PHYSICS

BOOKS - TARGET PHYSICS (HINGLISH)

ELASTICITY

Classical Thinking

1. Elasticity is the property due to which

A. a body opposes its deformation.

B. body remains in equilibrium under deforming unbalanced forces.

C. liquids have finite volume.

D. gases expand and contract.

Answer: A

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2. The forces which produces deformation in a body is called

A. deforming force.

B. electrostatic force.

C. restoring force.

D. intermolecular force.

Answer: A

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3. The quality of the material which opposes the changes in shape, volumer or length is called

A. intermolecular repulsion

B. intermolecular behaviour

C. viscosity

D. elasticity

Answer: D

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4. The elastic body completely regains its original dimensions

A. when deforming forces are applied.

B. when deforming forces are constant.

C. when deferming forces are removed.

D. when deforming forces are increased slowly

Answer: C

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5. Volume elasticity is possessed by

A. solids only

B. liquids only

C. gases only

D. all the three states of matter

Answer: D

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6. Arrange the following materials in order of increasing elasticity: glass, rubber, steel, copper

A. copper, glass, rubber, steel

B. steel, copper, glass, rubber

C. rubber, glass, copper, steel

D. glass, rubber, copper, steel

Answer: C

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7. A spring is made of steel and not of copper because

A. steel is harder than copper.

B. steel is not affected by weather.

C. steel is less elastic than copper.

D. steel is more elastic than copper.

Answer: D

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8. Plastic bodies are those which

A. change their state after removal of deforming force.

B. regain their original dimension after removal of deforming force.

C. do not regain their original dimension even after removal of deforming force.

D. starts stretching after removal of deforming force.

Answer: C

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9. Which of the following is not a plastic body?

A. Rubber

B. Clay

C. Plasticine

D. Putty

Answer: A

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10. Perfect plasticity exhibited by a body is its property to undergo______ deformation without any increase in load.

A. reversible

B. temporary

C. irreversible

D. instantaneous

Answer: C

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11. The magnitude of inter-atomic attracting force per unit area of a solid is called

A. deformation (strain)

B. Young's modulus.

C. stress

D. none of these

Answer: C

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12. Unit of stress is

A. newton/metre

B. $\text{newton} / \text{metre}^2$

C. $\text{newton}^2 / \text{metre}$

D. $\text{newton} / metre^3$

Answer: B

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13. The breaking stress on a unit cross sectional area is

A. tensile strength

B. yielding point

C. elastic fatigue

D. none of these

Answer: A

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14. The breaking stress of a wire depends on

A. length of the wire

B. radius of the wire

C. material of the wire

D. shape of the cross-section

Answer: C

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

A. same

B. half

C. double

D. one fourth

Answer: A

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16. The dimesional formula for stress is same as that for

A. force

B. pressure

C. torque

D. work

Answer: B

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17. Two wires A and B are made of same material and are having same weights. The strain in A will be more when

A. the length of A is double that of B.

B. the diameter of A is double that of B.

C. the length of A is double and its diameter is half.

D. the diameter of A is double and the length is half.

Answer: C

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18. Which one of the following quantities does not have the unit of force per unit area

A. Stress

B. Strain

C. Young's modulus of elasticity

D. Pressure

Answer: B

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19. When an external force is applied to a body, the change in length per unit original length along the direction of force is called

A. longitudinal strain

B. volume strain

C. shear strain

D. lateral strain

Answer: A

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20. The reason for the change in shape of a regular body is

A. Bulk strain

B. Shearing strain

C. Longitudinal strain

D. Metallic strain

Answer: B

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21. Fluids can develop

A. longitudinal and shearing strains.

B. longitudinal strain only

C. volume strain only

D. longitudinal, shear and volume strains.

Answer: C

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22. When a spiral spring is stretched by suspending a load on it, the strain produced is called

A. tensile

B. bulk

C. shear

D. both tensile and bulk

Answer: C

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23. Shearing strain is expressed by

A. angle of twist

B. decrease in volume

C. increases in surface area.

D. angle of shear.

Answer: D

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24. On applying a force parallel to the surface, no change in volume is brought about but the shape of the body changes. The change in such a case is called.

A. shear strain

B. volume strain

C. longitudinal strain

D. transverse strain

Answer: A

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25. An external force of 10 newton acts normally on a square area of each side 50 cm. The stress produced in equilibrium state is

A. $10N/m^2$

B. $20N/m^2$

C. $40N/m^2$

D. $50N/m^2$

Answer: C

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26. Two wires of different materials having Young's moduli in the ratio $3:5$, lengths in the ratio $2:1$ and diameters in the ratio $1:2$ are stretched with the same force. The ratio of stress in the wires is

A. $4:1$

B. $1:4$

C. $2:1$

D. $1:2$

Answer: A

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27. A cylindrical bar of length 'L' metre deforms by 1mm. The strain in the bar will be

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

B. $\frac{0.1}{L}$

C. $\frac{0.01}{L}$

D. $\frac{0.001}{L}$

Answer: D

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28. A cube of aluminium of sides 0.1 m is subjected to a shearing force of 100 N. The top face of the cube is displaced through 0.02 cm with respect to the bottom face. The shearing strain would be

A. 0.02

B. 0.1

C. 0.005

D. 0.002

Answer: D

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29. The elastic limit for a gas

A. exists at vapourisation temperature.

B. exists only at absoulte zero

C. exists for a perfect gas.

D. does not exist.

Answer: D

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30. The maximum stress up to which a body can subjected without permanent deformation is

A. Plastic limit

B. stress limit.

C. proportionality limit.

D. elastic limit.

Answer: D

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31. Hooke's law states that,

A. stress is directly proportinal to the strain.

B. stress is inversely proportional to the strain.

C. stress is proportional to Young's modulus.

D. stress and strain are independent of each other.

Answer: A

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32. Which of the following statements is correct?

A. Hooke's law is applicable only within elastic limit.

B. The adiabatic and isothermal elastic constants of a gas are equal.

C. Young's modulus is dimensionless.

D. Stress multiplied by strain is equal to the stored energy.

Answer: A

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

A. increases

B. decreases

C. becomes zero

D. remains constant

Answer: D

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34. After effects of elasticity are maximum for

A. Glass

B. Quartz

C. Rubber

D. Metal

Answer: A

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35. For a steel wire, stress is directly proportional to strain. This is possible only when

A. the wire undergoes plastic deformation.

B. wire is loaded till the breaking point.

C. wire is loaded till the elastic limit.

D. wire exhibits neck formation.

Answer: C

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36. Young's modulus of elasticity is the ratio of

A. stress and volume strain.

B. longitudinal stress and longitudinal strain.

C. shear stress and shear strain.

D. longitudinal stress and lateral deformation (strain)

Answer: B

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37. For a perfectly rigid body

A. is zero

B. is unity

C. is infinity

D. may have any finite non-zero value.

Answer: C

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38. The young's modulus of a liquid is

A. one

B. zero

C. infinite

D. 0.5

Answer: B

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39. 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. $1.7 \times 10^{-8} m^2$

