DPP
DAILY PRACTICE PROBLEMS

CLASS : XIth
DATE :

Solutions

SUBJECT : PHYSICS
DPP NO. : 10

Topic :- MECHANICAL PROPERTIES OF SOLIDS

2 **(a)**

We know that the Poisson's ratio have the theoretical value

$-1 < \sigma < \frac{1}{2}$

But practically the value of σ (Poisson's ratio) is

$0 < \sigma < \frac{1}{2}$

So the Poisson's ratio cannot have the value 0.7.

3 **(b)**

$F = Y \times A \times \frac{l}{L}$

$\Rightarrow F \propto r^2$[$Y$,$l$ and L are constant]

If diameter is made four times then force required will be 16 times, *i.e.*$16 \times 10^3 N$

4 **(d)**

$Y = \frac{Fl}{A\Delta l}$

In the given problem, Y, l and Δl are constants .

$\therefore\ F \propto A$

Or $F = \pi^2$ or $F \propto r^2$ $or \frac{F_1}{F_2} = \frac{r_1^2}{r_2^2} = \frac{1}{4}$

5 **(d)**

According to Boyle's law, $p_2V_2 = p_1V_1$

Or $p_2 = p_1\left(\frac{V_1}{V_2}\right)$

Or $p_1 = 72 \times 1000/900$=80 cm of Hg.

Stress = increase in pressure

= p_2 - $p_1 = 80 - 72 = 8$

= 1066.4 Nm^{-2}

Volumetric strain = $\frac{V_1 - V_2}{V_1} = \frac{1000 - 900}{1000} = 0.1$

6 **(d)**

If side of the cube is L then $V = L^3 \Rightarrow \frac{dV}{V} = 3\frac{dL}{L}$

$\therefore$ % change in volume $= 3 \times$ (% change in length)

$= 3 \times 1\% = 3\%$

$\therefore$ Bulk strain, $\frac{\Delta V}{V} = 0.03$

7 **(c)**

Here, $\Delta l = x; Y = \frac{F/A}{\Delta l/L}$ or $F = \frac{YA\Delta l}{L}$

The work is done from 0 to x (change in length),

So the average distance = $\frac{0 + \Delta l}{2} = \frac{\Delta l}{2}$

Work done = Force $\times$ distance

$= \frac{YA\Delta l}{L} \times \frac{\Delta l}{2} = \frac{YA(\Delta l)^2}{2L} = \frac{YAx^2}{2L}$

8 **(b)**

$U = \frac{1}{2}Fl = \frac{F^2L}{2AY}. U \propto \frac{L}{r^2}$ [F and Y are constant]

$$\therefore \frac{U_A}{U_B} = \left(\frac{L_A}{L_B}\right) \times \left(\frac{r_B}{r_A}\right)^2 = (3) \times \left(\frac{1}{2}\right)^2 = \frac{3}{4}$$

9 **(b)**

Young's modulus of wire does not vary with dimension of wire. It is the property of given material

10 **(a)**

$$Y = \frac{\frac{F}{A}}{\frac{\Delta l}{l}} = \frac{Fl}{A\Delta l}$$

Or $Y = \frac{Fl \times 4}{\pi D^2 \times \Delta l}$ or $\Delta l \propto \frac{1}{D^2}$ or $\frac{\Delta L_2}{\Delta L_1} = \frac{D_1^2}{D_2^2} = \frac{n^2}{1}$

11 **(d)**

$L_2 = l_2(1 + \alpha_2\Delta\theta)$ and $L_1 = l_1(1 + \alpha_1\Delta\theta)$

$\Rightarrow (L_2 - L_1) = (l_2 - l_1) + \Delta\theta(l_2\alpha_2 - l_1\alpha_1)$

Now $(L_2 - L_1) = (l_2 - l_1)$ so, $l_2\alpha_2 - l_1\alpha_1 = 0$

13 **(d)**

$$Y = \frac{Fl}{A\Delta l}$$

Y, l *and* F are constants.

