Holiday Assignments

Section Name: A/L

Subject: Physics **Grade : 13 E Sci** **Medium:English**

(1) The Young's Modulus of steel is $2 \times 10^{11}\ N\ m^{-2}$. Calculate the force needed to extend the length of a 3.0 m long steel wire by 5 mm (cross section area $= 0.6mm^2$)

(2) The diameter of an elastic wire of length 5.0 m is 1.0 mm. If its length is increased by 0.1% by applying a force, calculate the force. The Young's Modulus of material of the wire is $2 \times 10^{11}\ N\ m^{-2}$.

(3) Calculate the extension and the energy stored when a 8 kg mass is hung from a steel wire of length 4.0m and diameter 2.0 mm. Young Modulus of steel $2 = 10^{11}\ N\ m^{-2}$.

(4) In an experiment to measure Young's Modulus, a 400 g mass is suspended from a wire of length 3.0 m and area of cross section $0.16\ cm^2$. The extension is 0.30 cm. What will be the stress and strain and the Young's Modulus?

(5) A steel column of height 3.0 m and diameter 14 cm supports a mass of 9240 kg. the Young's Modulus of steel is $2 \times 10^{11}\ N\ m^{-2}$). What will be

(a) the stress of the column

(b) the strain of the column

(c) the decrease in length of the column

(6) The internal and external diameters of rubber tube are 0.7 cm and 1.4 cm. A 5 kg mass is attached to the lower end of a rubber tube of length 40 cm hanging vertically. If the Young's Modulus rubber is $5 \times 10^{8}\ N\ m^{-2}$, find the extension of the tube and the energy stored in the tube.

(7) The external and internal diameters of a length 0.40 m are 1.0 cm and 0.40 cm. When a mass of 5 kg is attached to the lower end the tube its length will increase by 0.6 mm. Calculate the Young's Modulus of rubber.

(8) The height of a metal column whose cross section is a square of side 10 cm is 2.5 m. The column fixed vertically at a point where the column does not submerge. The Young's Modulus of the metal is $1 \times 10^{11}\ N\ m^{-2}$. A mass of 1000 kg is placed at the top of the column.

(a) Calculate the compress of the tube.

(b) If a square hole of side 4cm is drilled along the axis of the column, what will be percentage increase of the compression due to the lord?

(9) A mass is hung from the lower end of a uniform wire whose upper end is tied to a fixed point. The strain energy per unit volume of the wire is $2 \times 10^{3}\ J\ m^{-3}$ and the extension per unit length is 2×10^{4}. Calculate

(a) Young's Modulus of the material of the wire and

(b) The stress of the wire.

M.A.Shafi [B.Sc(Hons.)Phy.Sp]

(10) In a catapult with two straps, rubber straps were extended till their lengths are doubled. If the area of the cross section of the rubber straps is $0.4\ mm^2$each and the Young's Modulus of rubber $107\ N\ m^{-2}$,

(a) Calculate the tension in the straps.

(b) If this catapult was used to project an object of mass 5.0 g, calculate the velocity of projection of the object. The initial length of a rubber strap is 0.10 m.

(11) What will be the extension of a steel wire of natural length 5.0 m and diameter 2 mm when a mass of 10 kg is suspended? Young's Modulus of steel is $2\ \times\ 10^{11}\ N\ m^{-2}$.

(12) Two vertical wires of steel and brass each of length 4.0m and area of cross section $4\ \times 10^{-7}\ m^2$ are hung from a ceiling so that the distance between them is 30 cm. The lower ends of the wires are connected to the ends of a light rod of length 30 cm.

(a) Calculate the mass that should be hung from the rod to make each wire to extend by 0.10 cm.

(b) At what distance from the brass wire should the mass be suspended. The Young's Modulus of steel and brass are respectively $2\ \times\ 10^{11}\ N\ m^{-2}$ and $1\ \times\ 10^{11}\ N\ m^{-2}$.

(13) A weight of 20 kg is hung by a 5 m long compound wire made respectively by brass and steel wires each 5.0 m long and joined together at both ends. If the cross sectional area of each wire is $1\ \times\ 10^{-6}\ m^2$, calculate the extension of each wire. (Young's Modulus for steel $=$ $2\ \times\ 10^{10}\ Nm^{-2}$, Young's Modulus for brass $=\ 10\ \times\ 10^{10} Nm^{-2}$)

(14) The unextended length and the area of cross section of a single cord catapult are 10.0 cm and $1.0\ mm^2$. This was extended to 12.0 cm and a 5.0 g object was projected. If Young's Modulus of rubber is $5.0\ \times\ 10^{8}\ N\ m^{-2}$, calculate the velocity of projection

(15) A catapult (an instrument used to project a stone using rubber straps) is constructed using two rubber straps each of length 10.00 cm and area of cross section $0.40\ cm^2$. Assuming that the total energy stored when the straps are extended gets transformed into potential energy of the stone projected by the catapult, calculate the vertical height to which a stone of mass 100 g will rise if each rubber straps was extended by 5.0 cm and released. Young's modulus of rubber is $1\ \times\ 10^{7}\ N\ m^{-2}$ $(5m)$