



# PHYSICS

**BOOKS - JEEVITH PUBLICATIONS**

**PHYSICS (KANNADA ENGLISH)**

**MECHANICAL PROPERTIES OF SOLIDS**

**One Mark Questions And Answers**

1. What is meant by elasticity?



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2. What is the meat by plasticity?



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3. Define stress developed in an elastic material.



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4. Define strain.



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**5. State Hooke's law.**



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**6. What is meant by tensile strength?**



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7. Define young's modulus. Give the expression for young's modulus of elasticity.



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8. Define longitudinal stress.



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9. Define longitudinal strain.



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**10.** Define volumetric strain.



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**11.** Define shearing strain.



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**12.** What is the unit of strain?



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**13. Define compressibility.**



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**14. Mention the S.I., unit of compressibility.**



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**15. What is ductility?**



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**16.** What is malleability?



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**17.** What is elastic limit?



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**18.** Give the relation between  $Y$ ,  $\eta$  and  $\sigma$



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19. Give the relation between  $Y$ ,  $K$  and  $\sigma$ .



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20. Give the relation between  $K$ ,  $\eta$  and  $\sigma$



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21. Give the relation between  $Y$ ,  $K$  and  $\eta$



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22. If  $a$  is the inter atomic spacing and  $Y$  the young's modulus then express atomic force constant in terms  $y$  and  $a$ .



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## Two Marks Questions And Answers

1. Define young's modulus. Give the expression for young's modulus of elasticity.



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2. Define Bulk modulus. Give the expression for Bulk modulus.



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3. Define rigidity modulus. Give the expression for rigidity modulus.



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4. Give the expression for Young's modulus of elasticity pertaining to a stretched wire.



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5. Why elasticity is termed as the internal property of matter?



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6. Which is more elastic between steel and rubber?



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7. Give reasons for the plastic behaviour of a material.



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8. Give the expression for work done per unit volume in stretching a wire.



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9. Distinguish between normal stress and tangential stresses.



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10. Define Poisson's ratio ( $\sigma$ ). What is the range of values of  $\sigma$ ?



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**11.** Express breaking stress in terms of density, maximum length of the wire and acceleration due to gravity.



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## Three Marks Questions And Answers

**1.** State Hooke's law.



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## Numericals With Solutions

1. Calculate the percentage increase in length of a wire of diameter 0.40 mm, stretched by a load of 5 kg. (Given: Young's modulus of elasticity of material of the wire  $12.5 \times 10^{10} Nm^{-2}$ )



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2. What is the density of water at a depth where pressure is 80.0 atm. Given that its

density at the surface is  $1.03 \times 10^3 \text{kgm}^{-3}$ ?

Compressibility of water is  $45.8 \times 10^{-11} \text{Pa}^{-1}$



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3. A glass rod has radius  $0.5 \times 10^{-2} \text{m}$  and is 0.1 m long. If density of glass =  $2190 \text{kgm}^{-3}$ , Young's Modulus  $Y = 6.5 \times 10^{10} \text{Nm}^{-2}$  and breaking stress =  $5 \times 10^7 \text{Nm}^{-2}$ , then find the maximum load that can supported by the hanging glass rod (without breaking the rod).



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4. A wire 4 m long and 0.3 mm in diameter is stretched by a force of 100 N. If extension in the wire is 0.3 mm, then calculate the potential energy stored in the wire.



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5. A steel wire of length 0.20m and uniform cross section  $10^{-6}m^2$  is tied rigidly at both ends. The temperature of the wire is changed from  $40^{\circ}C$  to  $20^{\circ}C$ . Calculate the thermal

tension in the wire given

$$\alpha = 1.1 \times 10^{-5} / .^{\circ} C \quad \text{and}$$

$$Y = 2 \times 10^{11} Nm^{-2}$$



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6. A cube of aluminium of each side 0.10 m is subjected to a tangential force of  $10^6 N$ . If the top surface slides through  $3.0 \times 10^{-4}$  with respect to the bottom face then calculate (i) Shearing strain (ii) shearing stress (iii)

modulus of rigidity (iv) elastic potential energy.



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7. Calculate the increase in energy of a gold bar of length 0.15m, and area of cross section  $15 \times 10^{-4} m^2$  when compressed with a load of 10 kg weight along its length.

Given  $Y = 71 \times 10^9 Nm^{-2}$  and  $g = 9.8ms^{-2}$



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8. Given Young's modulus of elasticity for nickel as  $207 \times 10^9 \text{ Nm}^{-2}$  and Poisson's ratio 0.36 calculate its rigidity modulus and bulk modulus of elasticity.



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9.  $10^{-6} \text{ m}^3$  volume of water is taken from the surface to the bottom of a lake to a depth of 200 m inside the lake. If the bulk modulus of elasticity of water is 220 atm., then what will

be the change in its volume? (Density of water  
 $= 10^3 \text{ kgm}^{-3}$ )



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**10.** A steel pillar of length 1 m has to support a building of 5000 kgwt. If the maximum permissible change in the length of the pillar is 2 mm, then what should be the minimum area of cross -section of the pillar. Given Young's Modulus of steel  $= 2.2 \times 10^{11} \text{ Nm}^2$



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11. A material breaks with a stress  $2.0 \times 10^6 Nm^{-2}$  and density  $2.5 \times 10^3 kgm^{-3}$  breaks under his own weight ( $g = 9.8ms^{-2}$ ).

Calculate its length.



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