DPP
DAILY PRACTICE PROBLEMS

CLASS : XITH
DATE :

Solutions

SUBJECT : PHYSICS
DPP NO. : 2

Topic :- MECHANICAL PROPERTIES OF SOLIDS

2 **(a)**

$L = 1 \text{ m} = 100 \text{ cm}$

$A = 1 \text{ cm}^2$

$Y = 10^{12}$ dyne cm^{-2}

$l = 1 \times 10^{-1}$ cm

Force, $F = \frac{AYl}{L} = \frac{1 \times 10^{12} \times 10^{-1}}{100}$

$= 10^9$ dyne

3 **(a)**

strain $= \frac{r}{l}\phi \; \frac{2 \times 10^{-3}}{1} \times 45° = 0.9$

4 **(c)**

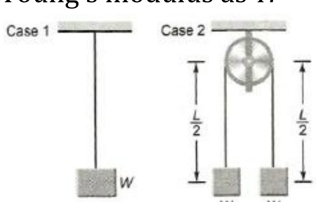
$B = \frac{P}{\Delta V/V}$

$\frac{\Delta V}{V} = \frac{P}{B}$

$= \frac{\rho g h}{B} = 1.36\%$

5 **(a)**

Let us consider the length of wire as L and cross-sectional area A, the material of wire has Young's modulus as Y.



Then for 1st case $Y = \frac{W/A}{l/L}$

For 2$^{\text{nd}}$ case, $Y = \frac{\frac{W}{A}}{\frac{2l'}{L}}$

$\therefore \; l' = \frac{l}{2}$

So, total elongation of both sides $= 2l' = l$

6 **(c)**

The density would increase by 0.1% if the volume decrease by 0.1%

$K = \frac{\Delta p}{\Delta V/V}$

$\Delta V = K\frac{\Delta V}{V} = 2 \times 10^9 \times \frac{0.1}{100} = 2 \times 10^6$ Nm^{-2}

7 **(c)**

$\sigma = \frac{\text{lateral strain}}{\text{longitudinal strain}} \Rightarrow 0.5 = \frac{\text{lateral strain}}{0.03}$

$\Rightarrow$ Lateral strain $= 0.5 \times 0.03 = 0.015$

8 **(d)**

Poisson's ratio varies between -1 and 0.5

9 **(b)**

Young's modulus $Y = \frac{F}{A} \cdot \frac{L}{l}$

$\therefore$ Force $F = \frac{AYl}{L} = \frac{AY[2\pi(R-r)]}{2\pi r}$

$\Longrightarrow F = \frac{AY(R-r)}{r}$

10 **(a)**

$E = \frac{FL}{\pi r^2 \Delta L}$ or $\Delta L = \frac{FL}{\pi r^2 E}$

Clearly, $\Delta L \propto L$

11 **(b)**

$r\theta = L\phi \Rightarrow 10^{-2} \times 0.8 = 2 \times \phi \Rightarrow \phi = 0.004$

12 **(b)**

Angle of shear $\phi = \frac{r}{l}\theta = \frac{0.4}{100} \times 30 = 0.12°$

13 **(d)**

At extension l_1, the stored energy $= \frac{1}{2}Kl_1^2$

At extension l_2, the stored energy $= \frac{1}{2}Kl_2^2$

Work done in increasing its extension from l_1 to l_2

$= \frac{1}{2}K(l_2^2 - l_1^2)$

14 **(d)**

Elastic energy stored in the wire is

$U = \frac{1}{2} \times \text{stress} \times \text{strain} \times \text{volume}$

$= \frac{1}{2} \times \frac{F}{A} \times \frac{\Delta l}{l} \times Al$

$= \frac{1}{2} F\Delta l$

$= \frac{1}{2} \times 200 \times 1 \times 10^{-3} = 0.1$ J

15 **(c)**

$$Y = \frac{F}{\pi r^2} \times \frac{L}{\Delta L} = \frac{F \times 2L}{x(r/2)^2 \, \Delta L} \quad \text{or} \quad \frac{\Delta L}{\Delta L'} = \frac{1}{8}$$

16 **(b)**

$$k = \frac{10 \text{ N}}{40 \times 10^{-3}\text{m}} = \frac{1000}{4} \text{ Nm}^{-1} = 250 \text{ Nm}^{-1}$$

Spring constant of combination

$= \frac{250}{2} \text{ Nm}^{-1} = 125 \text{ Nm}^{-1}$

Energy $= \frac{1}{2} \times 125 \times \left(40 \times 10^{-3}\right)^2 \text{ J} = 0.1 \text{ J}$

17 **(d)**

Coefficient of elasticity in increasing order is given by

Rubber<Glass<Copper<Steel.

18 **(c)**

The Bulk modulus is given by

$$B = -\frac{pV}{\Delta V}$$

If liquid is incompressible, so

$\Delta V = 0$

Hence, $B = -\frac{pV}{0} = \infty \Longrightarrow B = \infty \text{(infinity)}$

19 **(b)**

Because strain is a dimensionless and unitless quantity

20 **(d)**

$$F = \frac{YAl}{L} = \frac{2.2 \times 10^{11} \times 2 \times 10^{-6} \times 5 \times 10^{-4}}{2} = 1.1 \times 10^2 N$$

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