PHYSICS

BOOKS - PSEB

MECHANICAL PROPERTIES OF SOLID

Exercise

1. A steel wire of length 4.7 m and cross-sectional area $3.0 \times 10^{-5} m^2$ stretches by the same amount as a copper wire of length 3.5 m

and cross-sectional area of $4.0 \times 10^{-5} M^2$ under a given load. What is the ratio of the Young's modulus of steel to that of copper?

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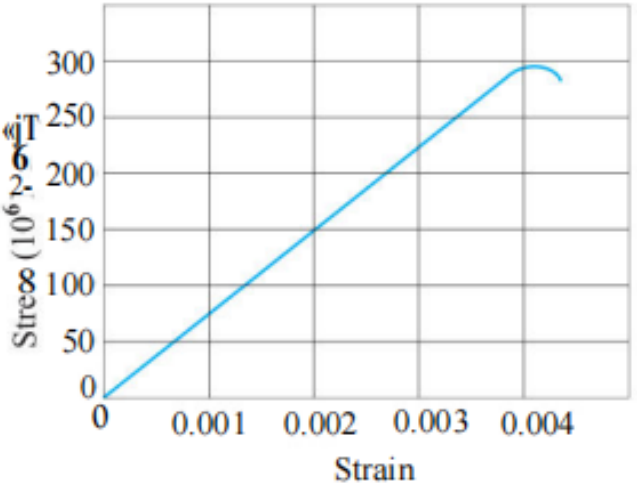
2. Figure 9.11 shows the strain-stress curve for a given material. What are Young'sb modulus :



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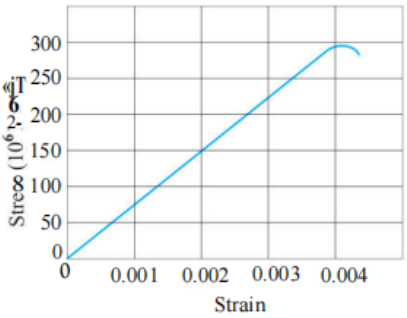
3. Figure 9.11 shows the strain-stress curve for a given material. What are approximate yield strength for this material:



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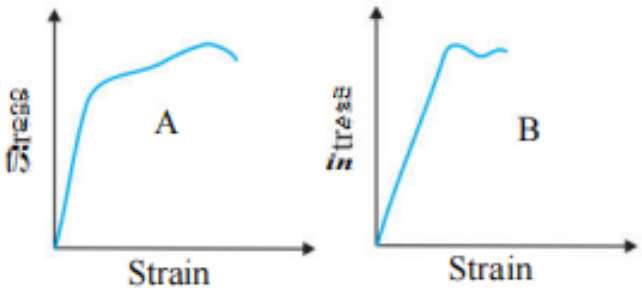
4. The stress-strain graphs for materials A and B are shown in Fig. 9.12.Tire graphs are drawn to the same scale. Which of the materials has the greater Young's modulus:



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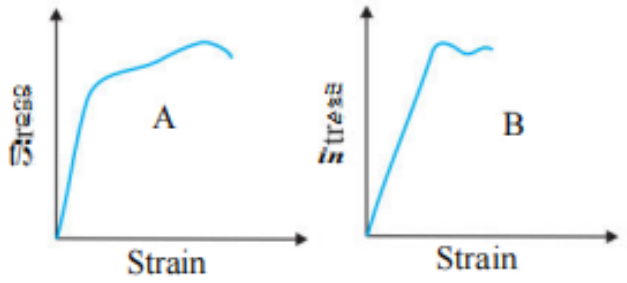
5. The stress-strain graphs for materials A and B are shown in Fig. 9.12.Tire graphs are drawn to the same scale) Which of the two is the stronger material?



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6. Read the following two statements below carefully and state, with reasons, if it is true or

false. The Young's modulus of rubber is greater than that of steel,

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7. Read the following two statements below carefully and state, with reasons, if it is true or false. The stretching of a coil is determined by its shear modulus.