$$\therefore \Delta l \propto \frac{1}{D^2}$$

$$\frac{\Delta l_2}{\Delta l_1} = \frac{D_1^2}{D_2^2} = \frac{1}{16}$$

$$\therefore \Delta l_2 = \frac{1}{16} \text{ mm}$$

14 **(a)**

$l \propto \frac{1}{Y} \Rightarrow \frac{Y_s}{Y_c} = \frac{l_c}{l_s} \Rightarrow \frac{l_c}{l_s} = \frac{2 \times 10^{11}}{1.2 \times 10^{11}} = \frac{5}{3}$ ...(i)

Also $l_c - l_s = 0.5$ ...(ii)

On solving (i) and (ii) $l_c = 1.25 cm$ and $l_s = 0.75\ cm$

15 **(c)**

$k_1 = \dfrac{Y\pi(2R)^2}{L}, k_2 = \dfrac{Y\pi(R)^2}{L}$

Equivalent $\frac{1}{k_1} + \frac{1}{k_2} = \frac{L}{4Y\pi R^2} + \frac{L}{Y\pi R^2}$

Since, $k_1 x_1 = k_2 x_2 = w$

Elastic potential energy of the system

$U = \dfrac{1}{2}k_1 x_1^2 + \dfrac{1}{2}\ k_2 x_2^2$

$U = \dfrac{1}{2}\ k_1\left(\dfrac{w}{k_1}\right)^2 + \dfrac{1}{2}k_2\left(\dfrac{w}{k_2}\right)^2$

$= \frac{1}{2}w^2\left\{\frac{1}{k_1} + \frac{1}{k_2}\right\} = \frac{1}{2}w^2\left(\frac{5L}{4Y\pi R^2}\right)$

$U = \frac{5w^2 L}{8\pi Y R^2}$

16 **(d)**

$A_1 l_1 = A_2 l_2$

$\Rightarrow l_2 = \dfrac{A_2 l_1}{A_1} = \dfrac{A \times l_1}{3A} = \dfrac{l}{3}$

$\Rightarrow \dfrac{l_1}{l_2} = 3$

$\Delta x_1 = \dfrac{F_1}{A\gamma}\ l_1$ ...(i)

$\Delta x_2 = \frac{F_2}{3A\gamma} l_2$ .....(ii)

Here $\Delta x_1 = \Delta x_2$

$\dfrac{F_2}{3A\gamma} l_2 = \dfrac{F_1}{A\gamma} l_1$

$F_2 = 3F_1 \times \dfrac{l_1}{l_2}$

$= 3F_1 \times 3 = 9F$

17 **(c)**

$K = \dfrac{1.5\ \text{N}^2}{30\ \times 10^{-3}} = 50\ \text{Nm}^{-1}$

$l\ = \dfrac{0.2 \times 10}{50}\text{m} = 0.04\ \text{m}$

Energy stored = $\frac{1}{2}\ \times 0.20\ \times 10 \times 0.04\ \text{J} = 0.04\ \text{J}$

18 **(b)**

Young's modulus $= \frac{\text{stress}}{\text{strain}}$

As the length of wire get doubled therefore strain = 1

$\therefore Y = \text{strain} = 20 \times 10^8 N/m^2$

19 **(d)**

$Y = \frac{Fl}{A_\Delta l}$ or $F = \frac{YA\,\Delta l}{l}$

Or $F = \frac{2.2 \times 10^{11} \times 2 \times 10^{-6} \times 0.5 \times 10^{-3}}{2}$

$= 1.1 \times 10^2$N

20 **(b)**

In case of shearing stress there is a change in shape without any change in volume. In case of hydraulic stress there is a change in volume without any change in shape. In case of tensile stress there is no change in volume

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	C	A	B	D	D	D	C	B	B	A
Q.	11	12	13	14	15	16	17	18	19	20
A.	D	A	D	A	C	D	C	B	D	B