Chapter- 09

Mechanical Properties Of Solid

Very Short Answer Type Questions

Very Short Answer Type Questions

01. What is elasticity?
02. Which of the two forces-deforming or restoring is responsible for the elastic behavior of a substance?
03. Name the factors which affect the property of elasticity of a solid.
04. What is a perfect plastic body?
05. Which is more elastic water or air? Justify your answer.
06. What is the value of Young's modulus for a perfectly rigid body?
07. What are the factors on which the modulus of elasticity of material depends?
08. Define Hooke's law.
09. Which is the property of a body that opposes its deformation?
10. Write units & dimension of Poisson's ratio
11. What is the value of the modulus of rigidity for a liquid?
12. A wire is replaced by another wire of the same length and material but of twice diameter:
(i) What will be the effect on the increase in its length under a given load?
(ii) What will be the effect on the maximum load which it can bear?
13. The Young's modulus of a wire of length L and radius r is Y. If the length is reduced to L/2 and radius r/2 what will be its Young's modulus?

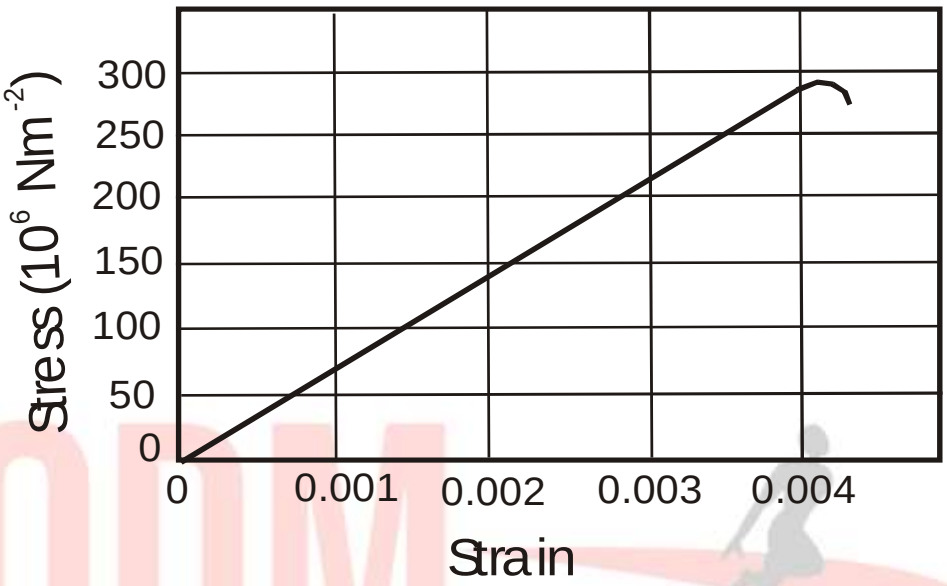
Short Answer Type Questions (2 marks):

14. What is the elastic limit? What happens if it is exceeded?
15. Why is the stretching of a coil spring determined by its shear modulus?
16. Why do spring balances show wrong reading after they have been used for a long time?
17. A force of 1000 N stretches the length of a hanging wire by 1 mm. What force is required to stretch a wire of the same material and length but having four times the diameter by 1 mm?
18. Steel is more elastic than a rubber. Justify the statement.
19. Draw a stress-strain graph for a metallic wire. Indicate the elastic and plastic regions of the graph.
20. A spherical ball contracts in volume by 0.01% when subjected to a normal uniform pressure of 100 atmospheres. Calculate the bulk modulus of the material.

