Physics assignment (Elasticity)

Two Marks Each

1. What pressure should be applied to a lead block to educe its volume by 10%(Bulk modulus of lead =6 $\times 10^9$ N/m^2) (**6×10^8 N/m^2**)
2. A steel wire of diameter 1 mm and length 2 m is stretched by a force of 2 kg – wt , calculate i) increase in length of wire ,ii) strain . (**12.48 $\times10^{-5}$**)
3. A metallic wire is subjected to a tension of 400 gm Wt. If its diameter is 0.5 mm, find the value of stress exerted upon it. (**19.97 $\times$106 N/m^2**)
4. Calculate the stress applied to the wire having mass per unit length 0.1 gm/cm and density 7 gm /cm^3, when 10 gm Wt is attached to its free end. (**6.86 $\times10^2$ N/m^2**)
5. When a liquid of volume 4 litre is subjected to an additional pressure of 5×10^7 N/m^2, the change in the volume is found to be 4ml, calculate the Bulk modulus of the liquid. (**5×10^{10} N/m^2**)
6. The radius of a copper wire is 4 mm. What force is required to stretch the wire by 20% of its length, assuming that the elastic limit is not exceeded? (**12.06$\times10^5$ N**)
7. The diameter of steel rod is 8 $\times10^{-3}$ m. What force will stretch it by 0.3 % of its length? (**301.44$\times10^3$ N**)
8. A brass wire of radius 1 mm is loaded by a mass of 3.14 kg. What would be the decrease in its radius? (Y =9 $\times10^{10}$ N/m^2, Poisson's ratio σ =0.36) (**3.92 $\times10^{-7}$ m**)
9. A steel of diameter 1 mm and length 2m is stretched by a force of 2 kg wt. Calculate (a) Increase in length of wire (b) Strain (y=10^{10} N/m^2) (**24.97 $\times$10-4**)
10. A steel wire of length 1 m and diameter 0.2 mm is elongated by 1 mm due to a weight of 3.14 kg. Determine Young's modulus of steel wire. (**9.8 $\times10^{11}$ N/m^2**)
11. Determine the pressure required to reduce the given volume o water by 1% (Bulk modulus of water =2 $\times$ 10^8 N/m^2) (**2×10^6 N/m^2**)
12. If a pressure of 8 $\times10^8$ N/m^2 is applied to a lead block so that is volume reduces by 20% , calculate Bulk modulus of lead block . (**4 $\times$ 10^9 N/m^2**)
13. A wire having Young's modulus 1.2 $\times10^{11}$ N/m^2 is subjected to the stress of 2.4 $\times10^7$ N/m^2) If the length of the wire is 10 m, find the extension produced in it. (**2 mm**)
14. Bulk modulus of water is 2.05 $\times10^9$ N/m^2 What change of pressure will compress a given quantity of water by 0.5 %? (**1.025 $\times10^7$N/m^2**)
15. A cube of side 5 cm substance has its upper surface displaced by 0.65 mm by a tangential force of 0.26 N. Calculate the modulus of rigidity of the substance. (**8 $\times$ 10^3 N/m^2**)
16. A 3 m long steel wire is stretched to increase its length by 0.3 cm, poisson's ratio for steel is 0.26. Find the lateral strain produced in the wire. (**0.26 $\times10^{-3}$**)
17. Two wires having same material have radii and lengths in the ratio 1:2 If the extensions produced are equal, what is the ratio of the loads applied? ($\frac{1}{2}$)
18. How much will a steel wire 2 m long and 1 mm diameter stretch under a 5 kg wt load? (**62.42 $\times$ 10^{-5} m**)
19. Stress applied to the wire is equal to its Yong's modulus. Find the change in length of wire in terms of its original length. (**L**)

20. Tangential force of 10^5 N is applied on a surface area $3\times 10^{-6}m^2$which is 10cm from the fixed surface of the body. The force produces of shift of 0.35 mm of the upper surface with respect to the bottom. Calculate the modulus of rigidity of the material.
(**9.524×10^{12} N/m^2**)
21. A write of length 3 m and diameter 1 mm is stretched so that its length increases by 2 mm Find the decrease in the diameter of the wire if poisson's ration for the material of the wire is 0.36. (**0.24×10^{-6} m**)
22. The Bulk modulus of a liquid is 1.25×10^{10} N/m^2 .Calculate the percentage decreases in the volume of the liquid when the pressure is increased by 20 atmospheres. (One atmospheric pressure =10^5 N/m^2) (**0.016)**
23. A wire of mass 'M' density 'o' and 'R' is stretched. If 'r' is the change in its radius and 'l' is the change in its length, the show that Poisson's Ratio **($rM/\pi R^3$ pl)**