B. $7.1 \times 10^{-6} m^2$

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

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

Answer: C

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40. When a wire 2 m long and $0.05 cm^2$ in cross-section is stretched by a mass of 2 kg, it increases in length by 0.04 mm. Young's modulus of the material of the wire is

$(g = 10 ms^{-2})$

A. $2 \times 10^9 Nm^{-2}$

B. $20 \times 10^{10} Nm^{-2}$

C. $20 \times 10^{11} Nm^{-2}$

D. $20 \times 10^{8} Nm^{-2}$

Answer: B

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41. Units and dimensions of bulk modulus are those of

A. work

B. pressure

C. energy

D. force

Answer: B

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42. Bulk modulus was first defined by

A. Young

B. Boltzmann

C. Maxwell

D. Thomson

Answer: C

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43. The compressibility of a substance is

A. same as bulk modulus

B. inverse of shear modulus

C. same as shear modulus

D. inverse of bulk modulus

Answer: D

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44. The S.I. unit of compressibility is

A. Pa

B. Pa^{-1}

C. N/m

D. m/N

Answer: B

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45. The dimensional formula for compressibility is

A. $\left[M^{1}L^{1}T^{2}\right]$

B. $\left[M^{1}L^{1}T^{2}\right]$

C. $\left[M^{-1}L^{1}T^{-2}\right]$

D. $\left[M^{1}L^{1}T^{-2}\right]$

Answer: B

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

A. remains constant

B. increases linearly with temperature.

C. decreases linearly with temperature.

D. decreases inversely with temperature.

Answer: A

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47. A liquid of volume 4 litere is subjected to additional pressure of $1.2 \times 10^7 N/m^2$. If the change in its volume is found to be 3 ml, then the bulk modulus of the liquid will be

A. $2.0 \times 10^{10} N/m^2$

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

C. $1.4 \times 10^{10} N / m^2$

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

Answer: B

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48. If the compressibility of water is $0.5 GPa^{-1}$, then its bulk modulus is

A. $0.5 \times 10^9 Nm^{-2}$

B. $0.5 \times 10^{-9} Nm^{-2}$

C. $2 \times 10^9 Nm^{-2}$

D. $2 \times 10^{-9} Nm^{-2}$

Answer: D

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

A. 1 mm of Hg

B. 13.6 mm of Hg

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

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

Answer: C

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50. Within the elastic limit, the ratio of shear stress and shearing strain is called

A. Y

B. K

C. η

D. σ

Answer: C

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51. The coefficient of rigidity is defined as a ratio of

A. stress and volume strain.

B. longitudinal stress and longitudinal strain.

C. shear stress and shear strain

D. longitudinal stress and lateral strain

Answer: C

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52. The dimensional formula for the modulus of rigidity is

A. $[M^1L^{-1}T^2]$

B. $[M^1L^1T^2]$

C. $[M^1L^{-1}T^{-2}]$

D. $[M^1L^{-2}T^2]$

Answer: C

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53. The shear modulus of a liquid is

A. zero

B. infinite

C. 1

D. some other finite value

Answer: A

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54. For which of the following is the value of modulus of rigidity highest?

A. Glass

B. Quartz

C. Rubber

D. Water5

Answer: B

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55. Modulus of rigidity of diamond is

A. negligibly small

B. greater than all the matter

C. less than all the matter

D. zero

Answer: B

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56. The shearing strain produced in a block of metal subjected to a shearing stress of $10^8 N/m^2$ is

(Modulus of rigidity $\eta = 8 \times 10^{10} N/m^2$)

A. 1.1×10^{-3}

B. 1.5×10^{-3}

C. 1.25×10^{-3}

D. 1.6×10^{-3}

Answer: C

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57. The ratio of lateral strain to the longitudinal strain of a wire is called

A. compressibility

B. modulus of rigidity

C. tensile strength

D. Poisson's ratio

Answer: D

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58. The dimension of Poisson's ratio are

A. $[M^0L^0T^0]$

B. $[M^1L^{-1}T^{-2}]$

C. $[M^1L^2T^{-4}]$

D. $[M^1L^2T^{-3}]$

Answer: A

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59. What is the S.I. unit of Poisson's ratio?

A. kg m^{-3}

B. Nm^{-2}

C. m^{-1}

D. Being a dimensional number, it has no unit.

Answer: D

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60. When a force is applied along the length of the wire

A. the length of the wire increases but its radius remains the same

B. both its length and radius increases

C. the length increases but radius decreases

D. the length of the wire remains same but its radius decreases

Answer: C

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61. Liquids have no Poisson's ratio because

A. they have no definite shape

B. they have greater volume

C. they have lesser density than solid

D. they have no definite volume

Answer: A

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62. Minimum and maximum values of Poisson's ratio for a metal lies between

A. $-\infty \text{ to } +\infty$

B. $o \text{ to } 1$

C. $-\infty \quad \text{to} \quad 1$

D. $0 \quad \text{to} \quad 0.5$

Answer: D

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63. The longitudinal strain and lateral strain of a given wire ar 5×10^{-5} and 25×10^{-6} respectively. The Poisson's ratio is

A. 0.2

B. 0.5

C. 1.25

D. 1.25×10^{-11}

Answer: B

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64. To determine Young's modulus of the material of a wire,

A. two wires of same length and radius are taken

B. Single straight wire of uniform cross section is taken

C. three wires of different lengths but of same material are taken

D. two springs of same length but different materials are taken

Answer: A

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65. The load which is given to the pan in the determination of Young's modulus causing no deformation in the wire is called

A. effort

B. extra load

C. balancing load

D. dead load

Answer: D

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66. Solids which break above the elastic limit are called

A. brittle

B. ductile

C. malleable

D. elastic

Answer: A

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67. The act of drawing wire beyond elastic limit without rupture is called

A. ductility

B. malleability

C. elasticity

D. rigidity

Answer: A

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68. The point on stress-strain graph at which the plastic flow starts is known as

A. elastic limit

B. neck formation

C. yield point

D. breaking point

Answer: C

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69. When the stress is increased beyond the elastic limit, the length of the wire starts increasing without increasing the force. This point is called

A. Yield point

B. breaking point

C. triple point

D. inverse point

Answer: A

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70. On applying external force beyond the elastic limit,

A. no effect is produced on the material

B. permanent deformation of the object is caused

C. deformation is zero

D. matter is liquified

Answer: B

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71. Which of the following substances has negligible elastic fatigue?

A. Glass

B. Copper

C. Quartz

D. Silver

Answer: C

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72. If a metal wire is stretched a little beyond its elastic limit (or yield point), and released, it will

A. It loses its elastic property completely

B. It does not contract.

C. It contacts, but its final length will be greater than its initial length

D. It contracts only up to its length at the elastic limit

Answer: C

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73. Why are the bridge declared unsafe after long use?

A. of loss of elastic strength

B. the pillars are in the water

C. of breaking stress of the bridge

D. of increase in air resistance

Answer: A

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74. Which of the following is not the application of elastic behaviour of material

A. Designing the bridge

B. Construction of house

C. Cranes

D. Isotope dating

Answer: D

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75. Which of the following is used for deciding the strength of a material?

A. Factor of safety

B. breaking point

C. yield point

D. Permanent set

Answer: A

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76. Bending of a beam is called

A. Rusting

B. Looping

C. Tilting

D. Buckling

Answer: D

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77. How can the sag in a beam be prevented?

