KD EDUCATION ACADEMY [9582701166]

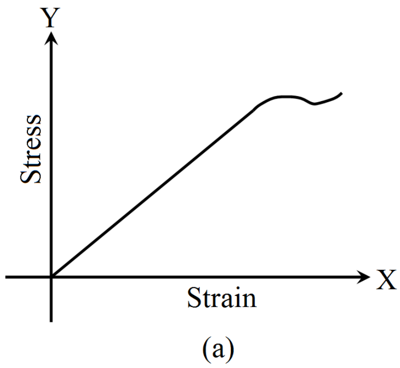
Time : 7 Hour | STD 11 Science Physics | Total Marks : 230

kd 90+ ch- 8 mechanical properties of solids

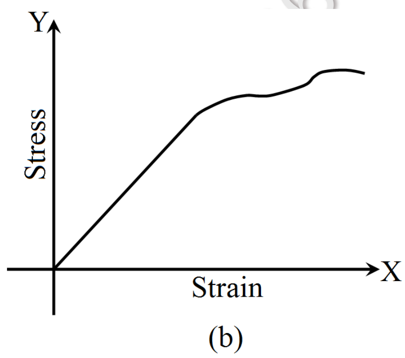
*** Choose The Right Answer From The Given Options.[1 Marks Each] [46]**

1. Following are the graphs of elastic materials. Which one corresponds to that of brittle material?

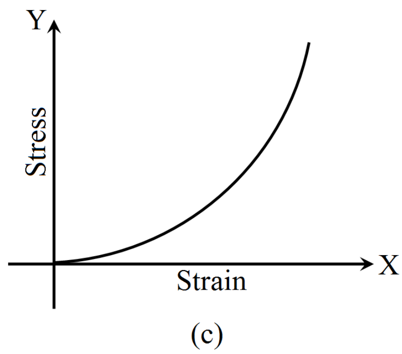
(A)



(B)



(C)



2. 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.
(B) Different stress.
(C) The same strain.
(D) Different strain.

3. 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

4. A wire is suspended from the ceiling and stretched under the action of a weight F suspended from its other end. The force exerted by the ceiling on it is equal and opposite to the weight.

(A) Tensile stress at any cross section A of the wire is F/ A.
(B) Tensile stress at any cross section is zero.
(C) Tensile stress at any cross section A of the wire is 2F/ A.
(D) Tension at any cross section A of the wire is F.

5. Amaterial 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.

6. On applying a stress of $20 \times 10^{8} Nm^{-2}$, the length of a perfectly elastic wire is doubled. Its Young's modulus will be:

(A) $40 \times 10^{8} Nm^{-2}$ (B) $20 \times 10^{8} Nm^{-2}$

(C) $10 \times 10^{8} Nm^{-2}$ (D) $5 \times 10^{8} Nm^{-2}$

7. Young's modulus of a material has the same unit as:

(A) Stress. (B) Energy.

(C) Compressibility. (D) Pressure.

8. 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.

9. 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) $\frac{Mg}{A}$ (B) $\frac{Mg}{2A}$ (C) $\frac{2Mg}{A}$ (D) $\frac{4Mg}{A}$

10. 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) $\frac{AER}{T}$ (B) $\frac{AE(R-r)}{r}$ (C) $\frac{E(R-r)}{Ar}$ (D) $\frac{Er}{AR}$

11. The length of a wire increases by 1% by a load of 2kg-wt. The linear strain produced in the wire will be:

(A) 0.02 (B) 0.001 (C) 0.01 (D) 0.002

12. 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.

13. The upper end of a wire of radius 4mm and length 100cm 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°

14. A long spring is stretched by 2cm and its potential energy is V. If the spring is stretched by 10cm, its potential energy will be:

(A) $\frac{V}{5}$ (B) $\frac{V}{25}$ (C) $5V$ (D) $25V$

15. 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.

16. 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.

17. 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.

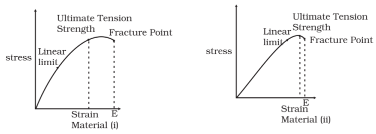
18. A wire of length L and radius r is rigidly fixed at one end. On stretching the other end of the wire with a force F, the increase in its length is l. If another wire of same material but of length 2L and radius 2r is stretched with a force of 2F, the increase in its length will be:

(A) l (B) $2l$ (C) $\frac{l}{2}$ (D) $\frac{l}{4}$

19. A wire suspended vertically from one end, is stretched by attaching a weight 200N to the lower end. The weight stretches the wire by 1mm. The energy gained by the wire is:

(A) 0.1J (B) 0.2J (C) 0.4J (D) 10J

20. The stress - strain graphs for two materials are shown in (assume same scale).



(A) Material (ii) is more elastic than material (i) and hence material (ii) is more brittle.

