Ravi Maths Tuition Centre

Time : 1 Mins **MECHANICAL PROPERTIES OF SOLIDS AND FLUIDS** **Marks : 313**

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1. The graph shows the behaviour of a length of wire in the for which the substance obeys Hooke's law. P and Q represent

a) P = applied force, Q = extension b) P = extension, Q = applied force
c) P = extension, Q = stored elastic energy d) P = stored elastic energy, Q = extension

2. A wire of length 2 m is made from 10 cm^3 of copper. A force F is applied so that its length increases by 2 mm. Another wire of length 8 m is made from the same volume of copper. If the force F is applied to it, its length will increase by
a) 0.8 cm b) 1.6 cm c) 2.4 cm d) 3.2 cm

3. Elasticity is due to
a) decrease of PE with separation between atoms/molecules
b) increase of PE with separation between atoms/molecules c) asymmetric nature of PE curve
d) None of the above

4. The temperature of a wire is doubled. The Young's modulus of elasticity
a) will also double. b) will become four times c) will remain same d) will decrease.

5. Two rods of different materials having coefficient of thermal expansion α_1, α_2 and Young's modulus 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 a $\alpha_1 : \alpha_2 = 2 : 3$, 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

6. The length of a wire increases by 1% by a load of 2 kg-wt. The linear strain produced in the wire will be
a) 0.02 b) 0.001 c) 0.01 d) 0.002

7. A material has Poisson's ratio 0.5. If a uniform rod of it suffers a longitudinal strain of 2×10^{-3} , then the percentage change in volume is
a) 0.6 b) 0.4 c) 0.2 d) Zero

8. A and B are two wires. The radius of A is twice that of B. They are stretched by the same load. Then, the stress on B is
a) equal to that on A b) four times that on A c) two times that on A d) half that on A

9. You have four wires A, B, C, D of same material having same area of cross - section such that length of A > B > C > D, the breaking force of
a) A > B > C > D b) A < B < C < D c) A = B = C = D d) A/B - C/D

10. With the increase in temperature, the Young's modulus of a material
a) increases b) decrease c) remains same d) fluctuates

11. A mild steel wire of length 2L and cross-sectional area A is stretched, well within elastic limit, horizontally between two pillars figure. A mass m is suspended from the mid point of the wire. Strain in the wire is

a) $\frac{x^2}{2L^2}$ b) $\frac{x}{L}$ c) $\frac{x^2}{L}$ d) $\frac{x^2}{2L}$

12. Elastic limit is equal to
    a) Young's modulus b) Modulus of rigidity c) stress d) strain

13. A uniform cube is subjected to volume compression. If each side is decreased by 1%, then bulk strain is
    a) 0.01 b) 0.06 c) 0.02 d) 0.03

14. A wire of length L, area of cross section A is hanging from a fixed support. The length of the wire changes to L_1 when mass M is suspended from its free end. The expression for Young's modulus is___
    a) $\frac{mgL}{A(L_1-L)}$ b) $\frac{mgL_1}{AL}$ c) $\frac{Mg(L_1-L)}{AL}$ d) $\frac{MgL}{AL_1}$

15. Brittle substanceare those in which there is
    a) no elastic b) no breaking point c) small gap between elastic limit and breaking point
    d) large gap between elastic limit and breaking point

16. One end of uniform wire of length L and of weight W is attached rigidly to a point in the roof and a weight WI 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) W_1/s b) $[W_1/s+W/4]s$ c) $[W_1+3W/4]s$ d) W_1+W/s

17. Two wires of the same material and length but diameter in the ratio 1: 2 are stretched by the same load. The ratio of elastic potential energy per unit volume for the two wires is
    a) 1 :1 b) 2 : 1 c) 4 : 1 d) 16 : 1

18. Four wires of the same material are Stretched by the same load. The dimensions are given below. Which of them will elongate the most
    a) length 100 cm, diameter 1 mm b) length 200 cm, diameter 2 mm c) length 300 cm, diameter 3 mm
    d) length 400 cm, diameter 0.5 mm

19. A metal wire is first stretched beyond its elastic limit then released it:
    a) Loses its elastic property completely and it will not contract b) Will contact to its length
    c) Will contract to its length at elastic limit d) Will but final length Will be greater than original length

20. In solids, inter-atomic forces are
    a) totally repulsive b) totally attractive c) combination of (a) and (b) d) None of these