A. Using a material having large value of Young's modulus

B. Using a material having small Young's modulus

C. Using a material having zero Young's modulus

D. Using a material having Poisson's ratio one

Answer: A

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78. When strain is produced in a body within elastic limit, its internal energy

A. remains constant

B. decreases

C. increases

D. first increase then decreases

Answer: C

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79. A stretched rubber has

A. increased kinetic energy

B. increased potential energy

C. decreased kinetic energy

D. decreased potential energy

Answer: B

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80. A graph of force against extension of a wire is plotted. The area under the curve is

A. energy density

B. work done during extension

C. the elastic constant

D. coefficient of elasticity

Answer: B

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81. This work done to increase the length in a wire by load 'Mg' is

A. Mgl

B. zero

C. $Mgl/2$

D. $2Mgl$

Answer: C

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82. In a wire of length L, the increase in its length is l. If the length is reduced to half, the increase in its length will be

A. l

B. $2l$

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

D. $\frac{l}{4}$

Answer: C

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83. A wire is stretched to double its length. The strain is

A. 2

B. 1

C. zero

D. 0.5

Answer: B

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84. Two identical wires of substances 'P' and 'Q' are subjected to equal stretching force along the length. If the elongation of 'Q' is more than that of 'P', then

A. A is more elastic then B.

B. B is more elastic than A.

C. both A and B are equally elastic.

D. A is plastic and B is elastic.

Answer: A

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Critical Thinking

1. If a solid metal is heated and then immersed in water, it becomes

A. hard and brittle.

B. soft and brittle

C. neither hard nor brittle

D. none of these

Answer: A

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2. The elasticity of invar

A. increases with temperature rise.

B. decreases with temperature rise.

C. does not depend on temperature.

D. varies linearly with temperature.

Answer: C

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3. 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. same stress but different strain.

C. same strain but different stresses.

D. different stresses and different strain.

Answer: B

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4. Which of the following statements is INCORRECT?

A. The stretching of a coil spring is determined by its shear modulus.

B. When a deforming force is applied to a wire of steel, its length increases and radius decreases.

C. Within elastic limit, when a deforming force is applied to rubber and steel. It shows almost perfect elastic property.

D. The modulus of elasticity of rubber is greater than that of steel.

Answer: D

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5. Two wires of copper having the length in the ratio $4:1$ and their radii ratio as $1:4$ are stretched by the same force. The ratio of longitudinal strain in the two will be

A. $1:16$

B. $16:1$

C. $1:64$

D. $64:1$

Answer: B

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6. 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. $\dfrac{W_1}{A}$

B. $\dfrac{W_1 + (W/4)}{A}$

C. $\dfrac{W_1 + (3W/4)}{A}$

D. $\dfrac{W_1 + W}{A}$

Answer: C

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7. A nylon rope of $2cm$ in diameter has a breaking strength of $1.5 \times 10^5 N$. The breaking strength of a similar rope of $1cm$ in diameter is

A. $0.75 \times 10^5 N$

B. $0.375 \times 10^5 N$

C. $3 \times 10^5 N$

D. $6 \times 10^5 N$

Answer: B

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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. 100 kg wt

B. 200 kg wt

C. 800 kg wt

D. 1600 kg wt

Answer: C

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9. A substance breaks down by a stress of $10^6 N/m^2$. If the density of the material of the wire is $3 \times 10^3 kg/m^3$, then the length of the wire of that substance which will break under its own weight, when suspended vertically, is its own weight, when suspended vertically, is

A. 3.4 m

B. 34 m

C. 340 m

D. 3400 m

Answer: B

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10. A wire of diameter 1 mm breaks under a tension of 1000 N. Another wire of same materials as that of the first one but of diameter 2 mm breaks under a tension of

A. 500 N

B. 1000 N

C. 10000 N

D. 4000 N

Answer: D

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11. The ratio of radii of two wires of same material is $2:1$. If they are stretched by the same force, the ratio of their stress is

A. $2:1$

B. $1:2$

C. $1:4$

D. $4:1$

Answer: C

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12. A body of mass 10 kg is attached to a wire 0.3 m long. Its breaking stress is $4.8 \times 10^7 N/m^2$. The area of cross-section of wire is $10^{-6} m^2$. What is the maximum angular velocity with which it can be rotated in a horizontal circle?

A. $4 rad/s$

B. $8 rad/s$

C. $16 rad/s$

D. $32 rad/s$

Answer: A

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13. For a constant hydraulic stress on an object, the fractional change in the object's volume $\left(\frac{\triangle V}{V}\right)$ and its bulk modulus (b) are related as

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

B. $\frac{\Delta V}{V} \propto \frac{1}{K}$

C. $\frac{\Delta V}{V} \propto K^2$

D. $\frac{\Delta V}{V} \propto K^{-2}$

Answer: B

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14. Ten litre of water is compressed by an increase in pressure of 10 atmosphere. If the compressibility of water is $5 \times 10^{-10} m^2 / N$, then the change in volume of water will be (one atmosphere $= 10^5 N / m^2$).

A. 2 c c

B. 0.2 c c

C. 5 c c

D. 0.5 c c

Answer: C

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15. A ball falling in a lake of depth $200m$ shows a decrease of 0.1% in its volume at the bottom. The bulk modulus of elasticity of the material of the ball is (take $g = 10ms^{-2}$)

A. $19.6 \times 10^{8} N / m^{2}$

B. $19.6 \times 10^{-10} m^{2} / N$,

C. $19.6 \times 10^{10} N / m^{2}$

D. $19.6 \times 10^{-8} N / m^{2}$

Answer: A

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16. A solid rubber ball is carried from the surface to the bottom of a 200 m deep pond as a result of which its volume decreases by 0.1%. The denisty of pond water is $1.0 \times 10^3 kg/m^3$. If $g = 10m/s^2$ then the bulk modulus of elasticity of rubber will be ______ in N/m^2.

A. 10^3

B. 2×10^2

C. 10^9

D. 2×10^9

Answer: D

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17. The bulk modulus of rubber is $9.8 \times 10^8 N/m^2$. To what depth a rubber ball be taken in a lake so that its volume is decreased by 0.1% ?

A. 1 km

B. 25 m

C. 100 m

D. 200 m

Answer: C

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18. If the volume of a block os aluminium is decreased be 1% the pressure (stress) on is surface is increased by (Bulk moduals) of $Al = 7.5 \times 10^{10} Nm^{-2}$)

A. $7.5 \times 10^{10} Nm^{-2}$

B. $7.5 \times 10^{8} Nm^{-2}$

C. $7.5 \times 10^{6} Nm^{-2}$

D. $7.5 \times 10^{4} Nm^{-2}$

Answer: B

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19. 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. 0.4 c c

B. $4 \times 10^{-5} cc$

C. 0.025 c c

D. 0.004 c c

Answer: A

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20. Two wires W_1 and W_2 are made of same material and have the same length. The radius of cross-section of W_2 is twice that of W_1. Same load is suspended from both of them. If the strain in W_1 is 4, then that in W_2 will be

A. 1

B. 2

C. 4

D. 8

Answer: A

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21. In an experiment to measure Young's modulus, the wire is thin and long so that

A. another identical wire can be arranged parallel to it.

B. very heavy weights can be attached.

C. the stress is large and the extension is measurable for laboratory loads.

D. the wire can be suspended from the ceiling.

Answer: C

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22. Assertion : Two wires A and B have the same cross-sectional area and are made of the same material but the length of wire A is twice that of B. For a given load, the strain in wire A is twice that in B.