(B) Material (i) and (ii) have the same elasticity and the same brittleness.

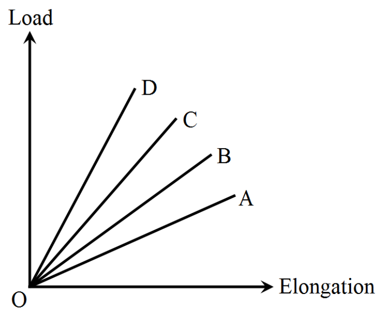
(C) Material (ii) is elastic over a larger region of strain as compared to (i).

(D) Material (ii) is more brittle than material (i).

21. 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

22. 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

23. Modulus of rigidity of ideal liquids is

(A) Infinity. (B) Zero.

(C) Unity. (D) Some finite small non - zero constant value.

24. 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

25. A steel rod of length 1m and radius 10mm is stretched by a force 100kN along its length. The stress produced in the rod is $Y_{steel} = 2 \times 10^{11} Nm^{-2}$.

(A) $3.18 \times 10^6 Nm^{-2}$ (B) $3.18 \times 10^7 Nm^{-2}$

(C) $3.18 \times 10^8 Nm^{-2}$ (D) $3.18 \times 10^9 Nm^{-2}$

26. The nature of molecular forces resembles with the nature of the:

(A) Gravitational force. (B) Nuclear force.

(C) Electromagnetic force. (D) Weak force.

27. 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}

28. The upper end of a wire of radius 4mm and length 100cm is clamped and its other end is twisted through an angle of 30°. The angle of shear is:

(A) 12° (B) 1.2° (C) 0.12° (D) 0.012°

29. When an elastic material with Young's modulus Y is subjected to stretching stress S, the elastic energy stored per unit volume of the material is:

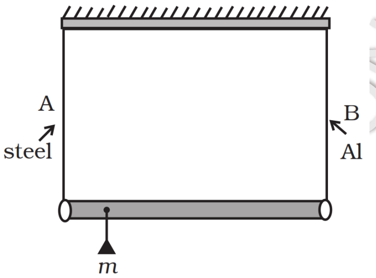
(A) $\frac{YS}{2}$ (B) $\frac{YS^2}{2}$ (C) $\frac{S^2}{2Y}$ (D) $\frac{2}{2Y}$

30. 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.

31. A rod of length l and negligible mass is suspended at its two ends by two wires of steel (wire A) and aluminium (wire B) of equal lengths. The cross - sectional areas of wires A and B are $1.0mm^2$ and $2.0mm^2$, respectively. ($Y_{al} = 70 \times 10 Nm^{-2}$ and $Y_{steel} = 200 \times$



$10^9 Nm^{-2}$)

(A) Mass m should be suspended close to wire A to have equal stresses in both the wires.

(B) Mass m should be suspended close to B to have equal stresses in both the wires.

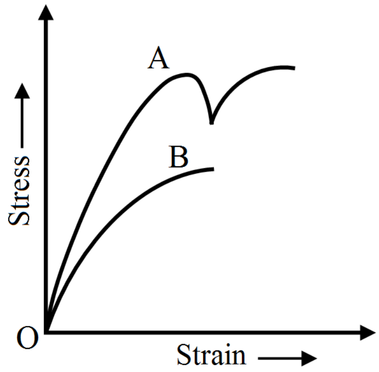
(C) Mass m should be suspended at the middle of the wires to have equal stresses in both the wires.

(D) Mass m should be suspended close to wire A to have equal strain in both wires.

32. 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) Y_{copper}/Y_{iron}. (B) $\sqrt{\frac{Y_{iron}}{Y_{copper}}}$. (C) $\frac{Y_{iron}^2}{Y_{copper}^2}$. (D) $\frac{Y_{iron}}{Y_{copper}}$.

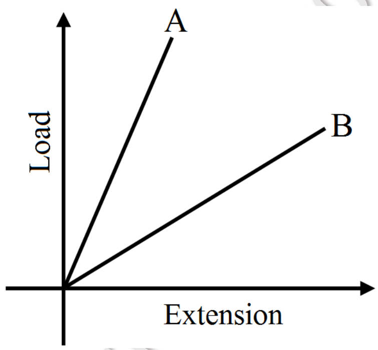
33. Stress-strain curves for the material A and B are shown below:



Then,

(A) A is brittle material.
(B) B is ductile material.
(C) B is brittle material.
(D) Both (a) and (b).