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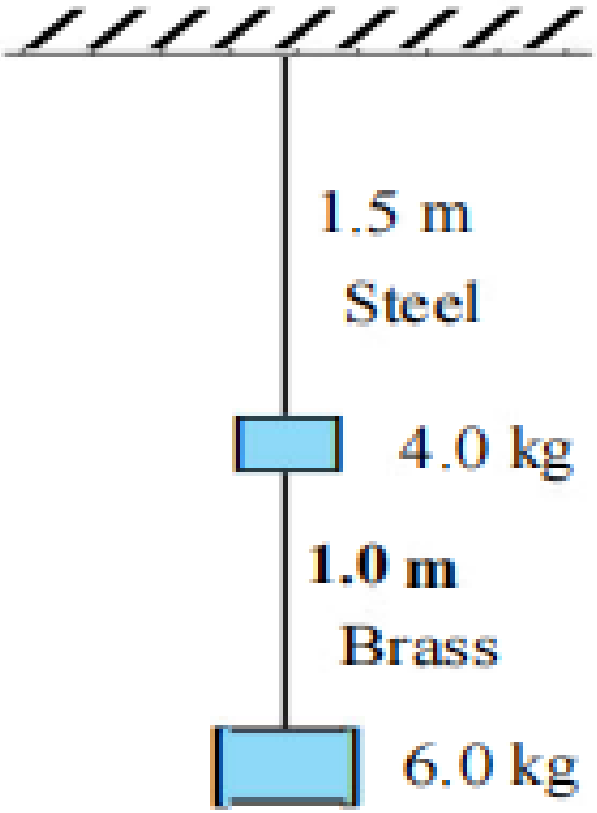
8. Two wires of diameter 0.25 cm, one made of steel and the other made of brass are loaded as shown in Fig. 9.13. The unloaded length of steel wire is 1.5 m and that of brass wire is 1.0 m. Compute the elongations of the steel and

the brass wires:



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

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10. Four identical hollow cylindrical columns of mild steel support a big structure of mass

50,000 kg. The inner and outer radii of each column are 30 and 60 cm respectively. Assuming the load distribution to be uniform, calculate the compressional strain of each column.

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11. A piece of copper having a rectangular cross-section of $15.2mm \times 19.1mm$ is pulled in tension with 44,500 N force, producing only

elastic deformation. Calculate the resulting strain?

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12. A steel cable with a radius of 1.5 cm supports a chairlift at a ski area. If the maximum stress is not to exceed $10^8 Nm^{-2}$, what is the maximum load the cable can support ?

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13. A rigid bar of mass 15 kg is supported symmetrically by three wires each 2.0 m 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.

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14. A 14.5 kg mass, fastened to the end of a steel wire of unstretched length 1.0 m, is whirled in a vertical circle with an angular

velocity of 2 rev/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.

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15. Compute the bulk modulus of water from the following data: Initial volume = 100.0 litre, Pressure increase = 100.0 atm (1 atm = 1.013×10^5 Pa). Final volume = 100.5 litre.

Compare the bulk modulus of water with that of air (at constant temperature). Explain in simple terms why the ratio is so large.

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16. What is the density of water at a depth where pressure is 80.0 atm, given that its density at the surface is $1.03 \times 103 kgm^{-3}$?

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17. Compute the fractional change in volume of a glassslab, when subjected to a hydraulic pressure of 10 atm.

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

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19. How much should the pressure on a litre of water be changed to compressit by 0.10%?

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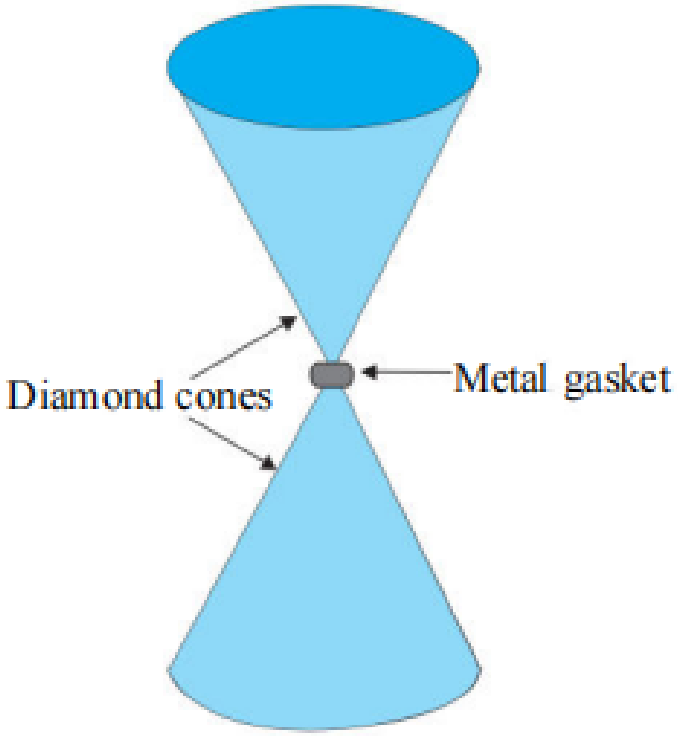
20. Anvils made of single crystals of diamond, with the shape as shown in Fig. 9.14, are used to investigate behaviour of materials under very high pressures. Flat faces at the narrow end of the anvil have a diameter of 0.50 mm, and the wide ends are subjected to a