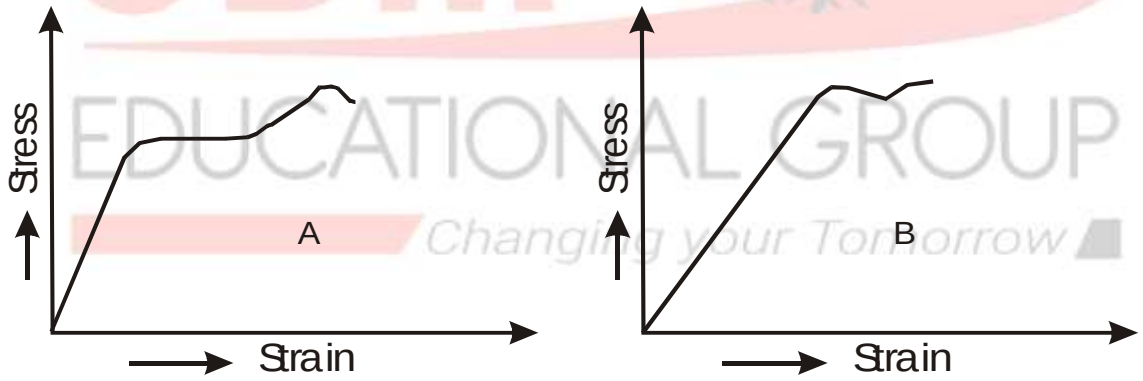
21. The figure below shows the strain-stress curve for a given material. What are

(a) Young's modulus and

(b) Approximate yield strength for this material?



22. The stress-strain graphs for materials A and B are shown in Fig. below.



The graphs are drawn to the same scale.

(a) Which of the materials has the greater Young's modulus?

(b) Which of the two is the stronger material?

23. What is the density of water at a depth where pressure is 80.0 atm, given that its density at the surface is 1.03x103 kg m^{-3}?

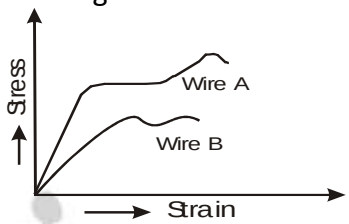
24. Compute the fractional change in volume of a glass slab, when subjected to a hydraulic pressure of 10 atm.

Short Answer Type Questions: (3 marks each)

25. The length of a wire is cut to half. What is the
i) effect on the maximum load the wire can support?
ii) effect on the increase in its length under a given load?

26. A wire of length L and area of cross-section A is made of a material of Young's modulus Y. It is stretched by an amount x. What is the work done?

27 The stress versus strain graphs of two wires A & B is shown in fig.
(i) Which wire has greater Young's modulus?
(ii) Which material is more ductile?
(iii) Which of the two is the stronger material?
Justify your answer in each case.



28. Define (a) Young's modulus of elasticity (b) Bulk modulus of elasticity and (c) Modulus of elasticity.

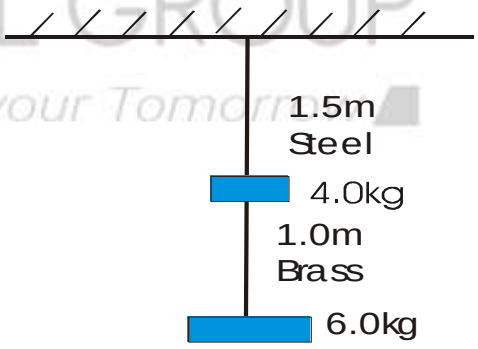
29. When subjected to a force of compression, the length of a bone decreases by 2.7×10^{-5} m. When this same bone is subjected to a tensile force of the same magnitude, by how much does it stretch? (Assume the same Young's Modulus).

30. Prove that elastic energy density = $\frac{1}{2} stress \times strain$.

31. State and explain Hooke's law. Discuss three applications of elasticity.

32. Explain the terms elastic limit, yield point, ultimate strength, breaking point from the stress-strain curve.

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



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

35. Four identical hollow cylindrical columns of mild steel support a big structure of mass 50,000 kg. The inner and outer radius of each column is 30 and 60 cm respectively. Assuming the load distribution to be uniform, calculate the compressional strain of each column.