34. 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.

35. 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).

36. 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 $\alpha_1 : \alpha_2 = 2 : 3,$ 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

37. Dimensional formula of stress is same as that of:

(A) Impulse.
(B) Strain.
(C) Force.
(D) Pressure.

38. A wire of diameter 1mm breaks under a tension of 1000N. Another wire of same material as that of the first one, but of diameter 2mm breaks under a tension of:

(A) 500N
(B) 1000N
(C) 10000N
(D) 4000N

39. 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) 12 : 1
(C) 3 : 2
(D) 6 : 1

40. A solid sphere falls with a terminal velocity of 20m/s in air. If it is allowed to fall in vacuum,

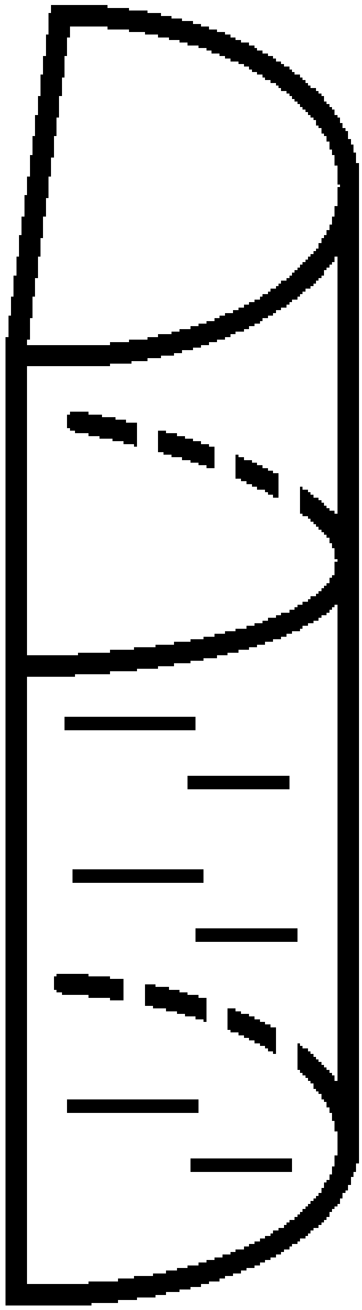
a. Terminal velocity will be 20m/s

b. Terminal velocity will be less than 20m/s
c. Terminal velocity will be more than 20m/s
d. There will be no terminal velocity.

41. The force of viscosity is:
a. Electromagnetic.
b. Gravitational.
c. Nuclear.
d. Weak.

42. A wire can sustain the weight of 20kg before breaking. If the wire is cut into two equal parts, each part can sustain a weight of.
a. 10kg
b. 20kg
c. 40kg
d. 80kg.

43. A liquid is contained in a vertical tube of semicircular cross-section The contact angle is zero. The forces of surface tension on the curved part and on the flat part are in ratio:
a. $1:1$
b. $1:2$
c. $\pi:2$
d. $2:\pi$



44. A solid sphere moves at a terminal velocity of 20m/s in air at a place where g = 9.8m/s^2. The sphere is taken in a gravity free hall having air at the same pressure and pushed down at a speed of 20m/s.

  a. Its initial acceleration will be 9.8m/s^2 downward.
  b. Its initial acceleration will be 9.8m/s^2 upward.
  c. The magnitude of acceleration will decrease as the time passes.
  d. It will eventually stop.

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

  a. 500N
  b. 250N
  c. 1000N
  d. 2000N.

46. A wire elongates by 1.0mm when a load W is hung from it. If this wire goes over a a pulley and two weights W each are hung at the two ends, he eloogation of he wire will be:

a. 0.5m
b. 1.0mm
c. 2.0mm
d. 4.0mm.

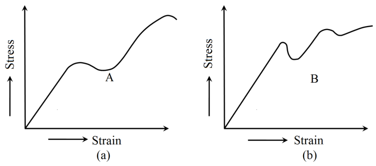
* Answer The Following Questions In One Sentence.[1 Marks Each] [9]

47. A wire increases by 10^{-3} of its length when a stress of $10^{8}Nm^{-2}$ is applied to it. What is the Young's modulus of the material of the wire?

48. What is the value of bulk modulus for an incompressible liquid?

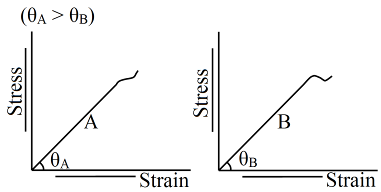
49. What does Hooke's law essentially define?