Reason : For a given load, the extension in a wire is prportional to its length.

A. Assertion is True, Reason is True,

Reason is a correct explanation for Assertion.

B. Assertion is True, Reason is True,

Reason is not a correct explanation for Assertion.

C. Assertion is True, Reason is False.

D. Assertion is False but, Reason is True.

Answer: D

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23. The length of a rubber cord doubles, when stretched. Its Young's modulus is equal to

A. the strain in the wire.

B. stress developed in the wire.

C. energy stored in the wire.

D. energy density of the wire.

Answer: B

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24. When radius of wire is doubled, the elongation dl of the wire

A. is doubled

B. remains same.

C. becomes half.

D. becomes one fourth

Answer: D

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25. A wire of length L extends by l on application of force F. Suppose the wire is cut into 3 equal parts and the same force is applied to one of them. Now the extension will be

A. l

B. $3l$

C. $\frac{l}{3}$

D. $\left(l+\frac{l}{12}\right)$

Answer: C

Watch Video Solution

26. 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. $2 \times 10^{12} N$

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

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

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

Answer: D

Watch Video Solution

27. Two identical wires of materials are joined together and subjected to a force. Their Young's modulus are in the ratio $2:1$. Then their indidual extensions are in the ratio

A. $2:1$

B. $1:3$

C. $3:1$

D. $1:2$

Answer: D

Watch Video Solution

28. A 20 N stone is suspended from a wire and its length changes by 1%. If the Young's modulus of the material of wire is $2 \times 10^{11} N/m^2$, then the area of cross-section of the wire will be

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

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

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

D. $1 mm^2$

Answer: B

Watch Video Solution

Watch Video Solution

29. Two wires of different materials having Young's moduli in the ratio $3:5,$ lengths in the ratio $2:1$ and diameters in the ratio $1:2$ are stretched with the same force. The ratio of stress in the wires is

A. $1:60$

B. $10:2$

C. $60:3$

D. $40:3$

Answer: D

Watch Video Solution

30. When a certain weight is suspended from a long uniform wire, its length increases by $1cm$. If the same weight is suspended from another wire of the same material and length but having a diameter half of the first one, the increases in length will be

A. 0.5 cm

B. 2 cm

C. 4 cm

D. 8 cm

Answer: C

Watch Video Solution

31. The length of a copper wire increases by 0.01 metre, when it is loaded with 10 kg weight. Another copper wire of the same length but double the radius is loaded with the same weight. The increase in length of the second wire, in metre, will be

A. 0.002

B. 0.005

C. 0.0025

D. 0.01

Answer: C

Watch Video Solution

32. A copper wire and a steel wire of same length and same cross-section are joined end to end. The compositive wire is hung from a rigid support and a load is suspended form the free end. The increase in length of the compositive wire is 4 mm. The increase in copper wire will be

$$\left(Y_{copper} = 1.2 \times 10^{11} N/m^2, Y_{steel} = 2 \times 10^{11} N/m^2\right)$$

A. 3 mm

B. 1.5 mm

C. 2 mm

D. 2.5 mm

Answer: D

Watch Video Solution

33. Two pieces of wires A and B of the same material have their lengths in the ratio $2:3$ and diameters in the ratio $2:3$. They are stretched by forces, which are in the ratio $2:3$. Their elongations are in the ratio

A. $9:4$

B. $3:2$

C. $1:1$

D. $2:3$

Answer: C

Watch Video Solution

34. Length of an elastic string is x then tension 5N is applied and its length will be y when tension 7 N. What will be its original length ?

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

B. $\dfrac{7L_1 - 5L_2}{2}$

C. $\dfrac{7L_2 - 2L_1}{5}$

D. $\dfrac{7L_2 + 5L_1}{9}$

Answer: B

Watch Video Solution

35. A uniform rod of cross-section $4mm^2$ is heated from $0^\circ C$ to $10^\circ C$. The coefficient of linear expansion of the rod, $\propto\ = 12 \times 10^{-6} / ^\circ C$ and Young's modulus $= 10^{11} N / m^2$. The strain produced in the rod is

A. 8×10^{-4}

B. 12×10^{-4}

C. 8×10^{-5}

D. 12×10^{-5}

Answer: D

Watch Video Solution

36. A steel of $Xkg - wt/m^2$ is applied to a wire whose Young's modulus is Y. The precentage increase in its length is $(g = 9.8m/s^2)$

A. $0.98X/Y$

B. $980X/Y$

C. $9.8X/Y$

D. $100X/Y$

Answer: B

Watch Video Solution

37. A steel wire 2 mm in diameter is just stretched between two fixed points at a temperature of $20^\circ C$. If the temperature falls to $10^\circ C$, then the tension in the wire is (The coefficient of linear expansion of steel = $11 \times 10^{-6} / ^\circ C$ and Y for steel $2.1 \times 10^{11} N/m^2$)

A. 7.25 N

B. 725 N

C. 72.5 N

D. $7.25 \times 10^3 N$

Answer: C

Watch Video Solution

38. 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. $4:1$

B. $16:1$

C. $8:1$

D. $1:1$

Answer: D

Watch Video Solution

39. The backlash error can be elimintated in Searle's experiment, by rotating screw in

A. one direction

B. both of the two directions

C. any direction

D. fist clockwise and then in anticlockwise directions.

Answer: A

Watch Video Solution

40. To lift a load by a metallic rope, its radius of cross-section should be

A. $\geq 1mm$

B. $\leq 1cm$

C. $\geq 1cm$

D. $\geq 2cm$

Answer: C

View Text Solution

41. Which of the following relations is incorrect for the $sag(\delta)$ of beam?

A. $\delta \propto d^3$

B. $\delta \propto Y^{-1}$

C. $\delta \propto b^{-1}$

D. $\delta \propto l^{3}$

Answer: A

Watch Video Solution

42. A beam of metal supported at the two edges is loaded at the centre. The depression at the centre is proportional to

A. 1

B. -1

C. 2

D. 4

Answer: B

Watch Video Solution

43. A wire fixed at the upper end stretches by length l by applying a force F. The work done in stretching is

A. $F/2l$

B. Fl

C. $2Fl$

D. $Fl/2$

Answer: D

Watch Video Solution

44. On stretching a wire, the elastic energy stored pre unit volume is

A. $\frac{1}{2}\left(\frac{F}{A}\right)\left(\frac{dl}{l}\right)$

B. $\frac{1}{2}.\frac{FA}{l}$

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

D. $\frac{1}{2}.Fl$

Answer: A

Watch Video Solution

45. If one end of a wire is fixed with a rigid support and the other end is streched by a force of $10N$, then the increae in length is $0.5mm$. The ratio of the energy of the wire and the work done in displacing it through $0.5mm$ by the weight is

A. $\frac{1}{3}$

B. $\frac{1}{4}$

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

D. 1

Answer: C

Watch Video Solution

46. A wire of length L and cross sectional area A is made of a material of Young's modulus Y. If the wire is streched by an amount x, the work done is..................

