



PHYSICS

BOOKS - VGS BRILLIANT PHYSICS (TELUGU ENGLISH)

MECHANICAL PROPERTIES OF SOLIDS

Very Short Answer Questions

1. State Hooke's of elasticity.



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2. State the units and dimensions of stress.



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3. State the units and dimensions of modulus of elasticity



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4. State the units and dimensions of young's modulus.



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5. State the units and dimensions of modulus of rigidity.



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6. State the units and dimensions of Bulk modulus.



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7. State the examples of nearly perfect elastic and plastic bodies.



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Short Answer Questions

1. Define Hooke's law of elasticity, proportionality, permanent set and breaking stress.



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2. Define modulus of elasticity, stress, strain and Poisson's ratio.



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3. Define Young's modulus, Bulk modulus and Shear modulus.



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4. Define stress and explain the types of stress.



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5. Define strain and explain the types of strain.



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6. Define strain energy and derive the equation for the same.



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7. Explain why steel is preferred to copper, brass, aluminium in heavy-duty machines and in structural designs.



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8. Describe the behaviour of a wire under gradually increasing load.



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9. Two identical solid balls, one of ivory and the other of wetter-clay are dropped from the same height on to the floor. Which one will rise to a greater height after striking the floor and why?



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10. While constructing buildings and bridges a pillar with distributed ends is preferred to a pillar with rounded ends Why ?



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11. Explain why the maximum height of a mountain on earth is approximately 10km ?



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12. Define strain energy and derive the equation for the same.



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Long Answer Questions

1. Define Hooke's law of elasticity and describe an experiment to determine the Young's modulus of the material of wire.



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Problems

1. A copper wire of 1mm diameter is stretched by applying a force of 10 N. Find the stress in the wire.



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2. A tungsten wire of length 20cm is stretched by 0.1cm. Find the strain on the wire.



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3. If an iron wire is stretched by 1% , what is the strain on the wire?



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4. A brass wire of diameter 1mm and of length 2m is stretched by applying a force of 20N . If the increase in length is 0.51mm , find i) the stress, ii) the strain and iii) the young's modulus of the wire.



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5. A copper wire and an aluminium wire have lengths in the ratio 3:2, diameters in the ratio 4:3, Forces in the ratio 4:5. Find the ratio of increase in length of the two wires.

$$(Y_{cu} = 1.1 \times 10^{11} N/m^{-2}, Y_{Al} = 0.7 \times 10^{11} Nm^{-2})$$



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6. A brass wire of cross-sectional area $2mm^2$ is suspended from a rigid support and a body of volume $100cm^3$ is attached to its other end. If the decrease in the length of the wire is 0.11mm, when

the body is completely immeresd in water, find the natural length of the wire.

$$(Y_{brass} = 0.91 \times 10^{11} Nm^{-2}, \rho_{water} = kg^{-3}.$$



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7. There are two wires of same material. Their radii and lengths are both in the ratio 1:2. If the extensions produced are equal, what is the ratio of the loads?



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8. Two wires of different material have same lengths and areas of cross-section. What is the ratio of their increase in length when forces applied are the same ?

$$(Y_1 = 0.90 \times 10^{11} Nm^{-2}, Y_2 = 3.60 \times 10^{11} Nm^{-2}.)$$



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9. A metal wire of length 2.5m and area of cross-section $1.5 \times 10^{-6} m^2$ is stretched through 2mm. If its Young's modulus is $1.25 \times 10^{11} Nm^{-2}$, find the tension in the wire.





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10. An aluminium wire and a steel wire of the same length and cross-section are joined end-to-end. The composite wire is hung from a rigid support and a load is suspended from the free end. If the increase in length of the composite wire is 1.35 mm, find the ratio the (i) stress in the two wires and (ii) strain in the two wires.

$$\left(Y_{Al} = 0.7 \times 10^{11} \text{ Nm}^{-2}, Y_{\text{steel}} = 2 \times 10^{11} \text{ Nm}^{-2} \right)$$



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11. A 2 cm cube of some substance has its upper face displaced by 0.15 cm due to a tangential force of 0.3 N. Calculate the rigidity modulus of the substance.



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12. A spherical ball of volume 1000cm^3 is subjected to a pressure of 10 atmospheres. The change in volume is 10^{-8}cm^3 . If the ball is made of iron, find its bulk modulus.

(1 atmosphere = $1 \times 10^5 \text{Nm}^{-2}$).





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13. A copper cube of side of length 1 cm is subjected to a pressure of 100 atmosphere. Find the change in its volume if the bulk modulus of copper is $1.4 \times 10^{11} Nm^{-2}$ ($1 \text{ atm} = 1 \times 10^5 Nm^{-2}$).



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14. Determine the pressure required to reduce the given volume of water by 2%. Bulk modulus of water is $2.2 \times 10^9 Nm^{-2}$



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15. A steel wire of length 20 cm is stretched to increase its length by 0.2 cm. Find the lateral strain in the wire if the Poisson's ratio for steel is 0.19.



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