50. The stress versus strain graphs for two materials A and B are shown below: (The graphs are to the same scale).



i. Which material has greater Young's modulus?
ii. Which material is more ductile?
iii. Which is more brittle?

51. The stress-strain graph for material A and B are shown in the figure (drawn on same scale). Which of the two is stronger material? Justify your answer.



52. Bridges are declared unsafe after long use. Why?

53. Two persons pull a rope towards themselves. Each person exerts a force of 100N on the rope. Find the Young's modulus of the material of the rope if it extends in length by 1cm. Original length of the rope = 2m and the area of cross-section = $2cm^2$.

54. The elastic limit of steel is $8 \times 10^8 N/m^2$ and its Young's modulus $2 \times 10^{11} N/m^2$. Find the maximum elongation of a half meter steel wire that can be given without exceeding the elastic limit.

55. A 5.0cm long straight piece of thread is kept on the surface of water. Find the force with which the surface on one side of the thread pulls it. Surface tension of water = 0.076N/m.

* Given Section consists of questions of 2 marks each. [10]

56. A steel wire and a copper wire of equal length and equal cross-sectional area are joined end to end and the combination is subjected to a tension. Find the ratio of.

a. The stresses developed in the two wires.

b. The strains developed. Y of steel = $2 \times 10^{11} N/m^2$. Y of copper = $1.3 \times 10^{11} N/m^2$.

57. A load of 10kg is suspended by a metal wire 3m long and having a cross-sectional area $4mm^2$. Find.
   a. The stress.
   b. The strain and.
   c. The elongation. Young's modulus of the metal is $2.0 \times 10N^{11} N/ m^2$.

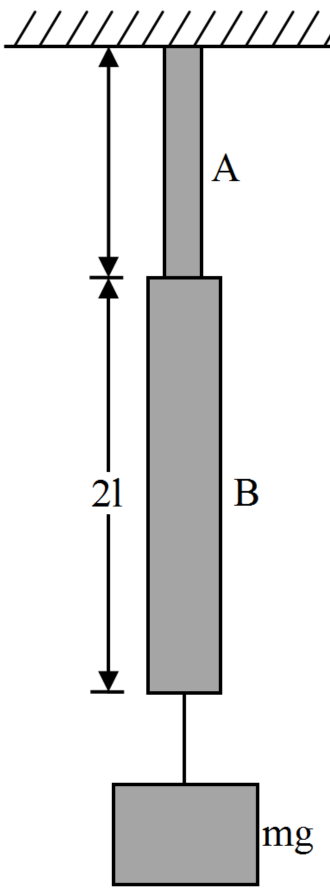
58. A wire forming a loop is dipped into soap solution and taken out so that a film of soap solution is formed. A loop of 6.28cm long thread is gently put on the film and the film is pricked with a needle inside the loop. The thread loop takes the shape of a circle. Find the tension in the thread. Surface tension of soap solution = 0.030N/m.

59. A copper wire of cross-sectional area $0.01cm^2$ is under a tension of 20N. Find the decrease in the cross-sectional area. Young's modulus of copper = $1.1 \times 10^{11} N/m^2$ and Poisson's ratio = 0.32. $\left[\textbf{Hint: } \frac{\triangle A}{A} = 2\frac{\triangle r}{r}\right]$

60. The contact angle between pure water and pure silver is 90º. If a capillary tube made of silver is dipped at one end in pure water, will the water rise in the capillary?

*** Given Section consists of questions of 3 marks each.** **[21]**

61. Two wires A and B of length l, radius r and length 2l, radius 2r having same Young's modulus Y are hung with a weight mg, see fig. What is the net elongation in the two



wires?

62. Determine the volume contraction of a solid copper cube, 10cm on an edge, when subjected to a hydraulic pressure of 7.0×10^6 Pa.

63. A steel wire of length 4m is stretched through 2mm. The cross-section area of the wire is $2.0 mm^2$. If Young's modulus of steel is $2.0 \times 10^{11} N/m^2$, find:
   i. The energy density of the wire,
   ii. The elastic potential energy stored in the wire.

64. Explain why steel is more elastic than rubber.

65. To what depth must a rubber ball be taken in deep sea so that its volume is decreased by 0.1%. (The bulk modulus of rubber is $9.8 \times 10^8 N\ m^{-2}$, and the density of sea water is $10^3 kg\ m^{-3}$.)