A. $\frac{YA}{2L}$

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

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

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

Answer: D

Watch Video Solution

47. A metal rod of Young's modulus $2 \times 10^{10} Nm^{-2}$ undergoes an elastic strain of 0.06%. The energy per unit volume stored in Jm^{-3} is

A. 3600

B. 7200

C. 1800

D. 900

Answer: A

Watch Video Solution

48. If the volume of the given mass of a gas is increased four times, the temperature is raised from $27^{\circ}C$ to $127^{\circ}C$. The elasticity will become

A. 4 times

B. $1/4\text{times}.$

C. 3 times

D. $1/3\text{times}.$

Answer: D

Watch Video Solution

49. A steel wire of length 5 m and area of cross-section $4mm^2$ is stretched by 2 mm by the application of a force. If young's modulus of steel is $2 \times 10^{11} N/m^2$, then the energy stored in the wire is

A. 0.64 J

B. 0.16 J

C. 0.32 J

D. 1.28 J

Answer: C

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Watch Video Solution

50. One end of a long mettalic wire of length L is tied to the ceiling. The other end is tied to massless spring of spring constant K. A mass M hangs freely from the free end of the spring. The area of cross-section and Young's modulus of the wire are A and Y respectively. If the mass is slightly pulled down and released, it will oscillate with a time period T equal to

A. $2\pi\sqrt{(M/K)}$

B. $2\pi\sqrt{M(YA+KL)/YAK}$

C. $2\pi\sqrt{(MYA/KL)}$

D. $\sqrt{(ML/YA)}$

Answer: B

Watch Video Solution

51. A rubber cord has a cross -sectional area $1mm^2$ and total unstretched length $10.0cm$. It is streched to $12.0cm$ and then released to project a missile of mass 5.0 g.Taking young's modulus Y for rubber as $5.0 \times 10^8 N/m^2$.Calculate the velocity of projection .

A. $0.2m/s$

B. $2m/s$

C. $20m/s$

D. $200m/s$

Answer: C

Watch Video Solution

52. The average depth of indian Ocean is about 3000 m. The fractional compression, $\frac{\triangle V}{V}$ of water at the bottom of the ocean is (Given Bulk modulus of the water $= 2.2 \times 10^9 Nm^{-2}$ and $g = 10ms^{-2}$)

A. $0.82\ \%$

B. $0.91\ \%$

C. $1.26\ \%$

D. $1.14\ \%$

Answer: D

Watch Video Solution

53. Forces of 100 N each are applied in opposite direction on the upper and lower faces of a cube of side 20 cm. The upper face is shifted parallel to itself by 0.25 cm. If the side of the cube were 10 cm, then the displacement would be

A. $4 \times 10^7 N/m^2$

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

C. $4 \times 10^5 N/m^2$

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

Answer: B

Watch Video Solution

54. Assertion: If length of a rod is doubled, the breaking load remains the same.

Reason: Breaking load is equal to the elastic limit.

A. Assertion is True, Reason is True,

Reason is a correct explanation for Assertion.

B. Assertion is True, Reason is True,

Reason is not a correct explanation for Assertion.

C. Assertion is True, Reason is False.

D. Assertion is False but, Reason is True.

Answer: C

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Competitive Thinking

1. Longitudinal strain is caused

A. only in solids

B. only in liquids

C. only in gases

D. in liquids and gases

Answer: A

Watch Video Solution

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

A. Volumetric

B. Shear

C. Longitudinal and Shear

D. Longitudinal

Answer: C

Watch Video Solution

3. The stress in a wire of diameter 2 mm, if a load of 100 g is applied to a wire, is

A. $3.1 \times 10^5 N/m^2$

B. $6.2 \times 10^5 N/m^2$

C. $1.5 \times 10^5 N/m^2$

D. $12.4 \times 10^5 N/m^2$

Answer: A

Watch Video Solution

4. Two wires A and B are stretched by the same load. If the area of cross-section of wire 'A' is double that of 'B,' then the stress on 'B' is

A. equal to that on A

B. twice that on A

C. half that on A

D. four times that on A

Answer: B

Watch Video Solution

5. A rope 1 cm in diameter breaks if the tension in it exceeds 500 N. The maximum tension that any be given to a similar rope of diameter 2 cm is

A. 2000 N

B. 1000 N

C. 500 N

D. 250 N

Answer: A

Watch Video Solution

6. A man grows into a giant such that his linear dimension increase by a factor of 9. Assuming that his density remains same, the stress in the leg will change by a factor of

A. 81

B. $\frac{1}{81}$

C. 9

D. $\frac{1}{9}$

Answer: C

Watch Video Solution

7. The pressure that has to be applied to the ends of a steel wire of length 10cm to keep its length constant when its temperature is raised by $100^{\circ}C$ is : (For steel Young's modulus is $2 \times 10^{11} Nm^{-2}$ and coefficient of thermal expansion is $1.1 \times 10^{-5} K{-1}$)

A. $2.2 \times 10^{8} Pa$

B. $2.2 \times 10^{9} Pa$

C. $2.2 \times 10^{7} Pa$

D. $2.2 \times 10^{6} Pa$

Answer: A

Watch Video Solution

8. The modulus of elasticity is dimesionally equivalent to

A. surface tension.

B. stress

C. strain

D. none of these

Answer: B

Watch Video Solution

9. If a spring is extended to length l, the according to Hook's law

A. $F = K / l$

B. $F = Kl$

C. $F = K^2 / l$

D. $F = K^2 l$

Answer: B

Watch Video Solution

10. Hook's law defines

A. Stress

B. Strain

C. Modulus of elasticity

D. elastic limit.

Answer: C

Watch Video Solution

11. Under elastic limit the stess is

A. inversely proportional to strain

B. directly proportional to strain

C. square root of strain

D. independent of strain

Answer: B

Watch Video Solution

12. The coefficient of elasticity normally

A. increases with temperature.

B. decreases with temperature.

C. is independent of temperature.

D. increases on reducing stress.

Answer: B

Watch Video Solution

13. Young's modulus for a wire of length L and area of cross-section A is Y. What will be Young's Modulus for wire of same material, but half its original length and double its area?