24. Two wires of the same material have their lengths in the ratio 3:2, diameters in the ratio 3:2 and stretching forces in the ratio 3:4 Calculate the ratio of their extensions. **($l_1:l_2$ = 1:2)**
25. A wire of length 2 m and diameter 1 mm when stretched by a load of 5.5 kg extends by 1 mm. Calculate Yong's modulus of the material of wire. **(1.373×10^{11} N/m^2)**
26. A steel wire of diameter 1 mm and length 2 m is stretched by applying a force of 2 kg wt. Calculate increase in length of the wire. (g = 9.8m/s^2, Y = 20×10^{10} N/m^2) **(24.97×10^{-5} m.)**
27. A steel wire of diameter 1 mm and length 2 m is stretched by a force of 2 kg wt. calculate i) increase in length of wire ii) Strain. (g = 9.8 m/s^2, Y = 2×10^{11} N/m^2) **(12.48×10^{-5})**
28. Strain energy of the stretched wire is 18×10^{-3} J and strain energy peer unit volume of the same wire under same conditions is 6×10^{-3} J/m^3. Find its volume. **(3 m^3)**
29. A wire of length 5 m and radius 1 mm is stretched by load of 10 N. if Y = 2×10^{11} N/m^2, find the work done per unit volume of the wire. **(25.35 J/m^3)**
30. A wire of length 2 m and radius 0.1 mm stretched by applying a stress of 3×10^7 N/m^2 produces extension of 3×10^{-4} m. Calculate the strain energy in the wire. **(14.13×10^{-5} J)**
31. Find the energy stored per unit volume in copper wire of uniform cross section cross section of length 1.5 m, when it is stretched to a length of 1.51 m by a stress of 3×10^2 N/m^2.**(1 J/m3)**
32. When the load applied to a suspended wire is increased gradually form 3 kg wt to 5 kg wt, the elongation increases from 0.6 mm to 1 mm. How much work is done during this extension of wire? (g = 9.8 m/s^2) **(15.68×10^{-3})**
33. A wire 5 m long and 0.4 mm in diameter is stretched by a load 2kg. If the extension in wire is 3 mm, calculate energy per unit volume. **(46.82×10^3 J/m^3)**
34. When the load suspended from the end of a wire is increased from 2 kg to 7 kg, the extension produced in the wire increases from 0.5 mm to 1 mm. find the work done during extension of the wire. (g = 9.8 m/s^2) **(29.4×10^{-3} Joule)**
35. What mass must be suspended from free end of steel wire of length 2 m and diameter 1 mm to stretch it by 1 mm? (Y = steel = 2×10^{11} N/m^2, g = 9.8 m/s^2) **(8.01 kg)**
36. Calculate the work done in stretching a wire of length 2 m and of diameter 0.8 mm by 2.5 cm. (Y = 2×10^{11} N/m^2) **(15.7 J)**
37. A copper wire is stretched by 1 percent of it's length. Calculate the energy stored per unit volume of the wire. (Y for copper = 1.1×10^{11} N/m^2) **(5.5×10^6 J/m^3)**

38. A steel wire of length 2 m is acted upon by a load of 10 N. Calculate the strain produced in the wire if the energy stored in the wire is 1.1 x 10^{-3} J. **(1.1×10^{-4})**

FOUR MARKS EACH

1. What would be the greatest length of a steel wire which when fixed at one end can hang freely without breading? (Density of steel = 7800 kg/m^3. Breaking stress for steel = 7.8 x 10^8N/m^2) **(1.021×10^4 m)**
2. A cube each side of 5 cm whose upper face is displaced by 0.65 cm due to a force of 0.25 N. Calculate shearing stress, shearing strain and modulus of rigidity. **(769.2 N/m^2)**
3. Two wires have diameters in the ratio 1:2, length in the ratio 3:4 and Young's moduli in the ratio 1:1:5. Calculate the ratio of elongation produced in the wires subjected to the same stretching force. **(4.5/1)**
4. A tangential force of 2100 N is applied on a surface area 3 x 10^{-6} N/m^2 which is 0.1 m from fixed face. The force produces a shift of 7 mm of upper surface with respect to bottom. Calculate modulus of rigidity of the material. **(10^{10} = 10^{10} N/m^2)**
5. A metal plate has the dimensions 10 cm x 10 cm x 1 mm, one of its faces having larger area is 100 cm^2 fixed and a tangential force is applied to the opposite larger face. If the lateral displacement between the two faces is 1.2 x 10^{-3} mm, find the value of shearing strain and the tangential force. (Modulus of rigidity of the metal = 5 x 10^{10} N/m^2) **(6 x 10^5 N)**
6. A metallic wire has strain energy per unit volume equal to 2.5 x 10^{-5} J/m^3. If young's modulus of the material of wire is 20 x 10^9 N/m^2, find the corresponding tensile stress and tensile strain. **(0.5 x 10^{-7})**
7. A copper wire of length 3 m has a diameter 1 mm. If weight of 10 kg is attached to one end of wire, what is the extension produced? Calculate lateral contraction if Poisson's ratio is 0.25. (Y = 12.5 x 10^{10} N/m^2) (**0.24971 $\times 10^{-6}$ m**)
8. An aluminum 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 load is suspended at the free end. If increase in the length of the composite wire is 2.7 mm, find increase in length of each wire. ($Y_A 1 = 7 \times 10^{10}$ N/m^2 , $Y_{steel} = 7 \times 10^{11}$ N/m^2) (**2.4545 mm**)
9. Find the greatest length of a copper wire that can hang vertically without breaking.(Breaking stress for copper =5×10^8 N/m^2 and density of copper =9×10^3 kg /m^3) (**5.668 $\times 10^3$ m**)
10. Two wires of same material are subjected to the same tension Compare the extensions produced if the length of the first wire is double that of the other, while its radius is half that of the other. (**8 : 1**)
11. A wire of length 2.5 m and diameter 0.8 mm is stretched by a load of 10 N .If $Y = 2 \times 10^{11}$ N/m^2,find the work done in stretching the wire. (**1.243 $\times 10^{-3}$**)