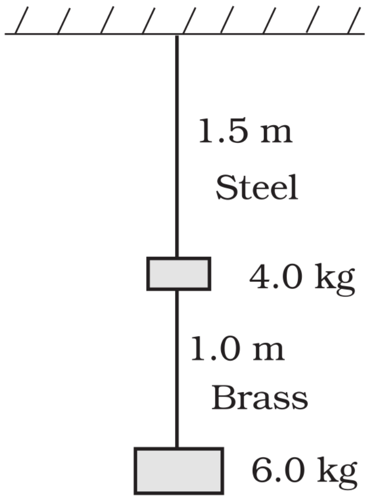
66. A sphere of mass 20kg is suspended by a metal wire of unstretched length 4m and diameter 1mm. When in equilibrium, there is a clear gap of 2mm between the sphere and the floor. The sphere is gently pushed aside so that the wire makes an angle θ with the vertical and is released. Find the maximum value of θ so that the sphere does not rub the floor. Young's modulus of the metal of the wire is $2.0 \times 10^{11} N/m^2$. Make appropriate approximations.

67. Water near the bed of a deep river is quiet while that near the surface flows. Give reasons.

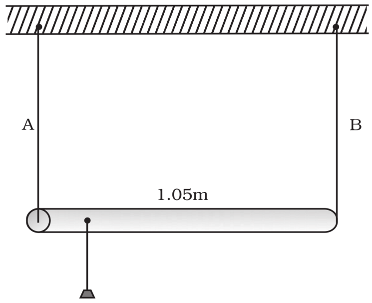
*** Given Section consists of questions of 5 marks each. [120]**

68. A rigid bar of mass 15kg is supported symmetrically by three wires each 2.0m long. Those at each end are of copper and the middle one is of iron. Determine the ratios of their diameters if each is to have the same tension.

69. Two wires of diameter 0.25cm, one made of steel and the other made of brass are loaded as shown in Fig. The unloaded length of steel wire is 1.5m and that of brass wire is 1.0m. Compute the elongations of the steel and the brass wires.



70. A rod of length 1.05m having negligible 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 areas of wires A and B are $1.0 mm^2$ and $2.0 mm^2$, 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.

71. The edge of an aluminium cube is 10cm long. One face of the cube is firmly fixed to a vertical wall. A mass of 100kg is then attached to the opposite face of the cube. The shear modulus of aluminium is 25G Pa. What is the vertical deflection of this face?

72. A 14.5kg mass, fastened to the end of a steel wire of unstretched length 1.0m, is whirled in a vertical circle with an angular velocity of 2rev/s at the bottom of the circle. The cross-sectional area of the wire is $0.065 cm^2$. Calculate the elongation of the wire when the mass is at the lowest point of its path.

73. The Marina trench is located in the Pacific Ocean, and at one place it is nearly eleven km beneath the surface of water. The water pressure at the bottom of the trench is about 1.1×10^8 Pa. A steel ball of initial volume $0.32 m^3$ is dropped into the ocean and falls to the bottom of the trench. What is the change in the volume of the ball when it reaches to the bottom?

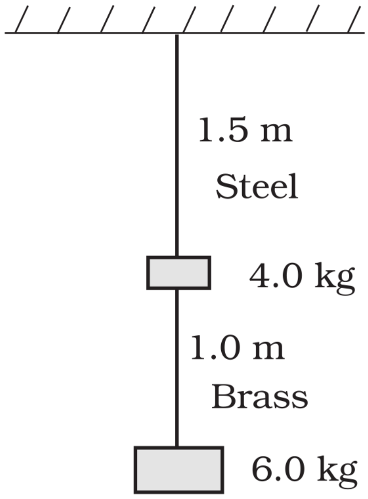
74. A steel rod of length 2l, cross sectional area A and mass M is set rotating in a horizontal plane about an axis passing through the centre. If Y is the Young's modulus for steel, find the extension in the length of the rod. (Assume the rod is uniform.)

75.

a. A steel wire of mass μ per unit length with a circular cross section has a radius of 0.1cm. The wire is of length 10m when measured lying horizontal, and hangs from a hook on the wall. A mass of 25kg is hung from the free end of the wire. Assuming the wire to be uniform and lateral strains << longitudinal strains, find the extension in the length of the wire. The density of steel is $7860 kg\ m^{-3}$ (Young's modules $Y = 2 \times 10^{11}\ Nm^{-2}$).

b. If the yield strength of steel is $2.5 \times 10^8\ Nm^{-2}$, what is the maximum weight that can be hung at the lower end of the wire?

76. Two wires of diameter 0.25cm, one made of steel and the other made of brass are loaded as shown in Fig. The unloaded length of steel wire is 1.5m and that of brass wire is 1.0m. Compute the elongations of the steel and the brass wires.