21. 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

22. Elasticity of a material can be altered by
    a) annealing b) hammering c) adding impurities d) All of the above

23. 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. The ratio of their diameters, if each is to have the same tension, is equal to
    a) $\frac{Y_{\text{Copper}}}{Y_{\text{Iron}}}$ b) $\sqrt{\frac{Y_{\text{Iron}}}{Y_{\text{Copper}}}}$ c) $\sqrt{\frac{Y_{\text{Iron}}^2}{Y_{\text{Copper}}^2}}$ d) $\frac{Y_{\text{Iron}}}{Y_{\text{Copper}}}$

24. A copper and a steel wire of the same diameter are connected end to end. A deforming force F is applied to this composite wire which causes a total elongation of 1cm. The two wires will have
    a) the same stress and strain b) the same stress but different strain c) the same strain but different stress
    d) different strains and stress

25. The approximate depth of an ocean is 2700 m. The compressibility of water is $45.4 \times 10^{-11}\ \text{Pa}^{-1}$ and density of water is $10^3\ \text{kg/m}^3$. 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}

26. The Young's modulus of a Wire is numerically equal to the stress Which Will
    a) Not change the length of the wire b) Double the length of the wire c) Increase the length by 50%
    d) Change the radius of the wire to half
27. Bulk modulus of water is 2 x 10^9 N/m^2. The pressure required to increase the density of water by 0.1 % in N/m^2 is
    a) 2 x 10^9 b) 2 x 10^8 c) 2 x 10^6 d) 2 x 10^4
28. Wire A and B are made from the same material A has twice the diameter and three times the length of B. If the elastic limits are not reached, when each is stretched by the same tension, the ratio of energy stored in A to that in B is:
    a) 2: 3 b) 3 : 4 c) 3: 2 d) 6 : 1
29. A wire of length L and cross section A is make of material of Young's modulus Y.It is stretched by an amount x. the work done is
    a) $\frac{YxA}{2L}$ b) $\frac{Yx^2A}{L}$ c) $\frac{Yx^2A}{2L}$ d) $\frac{2Yx^2A}{L}$
30. The maximum load a wire can withstand without breaking, when its length is reduced to half of its original length, will
    a) be double b) be half c) be four times d) remain same
31. The reciprocal of Bulk modulus (1/K) is called
    a) Young's modulus b) modulus of rigidity c) Hooke's law d) compressibility
32. The load versus elongation graph for four wires of the same material is shown in the fig. The thinnest wire is represented by the line.
    
    a) OC b) OD c) OA d) OB
33. The adjoining figure shows how the extension e of a wire varies with the applied F. If L is the original length of the A its cross sectional area and Y is the Young modulus of the material of the wire. the slope of the graph is
    
    a) YL/A b) YA^2/L c) YL^2A d) YA/L e) A/YL
34. Young's modulus of a wire depends on
    a) its material b) its length c) its area of cross-section d) both (b) and (c)
35. Which of the following statements is incorrect?
    a) Young's modulus and shear modulus are relevant only for solids
    b) Bulk modulus is relevant for liquids and gases.
    c) Metals have larger values of Young's modulus than elastomers
    d) Alloys have larger values of Young's modulus than metals.
36. The property of a body by virtue of which it tends to regain its original size and shape of a body when applied force is removed, is known as
    a) fluidity b) elasticity c) plasticity d) rigidity
37. Ductile substances are those in which
    a) there is no elastic limit b) there is no breaking point c) Hooke's law is not applicable
    d) there is a large gap between elastic limit and breaking point
38. The energy stored in a stained wire is given by
    a) 1/2 stress x strain b) 1/2 load x elongation c) 1/2 stress / strain d) 1/2 load / eloongation