A. $Y/2$

B. 2Y

C. y

D. $4Y$

Answer: C

Watch Video Solution

14. A wire of length L is hanging from a fixed support. The length changes to L_1 and L_2 when masses M_1 and M_2 are suspended respectively from its free end. Then L is equal to

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

B. $\sqrt{L_1 L_2}$

C. $\frac{L_1 M_2 + L_2 M_1}{M_1 + M_2}$

D. $\frac{L_1 M_2 - L_2 M_1}{M_2 - M_1}$

Answer: D

Watch Video Solution

15. 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

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

Watch Video Solution

16. The Young's modulus of a material is $2 \times 10^{11} N/m^2$ and its elastic limit is $1 \times 10^8 N/m^2$. For a wire of 1 m length of this material, the maximum elongation achievable is

A. 0.2 mm

B. 0.3 mm

C. 0.4 mm

D. 0.5 mm

Answer: D

Watch Video Solution

17. When a load of 80 N is suspended from a string, its length is 101 mm. If a load of 100 N is suspended, its length is 102 mm. If a load of 160 N is suspended form it, then the length of the string is (Assume the area of cross-section unchanged)

A. 15.5 cm

B. 13.5 cm

C. 16.5 cm

D. 10.5 cm

Answer: D

Watch Video Solution

18. The ratio of the lengths of two wires A and B of same material is $1:2$ and the ratio of their diameters is $2:1$. They are stretched by the same force, then the ratio of increase in length will be

A. $2:1$

B. $1:4$

C. $1:8$

D. $8:1$

Answer: C

Watch Video Solution

19. 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 Δx on applying force F, how much force is needed to stretch wire 2 by the same amount?

A. 9F

B. 6F

C. 4F

D. F

Answer: A

Watch Video Solution

20. Four wires of same material but having different length and radii are subjected under same load. Which of the following combination of length L and radius r will have highest elongation?

A. L=100 cm, r=1 mm

B. L=200 cm, r=2 mm

C. L=300 cm, r=3 mm

D. L= 400 cm, r=4 mm

Answer: A

Watch Video Solution

21. The following four wires are made of the same material. Which of these will have the largest extension when the same tension is applied

A. Length = 50 cm, diameter =0.5 mm

B. Length =100 cm, diameter= 1mm`

C. Length =200 cm, diameter =2 mm

D. Length =300 cm, diameter = 3 mm

Answer: A

Watch Video Solution

22. 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

23. A steal wire of cross-section area $3 \times 10^{-6} m^2$ can withstand a maximum strain of 10^{-3} .Young's modulus of steel is $2 \times 10^{11} Nm^{-2}$ .The maximum mass this wire can hold is

A. 40 kg

B. 60 kg

C. 80 kg

D. 100 kg

Answer: B

Watch Video Solution

24. 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. $1.33 \times 10^{11} Nm^{-2}$

B. $1.33 \times 10^{12} Nm^{-2}$

C. $7.5 \times 10^{-13} Nm^{-2}$

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

Answer: D

Watch Video Solution

25. The Young's modulus of steel is twice that of brass. Two wires of the same length and of the 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 weight added to the steel and brass wires must be in the ratio of

A. $1:1$

B. $1:2$

C. $2:1$

D. $4:1$

Answer: C

Watch Video Solution

26. The diameter of a brass rod is 4 mm and Young's modulus of brass is $9 \times 10^{10} N / m^2$. The force required to stretch by 0.1 % of its length is

A. $3600\pi N$

B. 36 N

C. $144\pi \times 10^3 N$

D. $36\pi \times 10^5 N$

Answer: A

Watch Video Solution

27. Two similar wires under the same load yield elongation of $0.1 mm$ and $0.05 mm$ respectively. If the area of cross-section of the first wire is $4 mm^2$, then the area of cross-section of the second wire is

A. $6 mm^2$

B. $8 mm^2$

C. $10 mm^2$

D. $12 mm^2$

Answer: B

Watch Video Solution

28. 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. $4:1$

B. $1:4$

C. $1:2$

D. $2:1$

Answer: D

Watch Video Solution

29. Two metal wires P and Q of same length and material are stretched by same load. Yheir masses are in the ratio $m_1 : m_2$. The ratio of elongation of wire P to that of Q is

A. $m_1^2 : m_2^2$

B. $m_2^2 : m_1^2$

C. $m_2 : m_1$

D. $m_1 : m_2$

Answer: C

Watch Video Solution

30. The only elastic modulus that applies to fluids is

A. Young's modulus

B. Shear modulus

C. Modulus of rigidity

D. Bulk modulus

Answer: D

Watch Video Solution

31. The ratio of hydraulic stress to the corresponding strain is known as

A. Young's modulus

B. Compressibility

C. Rigidity modulus

D. Bulk modulus

Answer: D

Watch Video Solution

32. The bulk modulus of a spherical object is B if it is subjected to uniform pressure p, the fractional decrease in radius is:

A. $\frac{P}{B}$

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

C. $\frac{3P}{B}$

D. $\frac{P}{3B}$

Answer: D

Watch Video Solution

33. A solid sphere of radius R made of a material of bulk modulus K is surrounded by a liquid in a cylindrical container. A massless pistion 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, $\delta R / R$, is ....

A. $\frac{mg}{3Ka}$

B. $\frac{mg}{Ka}$

C. $\frac{Ka}{mg}$

D. $\frac{Ka}{3mg}$

Answer: A

Watch Video Solution

34. To compress a liquid by $10\,\%$ of its original volume, the pressure required is 2×10^5 atmosphere. The bulk modulus of liquid is

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

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

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

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

Answer: D

Watch Video Solution

35. The bulk modulus of a gas is $6 \times 10^3 N / m^2$. The additional pressure needed to reduce the volume of the liquid by $10\,\%$ is

A. $1200 N / m^2$

B. $600 N / m^2$

C. $2400 N / m^2$

D. $1600 N / m^2$

Answer: B

Watch Video Solution

36. A liquid of bulk modulus k is compressed by applying an external pressure such that its density increases by $0.01\,\%$. The pressure applied on the liquid is

A. $\dfrac{K}{10000}$

B. $\dfrac{K}{1000}$

C. 1000 K

D. $0.01K$

Answer: A

Watch Video Solution

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

A. 0.8×10^{-2}

B. 1.0×10^{-2}

C. 1.2×10^{-2}

D. 1.4×10^{-2}

Answer: C

Watch Video Solution

38. The poisson's ratio cannot have the value

A. 0.7

B. 0.2

C. 0.1

D. 0.5

Answer: A

Watch Video Solution

39. Poisson's ratio of a material is 0.5. Percentage change in its length is 0.04%. What is the change in the diameter of wire?

A. 0.04%

B. 0.02%

C. 0.03%

D. 0.01%

Answer: B

Watch Video Solution

40. Consider a wire having initial diameter of 2 mm. Poisson's ratio for material is 0.05. The longitudinal strain produced in wire is 0.1%. The final diameter of wire is

A. 2.002 mm

B. 1.998 mm

C. 1.999 mm

D. 2.001 mm

Answer: C

Watch Video Solution

41. If the volume of a wire remains constant when subjected to tensile stress, the value of poisson's ratio of material of the wire is

A. 0.25

B. 0.4

C. 0.5

D. 0.75

Answer: C

Watch Video Solution

42. Relation between Y, η and $K is$

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

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

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

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

Answer: C

Watch Video Solution

43. A thick wire is clambed at one end and a torque is applied at the other so that it gets deformed. The modulus of elasticity involved in this process is