77. What is meant by elastic potential energy? Derive an expression for the elastic potential energy of a stretched wire. Prove that its elastic energy density is equal to $\frac{1}{2}\text{stress} \times \text{strain}.$

78. A wire loaded by a weight of density 7.6g/ cm^{-3} is found to measure 90cm. On immersing the weight in water, the length decreased by 0.18cm. Find the original length of wire.

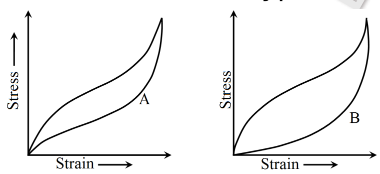
79. A steel wire of cross-sectional area $0.5mm^2$ is held between two fixed supports. If the tension in the wire is negligible and it is just taut at a temperature of 20°C, determine the tension when the temperature falls to 0°C. Young's modulus of steel is 21×10^{11} dyne cm^{-2} and the coefficient of linear expansion of steel is 12×10^{-6}per °C. Assume that the distance between the supports remains unchanged.

80. Two wires, one of steel and the other of aluminium, each 2m long and of diameter 2.0mm, are joined end to end to form a composite wire of length 4.0m. What tension in the wire will produce a total extension of 0.90mm? Y for steel = $2 \times 10^{11} Nm^{-2}$; Y for aluminium = $7 \times 10^{11} Nm^{-2}$

81. A load of 31.4kg is suspended from a wire of radius 10^{-3}m and density $9 \times 10^3 kg/ m^3$. Calculate the change in temperature of the wire if 75% of the work done is converted into heat. The Young's modulus and the specific heat capacity of the material of the wire are $9.8 \times 10^{10} N/ m^2$ and 490J/ kg/ k respectively.

82. An elastic spring of force constant K is compressed by an amount x. Show that its potential energy is $\frac{1}{2}\mathrm{Kr}^2$.

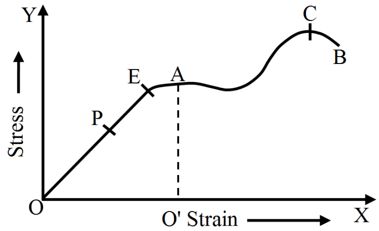
83. For two different type of rubber stress - strain curves are shown:



i. To make a shock absorber which rubber will you prefer and why?
ii. To make car tyre which of the two rubber would you prefer and why?

84. A wire of length L and radius r is clamped rigidly at one end. When the other end of the wire is pulled by a force f, its length increases by l. Another wire of the same material of length 2L and radius 2r, is pulled by a force 2f. Find the increase in length of this wire.

85. The Stress-Strain graph for a metal wire is shown in the figure upto the point E. The wire returns to its original state O along the curve EPO when it is gradually unloaded. Point B corresponds to the fracture of the wire:



i. Upto what point of the curve is Hooke's law obeyed?
ii. Which point on the curve corresponds to the elastic limit or yield point of the wire?
iii. Indicate the elastic and plastic regions of the Stress-Strain graph.
iv. Describe what happens when the wire is loaded upto a stress corresponding to the point A on the graph, and then unloaded gradually. In particular, explain, the dotted curve.
v. What is peculiar about the portion of the Stress-Strain graph from C to B? Upto what stress can the wire be subjected without causing fracture?

86. Why a hollow shaft is stronger than a solid shaft made from the same and equal amounts of material?

87. When a load on a wire is increased from 3kg wt to 5kg wt., the elongation increases from 0.61mm to 1.02mm. How much work is done during the extension of the wire?

88. A 14.5kg mass, fastened to the end of a steel wire of unstretched length 1.0m, is whirled in a vertical circle with an angular velocity of 2rev/s at the bottom of the circle. The cross-sectional area of the wire is 0.065cm^2. Calculate the elongation of the wire when the mass is at the lowest point of its path.

89. Two cylinders A and B of radii r and 2r are soldered co-axially. The free end of A is clamped and the free end of B is twisted by an angle ϕ. Find twist at the junction taking the material of two cylinders to be same and of equal length.

90. An equilateral triangle ABC is formed by two Cu rods AB and BC and one Al rod. It is heated in such a way that temperature of each rod increases by ΔT. Find change in the angle ABC. [Coeff. of linear expansion for 1 Cu is α_1 Coeff. of linear expansion for 2Al is α_2]

91. A stone of mass m is tied to an elastic string of negligible mass and spring constant k. The unstretched length of the string is L and has negligible mass. The other end of the string is fixed to a nail at a point P. Initially the stone is at the same level as the point P. The stone is dropped vertically from point P.
a. Find the distance y from the top when the mass comes to rest for an instant, for the first time.
b. What is the maximum velocity attained by the stone in this drop?
c. What shall be the nature of the motion after the stone has reached its lowest point?