compressional force of 50,000 N. What is the pressure at the tip of the anvil?:



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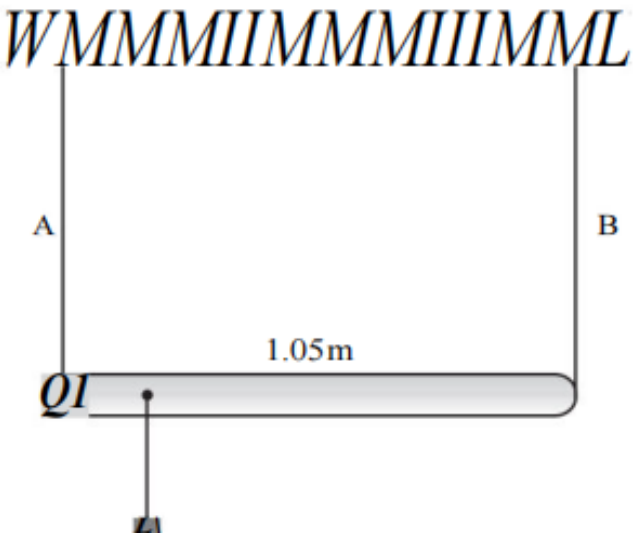
21. A rod of length 1.05 m having negligible mass is supported at its ends by two wires of steel (wire A) and aluminium (wire B) of equal lengths as shown in Fig. 9.15. The cross-sectional areas of wires A and B are $1.0mm^2$ and $2.0mm^2$, respectively. At what point along the rod should a mass m be suspended in order to produce (a) equal

stresses :



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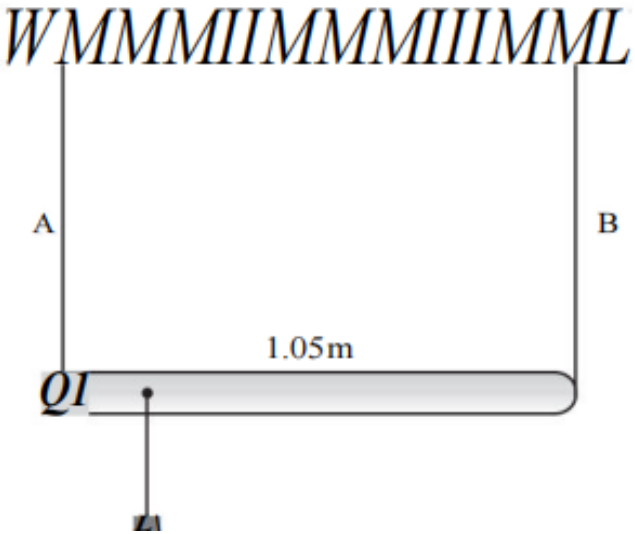
22. A rod of length 1.05 m having negligible mass is supported at its ends by two wires of steel (wire A) and aluminium (wire B) of equal

lengths as shown in Fig. 9.15. The cross-sectional areas of wires A and B are $1.0mm^2$ and $2.0mm^2$, respectively. At what point along the rod should a mass m be suspended in order to produce equal strains in both steel and aluminium wires.:



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23. Two strips of metal are riveted together at their ends by four rivets, each of diameter 6.0 mm. What is the maximum tension that can be exerted by the riveted strip if the shearing stress on the rivet is not to exceed 6.9×10^7 Pa? Assume that each rivet is to carry one quarter of the load.

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24. The Marina trench is located in the Pacific Ocean, and at one place it is nearly eleven km beneath the surface of water. Hie water pressure at the bottom of the trench is about 1.1×10^8 Pa. A steel ball of initial volume $0.32m^3$ 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?

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