY}$

Answer: C

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198. A metal rof having coefficient of linear expansion α and Young's modulus Y is heated to raise its temperature by $\Delta\theta$. The stress exerted by the rod is

A. $\frac{Y\alpha}{\Delta\theta}$

B. $\frac{Y\Delta\theta}{\alpha}$

C. $Y\alpha\Delta\theta$

D. $\frac{\alpha\Delta\theta}{Y}$

Answer: C

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199. A and B are two wires. The radius of A is twice that of B. They are stretched by the some load. The the stress on B is

A. four times that of A

B. two times that of A

C. three times that of A

D. same as that of A

Answer: A

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200. Two wires having same length and material are stretched by same force. Their diameters are in the ratio 1:3. The ratio of strain energy per unit volume for these two wires (smaller to larger diameter) when stretched is

A. $3:1$

B. $9:1$

C. $27:1$

D. $81:1$

Answer: D

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201. Let a steel bar of length 'l', breadth 'b' and depth 'd' be loaded at the centre by a load 'W'. Then the sag of bending of beam is (Y = Young's modulus of material of steel)

A. $\frac{Wl^3}{2bd^3Y}$

B. $\frac{Wl^3}{4bd^3Y}$

C. $\frac{Wl^2}{2bd^3Y}$

D. $\frac{Wl^3}{4bd^2Y}$

Answer: B

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202. A lift of mass 'm' is connected to a rope which is moving upward with maximum acceleration 'a'. For maximum safe stress, the elastic limit of the rope is 'T'. The minimum diameter of the rope is

(g = gravitational acceleration)

A. $\left[\frac{2m(g+a)}{\pi T}\right]^{1/2}$

B. $\left[\frac{4m(g+a)}{\pi T}\right]^{1/2}$

C. $\left[\frac{m(g+a)}{\pi T}\right]^{1/2}$

D. $\left[\frac{m(g+a)}{2\pi T}\right]^{1/2}$

Answer: B

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203. A metal rod of length 'L' and cross-sectional area 'A' is heated through $'T'^{\circ} C$ What is the force required to prevent the expansion of the rod lengthwise ?

A. $\dfrac{YA\alpha t}{(1-\alpha t)}$

B. $\dfrac{YA\alpha t}{(1+\alpha t)}$

C. $\dfrac{(1-\alpha t)}{YA\alpha t}$

D. $\dfrac{(1+\alpha t)}{YA\alpha t}$

Answer: B

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Test Your Grasp 5

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

A. Copper

B. Invar steel

C. Brass

D. Silver

Answer: B

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2. Elasitcity of a meterial can not be changed

A. by adding an impurity of higher elasticity

B. by adding an impurity of less elasticity

C. by increasing or decreasing the magnitude of the deforming force

D. by increasing the temperature of the body

Answer: C

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3. A tangential force of 0.25 N is applied to a 5 cm cube to displace its upper surface with respect to the bottom surface. The shearing stress is

A. $10N/m^2$

B. $50N/m^2$

C. $75N/m^2$

D. $100N/m^2$

Answer: D

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4. What would be the greatest length of a steel wire, which when fixed at one end can hang freely without breaking?

(Density of steel $= 7800 kg / m^3$, Breaking stress form steel $= 7.8 \times 10^8 N / m^2, g = 10 m / s^2$)

A. $L = 2 km$

B. $L = 5 km$

C. $L = 8 km$

D. $L = 10 km$

Answer: D

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5. For steel, the breaking stress is $8 \times 10^6 N / m^2$. What is the maximum length of a steel wire, which can be suspended without breaking under its own weight?