39. A uniform bar of square cross-section is lying along a frictionless horizontal surface. A horizontal force is applied to pull it from one of its ends, then
    a) the bar is under same stress throughout its length
    b) the bar is not under any stress because force has been applied only at one end
    c) the bar simply moves without any stress in it
    d) the stress developed gradually reduces to zero at the end of the bar where no force is applied
40. Modulus of rigidity of ideal liquids is
    a) infmity b) Zero c) unity d) some finite small non-zero constant value
41. Rigidity modulus of steel is η and its Young's modulus is Y. A piece of steel of cross-sectional area a is stretched into a wire of length L are a/10. Then
    a) Y increases and η decreases b) Y and η remain the same c) Y decreases and η increases
    d) Both Yand η increases
42. A copper rod of 88 cm and an aluminium rod of unknown length have their increase in length independent of increase in temperature. The length of aluminium rod is: $\left(\mathrm{a}_{\mathrm{Cu}}=1.7 \times 10^{-5}\ \mathrm{K}^{-1}\right.$ and $\left.\mathrm{a}_{\mathrm{Al}}^{-2.2} \times 10^{-5}\ \mathrm{K}^{-1}\right)$____
    a) $113.9\ \mathrm{cm}$ b) $88\ \mathrm{cm}$ c) $68\ \mathrm{cm}$ d) $6.8\ \mathrm{cm}$
43. When an elastic material with Young's modulus Y is subjected to stretching stress S, elastic energy stored per unit volume of the material is_____
    a) $YS/2$ b) $\mathrm{S}^2\mathrm{Y}/2$ c) $\mathrm{S}^2/2\mathrm{Y}$ d) $\mathrm{S}/2\mathrm{Y}$
44. Copper of fixed volume ' V ' is drawn into wire of length ' T '. When this wire is subjected to a constant force ' P ', the extension produced in the wire is $\mathrm{D}l'$. Which of the following graphs is a straight line?
    a) $\mathrm{D}l$ versus 1/l b) $\mathrm{D}l$ versus l^2 c) $\mathrm{D}l$ versus $1/l^2$ d) $\mathrm{D}l$ versus l
45. K is a force constant of a spring. The work done in increasing its extension from l_1 to l_2 will be:
    a) $K(l_1 - l_2)$ b) $K(l_1 + l_2)/2$ c) $K\left(l_1^2+l_1^2\right)$ d) $K\left(l_2^2+l_1^2\right)/2$
46. If both the length and radius of the wire are doubled. how does the rnodulus of elasticity change?
    a) becomes one fourth b) halved c) doubled d) remains unchanged
47. A wire of length L arid radius r is rigidly fixed at one end. On stretching the other end of the wire with a force F, the increase in its length is l. If another wire of same material but of length 2L and radius 2r is stretched with a force of 2F, the increase in its length will be
    a) l b) 2l c) l/2 d) l/4
48. One end of a uniform wire of length L and of weight W is attached rigidly to a point in the roof and weight W_1 is suspended from the lower end. If S is the area of cross-section of the wire, the stress in the wire at a height 3/4 from its lower end is;
    a) W_1/S b) $(W_1 + W/4)S$ c) $(W_1 + 3W/4)/S$ d) $W_1 + W)/S$
49. The nature of molecular forces resembles with the nature of the
    a) gravitational force b) nuclear force c) electromagnetic force d) weak force
50. Stress-strain curves for the material A and B are shown below Then,

    a) A is brittle material b) B is ductile material c) B is brittle rrraterial d) Both (a) and (b)
51. Young's modulus of a material has the same unit as
    a) stress b) energy c) compressibility d) pressure
52. A rod elongates by l when a body of mass M is suspended from it. The work done is:
    a) Mgl b) $\frac{1}{2}Mgl$ c) 2Mgl d) Zero
53. A cube of aluminium of side 0.1m 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

54. Dimensional formula of stress is same as that of
    a) impulse b) strain c) force d) pressure

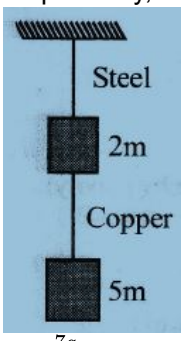
55. You have a wire whose area of cross section is $5mm^2$ and get stretched by 0.2mm by a certain load.If another wire of the same material has 3/2 times its area of cross section, the extension for the same load will be
    a) 0.2mm b) 0.24mm c) 0.133mm d) 0.03mm

56. A rope of nylon of radius 1.5cm has a breaking strength of 1.6×10^5N.The breaking strength of a similar rope of radius 7.5mm shall be
    a) 1.6×10^5N b) 0.8×10^5N c) 0.4×10^5N d) 0.2×10^5N

57. A wire suspended vertically from one end, is stretched by attaching a weight 200 N to the lower end. The weight stretches the wire by 1 mm. The energy gained by the wire is
    a) 0.1 J b) 0.2 J c) 0.4 J d) 4 k

58. 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 breaking point for steel is therefore
    a) 1.33×10^{11} Nm^{-2} b) 1.33×10^{12} Nm^{-2} c) 7.5×10^{-13} Nm^{-2} d) 3×10^{10} Nm^{-2}

59. If the ratio of diameters, lengths and Young's modulus of steel and copper wires shown in the figure are p, q and s respectively, then the corresponding ratio of increase in their lengths would be_____



    a) $\frac{7q}{(5sp)}$ b) $\frac{5q}{(7sp^2)}$ c) $\frac{7q}{(5sp^2)}$ d) $\frac{2q}{(5sp)}$

60. 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) 2: 1 b) 1: 4 c) 1: 8 d) 8: 1