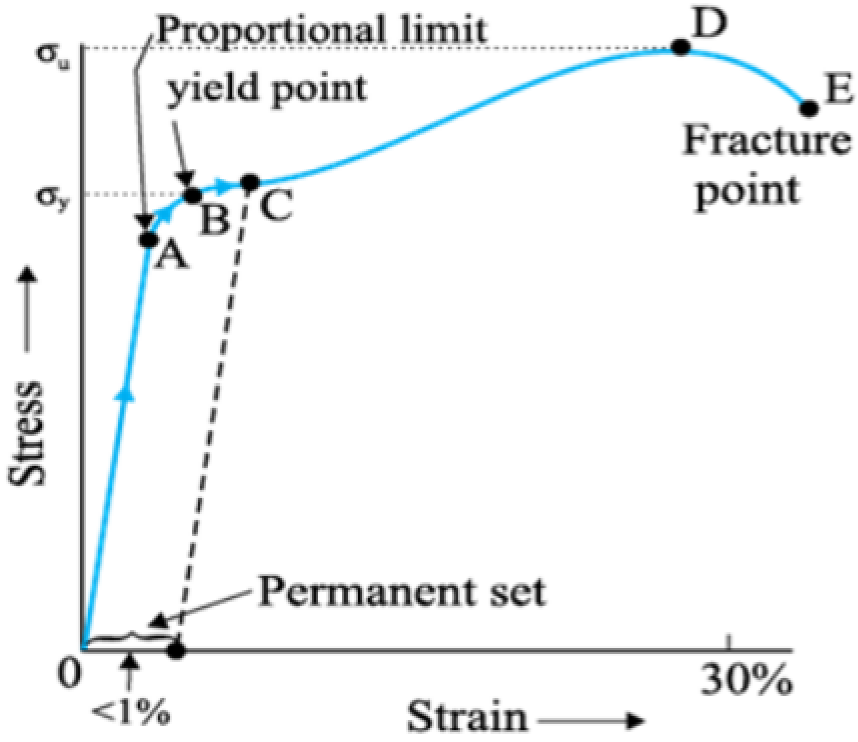
* Case study based questions [24]

92. Read the passage given below and answer the following questions from 1 to 5. When a body is subjected to a deforming force, a restoring force is developed in the body. This

restoring force is equal in magnitude but opposite in direction to the applied force. The restoring force per unit area is known as stress. If F is the force applied normal to the cross–section and A is the area of cross section of the body. Magnitude of the stress $= \frac{F}{A}$ The SI unit of stress is N-m^{-2} or Pascal (Pa) and its dimensional formula is [$ML^{-1}T^{-2}$]. The restoring force per unit area in this case is called tensile stress. If the cylinder is compressed under the action of applied forces, the restoring force per unit area is known as compressive stress. Tensile or compressive stress can also be termed as longitudinal stress. In both the cases, there is a change in the length of the cylinder. The change in the length ΔL to the original length L of the body is known as longitudinal strain. The restoring force per unit area developed due to the applied tangential force is known as tangential or shearing stress.

i. Restoring force per unit area is called as:
   a. Stress
   b. Strain
   c. Modulus of elasticity
   d. None of these
ii. Ratio of change in dimension to original dimension is called:
   a. Stress
   b. Strain
   c. Modulus of elasticity
   d. None of these
iii. Define shear stress.
iv. Define stress. Give its SI unit and dimension.
v. Define strain. Give its SI unit and dimension

93. Read the passage given below and answer the following questions from 1 to 5. For small deformations within elastic limit the stress and strain are proportional to each other. This is known as Hooke's law. Thus, stress α strain Stress = k × strain Where k is the proportionality constant and is known as modulus of elasticity. Hooke's law is an empirical law and is found to be valid for most materials. However, there are some materials which do not exhibit this linear relationship.