A. Bulk modulus

B. Young's modules.

C. Modulus of rigidity

D. Poisson's ratio

Answer: C

Watch Video Solution

44. The valve of Poisson's ratio lies between

A. -1 and 0.5

B. $3/4$ and $-1/2$

C. $-1/2$ and 1

D. 1 and 2

Answer: A

Watch Video Solution

45. For a given material, Young's modulus is 2.4 times that of rigidity modulus. Its Poisson's ratio is

A. 0.5

B. 0.25

C. 0.4

D. 0.2

Answer: D

Watch Video Solution

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

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

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

Answer: B

Watch Video Solution

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

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

Answer: B

Watch Video Solution

48. Which of the following is true for elastic potential energy density

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

B. Energy denstity $= (\text{strain})^2 \times volume$

C. Energy density $= (\text{strain}) \times volume$

D. Energy density = $(\text{Stress}) \times volume$

Answer: A

Watch Video Solution

49. ELASTIC POTENTIAL ENERGY STORED IN A STRETCHED WIRE

A. $\frac{1}{2}\frac{(stress)^2}{Y}$

B. $\frac{1}{2}\frac{(\text{strain})^2}{Y}$

C. $\frac{1}{2}\frac{Y}{(\text{strain})^2}$

D. $\frac{1}{2}Y = (stress)^2$

Answer: A

Watch Video Solution

50. The increase in energy of a metal bar of length L and cross-sectional area A when compressed with a load M along its length is (where, Y= Young's modulus of the material of metal bar)

A. $\frac{FL}{2AY}$

B. $\frac{F^2L}{2AY}$

C. $\frac{FL}{AY}$

D. $\frac{F^2L^2}{2AY}$

Answer: B

Watch Video Solution

51. A stretching wire has a Young's modulus Y and energy density E. The strain in a stretching wire is

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

B. $\frac{4E}{Y}$

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

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

Answer: D

Watch Video Solution

52. 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. 2E

C. 4E

D. 25 E

Answer: D

Watch Video Solution

53. Energy density of wire is $0.25 J/m^3$, when its extension is 0.2 cm. Find density of wire, when elongation is 1 cm

A. $\frac{25}{4} J/m^3$

B. $\frac{1}{1000} J/m^3$

C. $\frac{5}{4} J/m^3$

D. $\frac{25}{2} J/m^3$

Answer: A

Watch Video Solution

54. 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. $5.5 \times 10^4 J/m^3$

C. $5.5 \times 10^3 J/m^3$

D. $1.1 \times 10^4 J/m^3$

Answer: B

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55. When a rubber bandis streched by a distance x , if exerts resuring foprce of magnitube $F = ax + bx^2$ where$a$ and b are constant . The work in streached the unstreched rubber - band by L is

A. $aL^2 + bL^3$

B. $\frac{1}{2}(aL^2 + bL^3)$

C. $\frac{aL^2}{2} + \frac{bL^3}{3}$

D. $\frac{1}{2}\left(\frac{aL^2}{2} + \frac{bL^3}{3}\right)$

Answer: C

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56. Two, spring P and _(Q) of force constants K_p and $k_Q\left(k_Q = \frac{kp}{2}\right)$ are stretched by applying forces of equal magnitude. If the energy stored in $\_(Q)iaE,$ then the energy stored in P is

A. E

B. 2E

C. $\frac{E}{8}$

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

Answer: D

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57. 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: B

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58. Coefficient of linear expansion of brass and steel rods are α_1 and α_2. Length of brass and steel rods are l_1 and l_2 respectively. If $(l_2 - l_1)$ is maintained same at all temperature, which one of the following relations holds good?

A. $\alpha_1 l_2 = \alpha_2 l_1$

B. $\alpha_1 l_2^2 = \alpha_2 l_1^2$

C. $\alpha_1^2 l_1 = \alpha_2^2 l_2$

D. $\alpha_1 l_1 = \alpha_2 l_2$

Answer: D

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59. A string of length L and force constant k is stretched to obtain extension l. It is further stretched to obtain extension l_1. The work done in second streching is

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

B. $\frac{1}{2}Kl_1^2$

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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60. A metal rod of length l, cross-sectional area A, Young's modulus Y and coefficient of linear expansion α is heated to $t^{\circ}C$. The work that can be performed 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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61. 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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62. An external pressure P is applied on a cube at $0^{\circ}C$ so that it is equally compressed from all sides. K is the bulk modulus of the material of the cube and α is its coefficient of linear expansion. Suppose we want to bring the cube to its original size by heating. The temperature should be raised by

A. $\frac{3\alpha}{PK}$

B. $3PK\alpha$

C. $\frac{P}{3\alpha K}$

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

Answer: C

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

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

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

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

Answer: B

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64. One end of a horizontal thick copper wire of length 2L and radius 2R is welded to an end fo another horizontal thin copper wire of lenth L and radius R. When the arrangement is stretched by applying forces at two ends, the ratio of the elongation in the thin wire to that in the thick wire is

A. 0.25

B. 0.5

C. 2.00

D. 4.00

Answer: C

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65. A thick rope of density ρ and length L is hung from a rigid support. The increase in length of the rope due to its own weight is (Y is the Young's modulus)

A. $\frac{PL^2g}{4Y}$

B. $\frac{PL^2g}{2Y}$

C. $\frac{PL^2g}{Y}$

D. $\frac{PLg}{Y}$

Answer: B

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66. 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. $2l$

B. zero

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

D. l

Answer: D

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67. A pendulumd made of a uniform wire of cross sectional area (A) has time T.When an additionl mass (M) is added to its bob, the time period changes to T_M. $IftheYoung's$ mod $\underline{u}softhematerialofthewireis(Y)then$ 1/Y` is equal to:

A. $\left[\left(\frac{T_M}{T}\right)^2 - 1\right]\frac{A}{Mg}$

B. $\left[\left(\frac{T_M}{T}\right)^2 - 1\right]\frac{Mg}{A}$

C. $\left[1-\left(\frac{T_M}{T}\right)^2\right]\frac{A}{Mg}$

D. $\left[1-\left(\frac{T}{T_M}\right)^2\right]\frac{A}{Mg}$

Answer: A

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68. Two rods of different materials having coefficients of thermal expansion α_1, α_2 and Young's modulii Y_1, Y_2 respectively are fixed between two rigid massive walls. The rods are heated such that they undergo the same increase in temperature. There is no bending of the rods. If $\alpha_1 : \alpha_2 = 2 : 3$, the thermal stresses developed in the two rods are equal provided $Y_1 : Y_2$ is equal to

A. $2 : 3$

B. $1:1$

C. $3:2$

D. $4:9$

Answer: C

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69. The stress along the length of a rod with rectangular cross section) is 1% of the Young's modulus of its material. What is the approximate percentage of change of its volume? (poisson's ration of the material of the rod is 0.3)

A. 3%

B. 1%

C. 0.7%

D. 0.4%

Answer: D

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Evaluation Test

1. A ring of radius R is made of a thin wire of material of density ρ, having cross-section area a and Young's modulus y. The ring rotates about an axis perpendicular to its plane and through its centre. Angular frequency of rotation is ω.