61. A steel rod of length 1m and radius 10mm is stretched by a force 100 kN along its length. The stress produced in the rod is $Y_{Steel} = 2 \times 10^{11}$ Nm^{-2} .
    a) 3.18×10^6 Nm^{-2} b) 3.18×10^7 Nm^{-2} c) 3.18×10^8 Nm^{-2} d) 3.18×10^9 Nm^{-2}

62. A wire of diameter 1 mm breaks under a tension of 1000 N. Another wire of same material 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

63. When a pressure of 100 atmosphere is applied on a spherical ball of rubber, then its volume reduces to 0.01 %. The bulk modulus of the material of the rubber in dyne cm^{-2} is
    a) 10×10^{12} b) 100×10^{12} c) 1×10^{12} d) 20×10^{12}

64. The value of Bulk modulus for a perfectly right body is
    a) infinity b) zero c) one d) ±1

65. On suspending a weight Mg, the length l of elastic wire having area of cross-section A, becomes double the initial length. The instantaneous stress action on the wire is
    a) Mg / A b) Mg / 2A c) 2Mg / A d) 4Mg / A

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

a) attracted when r lies between A and B and repelled when r lies between Band C
b) attracted when r lies between Band C and repelled when r lies between A and B.
c) attracted when they reach B. d) repelled when they reach B.

67. Which of the following is not a unit of Young's modulus?
a) Nm^{-2} b) Mega Pascal (MPa) c) dyne cm^{-2} d) Nm^{-1}

68. When an elastic material with Young's modulus y is subjected to a stretching Stress S. the elastic energy stored per unit volume of the material is:
a) YS/2 b) $S^2Y/2$ c) $S^2/2Y$ d) S/2Y

69. On applying a stress of 20 x 10^8 Nm^2 , the length of a perfectly elastic wire is doubled. Its Young's modulus will be
a) 40 x 10^8 Nm^{-2} b) 20 x 10^8 Nm^{-2} c) 10 x 10^8 Nm^{-2} d) 5 x 10^8 Nm^{-2}

70. A wire fixed at the upper end stretches by length I by applying a force F. The work done in stretching is
a) F/2I b) FI c) 2FI d) FI/2

71. 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 : 1 b) 2 : 1 c) 1: 2 d) 1 : 4

72. A steel ring of radius r and cross-section area A is shifted on to a wooden disc of radius R(R > r). If Young's modulus be E, then the force with which the steel ring is expanded is
a) AER/r b) AE(R - r)/r c) E(R - r)/Ar d) Er/AR

73. A spring of force constant k is cut into two equal parts. The force constant of each part is
a) k/2 b) k c) 2k d) 4k

74. The compressibility of water is 4×10^{-5} per unit atmospheric pressure. The decrease in volume of $100\ \mathrm{cm}^3$ of water under a pressure of 100 atmosphere will be___
a) $0.4\ \mathrm{cm}^3$ b) $1 \times 10^{-5}\ \mathrm{cm}^3$ c) $0.025\ \mathrm{cm}^3$ d) $0.004\ \mathrm{cm}^3$

75. The upper end of a wire of radius 4 mm and length 100 cm is clamped and its other end is twisted through an angle of 30°.Then, angle of shear is
a) 12° b) 0.12° c) 1.2° d) 0.012°

76. In the given figure, if the dimension of the wire are the same and materials are different, Young's modulus is more for

a) A b) B c) Both d) None of these

77. A wire is stretched to double its length. The strain is
a) 2 b) 1 c) Zero d) 0.5

78. Elasticity is shown by materials because inter-atomic or inter-molecular forces
a) increases when a body is deformed b) decreases when a body is deformed
c) remains same when a body is deformed d) becomes non-zero when a body is deformed

79. When a block of mass M is suspended by a long wire of length L, the length of the wire becomes L + I. The elastic potential energy stored in the extended wire is____

a) mgI b) $\frac{1}{2}\mathrm{mgl}$ c) $\frac{1}{2}\mathrm{mgL}$ d) mgl

80. The upper face of a (side 4cm) is displaced 2 mm parallel to itself when 100 N forces are applied at the and lower faces. The lower face is fixed. The strain produced in the cube is
    a) 5 b) 0.5 c) 0.05 d) 0.005
81. A long spring is stretched by 2 cm and its potential energy is V. If the spring is stretched by 10 cm, its potential energy will be:
    a) V/5 b) V/25 c) 5 V d) 25 V
82. 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) $Length = 100\ \mathrm{cm}, diameter = 1\ \mathrm{mm}$ b) $Length = 200\ \mathrm{cm}, diameter = 2\ \mathrm{mm}$
    c) $Length = 300\ \mathrm{cm}, diameter = 3\ \mathrm{mm}$ d) $Length = 50\ \mathrm{cm}, diameter = 0.5\ \mathrm{mm}$