[$g = 10m / s^2$, density of steel $= 8 \times 10^3 kg / m^3$]

A. 50m

B. 75m

C. 100m

D. 125m

Answer: C

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6. Young's modulus of a wire is $2 \times 10^{11} N/m^2$. The wire is stretched by a 5 kg weight. If the radius of the wire is doubled, its Young's modulus

A. will become half

B. will be doubled

C. will not change

D. will increase by four times

Answer: C

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7. The bulk modulus of a metal is $8 \times 10^{9} N/m^2$. The pressure required to reduce the volume of a spherical ball of that metal by 5% is

A. $2 \times 10^8 N/m^2$

B. $4 \times 10^8 N/m^2$

C. $6 \times 10^8 N/m^2$

D. $1/4 \times 10^8 N/m^2$

Answer: B

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8. A steel wire of length 1m, and radius 0.1mm is elongated by 1mm due to a weight of 3.14kg. If $g = 10m/s^2$, the Young's modulus of the steel wire will be

A. $8 \times 10^{11} N/m^2$

B. $10^{12} N/m^2$

C. $4 \times 10^{11} N/m^2$

D. $5 \times 10^{11} N / m^2$

Answer: B

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9. A copper wire of length 3m and diameter 1mm is stretched to increase its length by 0.3cm. What is the lateral contraction, if the Poisson's ratio for copper is 0.25?

A. $1.5 \times 10^{-6} m$

B. $2.5 \times 10^{-5} m$

C. $2.5 \times 10^{-7} m$

D. $3 \times 10^{-7} m$

Answer: C

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10. The Young's modulus of a wire of length 2m and area of cross section $1mm^2$ is $2 \times 10^{11} N / m^2$. The work done in increasing its length by 2mm is

A. 0.1 J

B. 0.2 J

C. 0.02 J

D. 0.4 J

Answer: B

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11. A wire having Young's modulus $2 \times 10^{11} N / m^2$ is stretched by a force. If the energy stored per unit volume of the wire is

$40 \text{joule} / m^3$, then the stress produced in the wire is

A. $2 \times 10^6 N / m^2$

B. $3 \times 10^6 N / m^2$

C. $5 \times 10^6 N / m^2$

D. $4 \times 10^6 N / m^2$

Answer: D

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12. An elastic spring of unstretched length L and spring constant K is stretched by a small length x. It is further stretched by another small length y. the work done in second stretcing is

A. $\frac{1}{2} K y^2$

B. $\frac{1}{2} K (x^2 + y^2)$

C. $\frac{1}{2}Ky(2x+y)$

D. $\frac{1}{2}K(x+y)^2$

Answer: C

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13. A rectangular beam of metal supported at its two ends is loaded at the centre. The depression at the centre is proportional to

A. $\frac{1}{Y}$

B. Y^2

C. $\frac{1}{Y^2}$

D. Y

Answer: A

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14. A lift is tied with thick iron and its mass is 314 kg. What should be the minimum diameter of wire if the maximum acceleration of lift is $1.2\frac{m}{\sec^2}$ and the maximum safe stress of the wire is $1 \times 10^7 \frac{N}{m^2}$?

A. 4

B. 5

C. 6

D. 7

Answer: B

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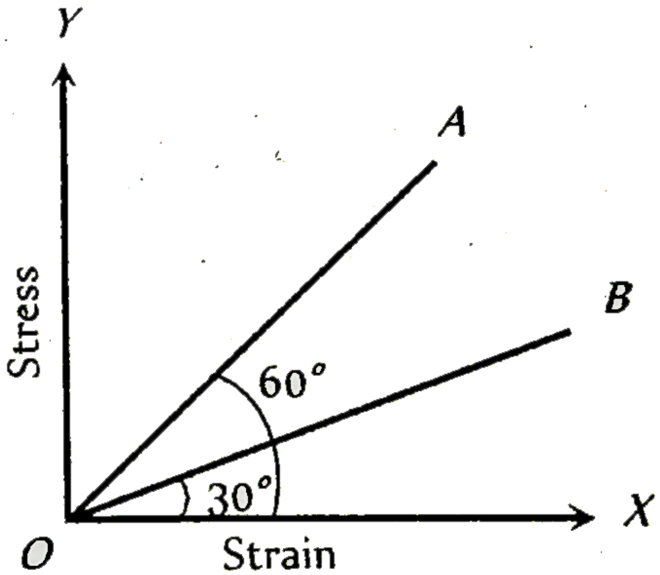
15. The stress versus strain graphs for wires of two materials A and B are as shown in the figure. If Y_A and Y_B are the younng's moduli of the materials, then



A. $Y_A = Y_B$

B. $Y_B = 2Y_A$

C. $Y_A = 2Y_B$

D. $Y_A = 3Y_B$

Answer: D

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