The ratio of kinetic energy to potential energy is

A. $\frac{Y}{pR^2\omega^2}$

B. $\frac{2Y}{pR^2\omega^2}$

C. $\frac{Y}{2pR^2\omega^2}$

D. $\frac{Y}{4pR^2\omega^2}$

Answer: A

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2. A uniform ring of mass M of outside radius r_2 is fitted tightly with a shaft of radius r_1. If the shaft is rotated with a constant angular acceleration. About it's axis, the moment of the elastic force in the ring about the axes of rotation is

A. $m\beta(r_2^2 + r_1^2)$

B. $\frac{m\beta(r_2^2 + r_1^2)}{2}$

C. $m\beta(r_2^2 - r_1^2)$

D. $\frac{m\beta(r_2^2 - r_1^2)}{2}$

Answer: B

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3. A steel wire of diameter $d = 1.0mm$ is stretched horizontally between two clamps located at the distance $l = 2.0m$ from each other. A weight of mass $m = 0.25kg$ is suspended from the mid-point O of the wire. What will the resulting descent of the point O be in centrimetres?

A. 3.5 cm

B. 4.5 cm

C. 2.5 cm

D. 1.5 cm

Answer: C

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4. A rod $1m$ long is $10cm^2$ in area for a portion of its length and $5cm^2$ in area for the remaining. The strain energy of this stepped bar is 40% of that a bar $10cm^2$ in area and $1m$ long under the same maximum stress. What is the length of the portion $10cm^2$ in area.

A. 10 cm

B. 20 cm

C. 30 cm

D. 40 cm

Answer: D

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5. The atmospheric pressure on the earth's surface is P in M.K.S. units. A table of area $2m^2$ is tilled at $45\circ$ with the horizontal. The force on the table due to the atmosphere is (stressxarea).

A. 2P

B. $\sqrt{2}P$

C. $2\sqrt{2}P$

D. $\frac{P}{\sqrt{2}}$

Answer: A

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6. A body of mass 6.28 kg is suspended from one end of a wire of length 10 m. The radius of the wire is changing uniformly from $19.6 \times 10^{-4} m$ at one end to $10 \times 10^{-4} m$ at the order end. Find the change in the length of the wire.

$[Y = 2 \times 10^{11} N/m^2]$

A. 0.1 mm

B. 0.3 mm

C. 0.5 mm

D. 0.7 mm

Answer: C

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7. A metal wire of length L_1 and area of cross-section A is attached to a rigid support. Another metal wire of length L_2 and of the same cross-sectional area is attached to free end of the first wire. A body of mass M is then suspended from the free end of the second wire. If Y_1 and Y_2 are the Young's moduli of the wires respectively, the effective force constant of the system of two wire is

A. $[(Y_1Y_2)A]/[2(Y_1L_2+Y_2L_1)]$

B. $[(Y_1Y_2)A]/[(L_1L_2)]^{1/2}$

C. $[(Y_1Y_2)A]/[(Y_1L_2+Y_2L_1)]$

D. $(Y_1Y_2)^{1/2}A/(L_1L_2)^{1/2}$

Answer: C

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8. A steel cylindrical rod of length l and radius r is suspended by its end from the ceiling.

(a) Find the elastic deformation energy U of the rod.

(b) Define U in terms of tensile strain $\Delta l / l$ of the rod.

A. $\frac{2}{3}\pi r^3 lE\left(\frac{\Delta l}{l}\right)^2$

B. $\frac{1}{3}\pi r^3 lE\left(\frac{\Delta l}{l}\right)^2$

C. $\frac{2}{3}\pi r^2 lE\left(\frac{\Delta l}{l}\right)^2$

D. $\frac{4}{3}\pi r^3 lE\left(\frac{\Delta l}{l}\right)^2$

Answer: C

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9. A ring of radius R is made of a thin wire of material of density ρ, having cross-section area a and Young's modulus y. The ring rotates about an axis perpendicular to its plane and through its centre. Angular frequency of rotation is ω.

The tension in the ring will be

A. $\dfrac{apR^2\omega^2}{2}$

B. $apR^2\omega^2$

C. $2apR^2\omega^2$

D. $\dfrac{apR^2\omega^2}{4}$

Answer: B

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10. If p is the density of the material of a wire and σ the breaking stress, the greatest length of the wire that can hang freely without breaking is

A. $\frac{2\sigma}{pg}$

B. $\frac{p}{\sigma g}$

C. $\frac{pg}{2\sigma}$

D. $\frac{\sigma}{pg}$

Answer: A

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11. A block of weight 10 N is fastened to one end of a wire of cross sectional area $3mm^2$ and is rotated in a vertical circle of radius 20 cmk. The speed of the block at the bottom of the circle is $2ms^{-1}$. Find the elongation of the wire when the block is at the bottom of the circle. Young modulus of the material of the wire $= 2 \times 10^{11} Nm^{-2}$.

A. the elongation of the wire when block is at the bottom of circle is $10^{-4} cm$.

B. the elongation of the wire when block is at top of circle is $1 \mu m$.

C. tension in wire is 30 N.

D. tension in wire is 20 N.

Answer: C

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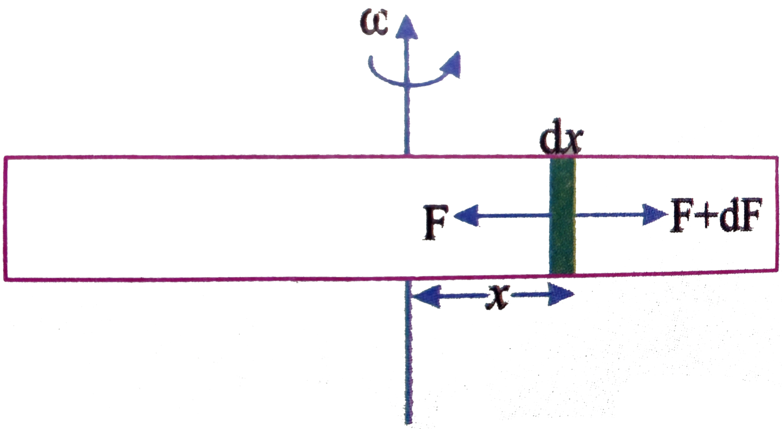
12. A horizontally orientied unifrom copper rod of length l is rotating about a vertical axis passing through its centre. Calculate the rotated frequency at which the rod ruptures. Breaking or rupture strength of copper is σ and density of copper is ρ.



A. $\frac{1}{\pi}l\sqrt{\frac{2\sigma_m}{p}}$

B. $\frac{\pi}{l}\sqrt{\frac{2\sigma_m}{p}}$

C. $\frac{2}{\pi}l\sqrt{\frac{2\sigma_m}{p}}$

D. $\frac{3}{\pi l}\sqrt{\frac{2\sigma_m}{p}}$

Answer: A

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13. What works has to be performed to make a hoop out of a steel band of length l, width h and thickness δ? The process is assumed to proceed within the elasticity range of the material.

A. $\pi^2 Eb\delta^3 / l$

B. $\pi^3 Eb\delta^3 / l$

C. $\pi^4 Eb\delta^3 / l$

D. $\pi^5 Eb\delta^3 / l$

Answer: A

View Text Solution

View Text Solution

14. A catapault is stretched with a force of 100 N which changes the length of the band from 10 cm to 14 cm. Find the velocity with which a stone of mass 1 kg will leave the catapault when aimed at a mango.

A. $1m/s$

B. $1cm/s$

C. $2m/s$

D. $2cm/s$

Answer: C

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