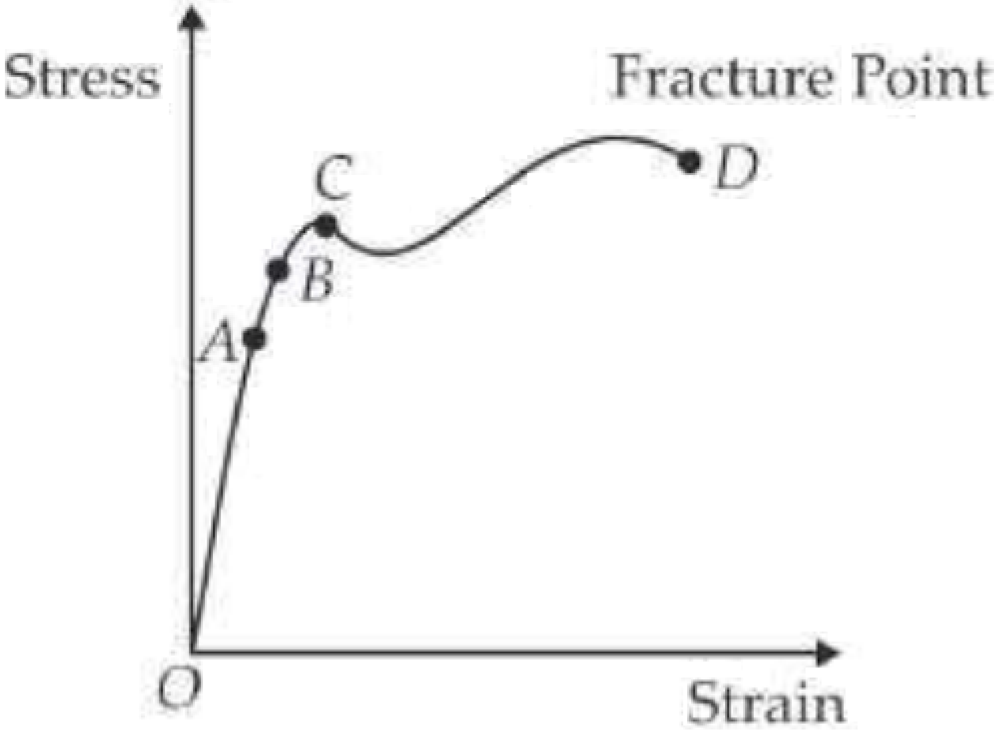


In the region from A to B, stress and strain are not proportional. Nevertheless, the body still returns to its original dimension when the load is removed. The point B in the curve is known as yield point (also known as elastic limit) and the corresponding stress is known as yield strength (σ_y) of the material. If the load is increased further, the stress developed exceeds the yield strength and strain increases rapidly even for a small change in the stress. The portion of the curve between B and D shows this. When the load is removed, say at some point C between B and D, the body does not regain its original dimension. In this case, even when the stress is zero, the strain is not zero. The material is said to have a permanent set. The deformation is said to be plastic deformation. The point D on the graph is the ultimate tensile strength (σ_u) of the material. Beyond this point, additional strain is produced even by a reduced applied force and fracture occurs at point E. If the ultimate strength and fracture points D and E are close, the material is said to be brittle. If they are far apart, the material is said to be ductile.

i. Stress is directly proportional to strain this is valid:
   a. Above elastic limit
   b. Within elastic limit
   c. Above plastic limit
   d. None of these
ii. SI unit of modulus of elasticity is:
   a. N/m^2
   b. N
   c. No unit
   d. None of these
iii. Define modulus of elasticity.
iv. State hooks law.
v. Write note on stress strain curve for ductile material.

94. Read the passage given below and answer the following questions from 1 to 5. Stress-Strain Curve The graph shown below shows qualitatively the relation between the stress

and the strain as the deformation gradually increases. Within Hooke's limit for a certain region stress and strain relation is linear. Beyond that up to a certain value of strain the body is still elastic and if deforming forces are removed the body recovers its original



shape.

i. If deforming forces are removed up to which point the curve will be retraced?
   a. Upto OA only
   b. Upto OB
   c. Upto C
   d. Never retraced its path

ii. In the above question, during loading and unloading the force exerted by the material are conservative up to:
   a. OA only
   b. OB only
   c. OC only
   d. OD only

iii. During unloading beyond B, say C, the length at zero stress in now equal to:
   a. Less than original length
   b. Greater than original length
   c. Original length
   d. Can't be predicted

iv. The breaking stress for a wire of unit cross - section is called:
   a. Yield point
   b. Elastic fatigue
   c. Tensile strength
   d. Young's modulus

v. Substances which can be stretched to cause large strains are called:
   a. Isomers
   b. Plastomers
   c. Elastomers
   d. Polymers

95. A steel blade placed gently on the surface of water floats on it. If the same blade is kept well inside the water, it sinks. Explain.

96. When some wax is rubbed on a cloth, it becomes waterproof. Explain.

97. If a mosquito is dipped into water and released, it is not able to fly till it is dry again. Explain.

----- if talent doesn't work hard then hardwork beat the talent -----