6th ws-5

Foundation T task

①

side $a = 1m$, $m = 3kg$

volume of cube $= a^3 = 1^3 = 1$

density $= \frac{mass}{volume} = \frac{3}{1} = 3 \ kg/m^3$

②

volume $= 25 \ m^3$; density $= 5 \ kg/m^3$.

mass = density × volume

$= 5 \times 25 = 125 \ kg$

③

mass $= 50 \ gm = 50 \times 10^{-3} \ kg$; R.D $= 10$

Relative density $= \frac{\text{density of a body}}{\text{density of water}}$

$\Rightarrow 10 = \frac{d_b}{10^3} \Rightarrow d_b = 10 \times 10^3$

$\Rightarrow d_b = 10^4$

volume $= \frac{m}{d_b} = \frac{50 \times 10^{-3}}{10^4} = 50 \times 10^{-7} \ m^3$

$= 5 \times 10^{-6} \ m^3 = 5 \ cm^3$

(4)

mass = 500 kg ; volume = 0.5 m^3.

$d_w = 10^3$ $\quad d_{body} = \frac{m}{V} = \frac{500}{0.5} = 10^3$ kg/m^3

Relative density $= \frac{d.body}{d water} = \frac{10^3}{10^3} = 1$

(5)

$m_1 = 30$ kg ; $vol_1 = 3 m^3$.

$m_2 = 15$ kg ; $vol_2 = 2\, vol_1 = 2 \times 3 = 6 m^3$.

∴ change in density $= d_2 \sim d_1$

$= \frac{m_2}{vol_2} \sim \frac{m_1}{vol_1}$

$= \frac{15}{6} \sim \frac{30}{3} \Rightarrow \frac{15 \sim 60}{6}$

$= \frac{45}{6} = \frac{15}{2} = 7.5$ kg/m^3

(6)

$m_1 = 5$ kg ; $m_2 = 3$ kg. $\quad$ density = same.

$\frac{V_1}{V_2} = \frac{m_1}{m_2} = \frac{5}{3}$

(7)

$V_1 = 2 m^3$; $V_2 = 4 m^3$ $\quad$ mass = same.

Density $\propto \frac{1}{volume}$

$\Rightarrow \frac{d_1}{d_2} = \frac{V_2}{V_1} = \frac{4}{2} = \frac{2}{1}$

(8)

mass = 100 gm = 10^{-1} kg ; V_b

volume of water displaced = 40 ~ 40 = 20 cm³
= 20×10^{-6} m³

loss of weight of the body = weight of water displaced

⇒ $d_b V_b g = d_w \times V_{liquid\ displaced}\ g$

⇒ m_b = $d_w \times 20 \times 10^{-6}$

⇒ $\frac{10^{-1}}{20} \times 10^6 = d_w$ ⇒ ∴ $d_w = 5 \times 10^3$ gm/cc
= 5 kg/m3

(9)

$m_1 = 1$ kg ; $m_2 = 2$ kg

$R.D = \frac{d_{body}}{d_{water}} = \frac{m_b}{V_b\, d_{water}}$

$\frac{R.D_1}{R.D_2} = \frac{m_{b_1}}{m_{b_2}} = \frac{1}{2}$

(10)

mass = 20 kg . V = 10 m³.

In order to float on water

$d_b = d_w$ R.D. $\frac{d_b}{d_w}$

⇒ ~~$\frac{m_b + m_b}{V} = 10^3$~~ ⇒

⇒ ~~$\frac{20 + m}{10} = 10$~~

(14)

$m_{b_1} = 2\ kg \qquad d_b = 10\ kg/m^3$

$m_{b_2} = 2m_{b_1}, \quad d_b = ? \qquad d \propto m$

$\Rightarrow \dfrac{d_{b_1}}{d_{b_2}} = \dfrac{m_{b_1}}{m_{b_2}}$

$\Rightarrow \dfrac{10}{d_{b_2}} = \dfrac{m_{b_1}}{2m_{b_1}} = \dfrac{1}{2}$

$\Rightarrow d_{b_2} = 2 \times 10 = 20\ kg/m^3$

(15)

$vol_1 = 2m^3 \qquad d_1 = 5\ kg/m^3$

$V_2 = 1m^3 \qquad d_2 = ?$

$d \propto \dfrac{1}{V} \Rightarrow \dfrac{d_1}{d_2} = \dfrac{V_2}{V_1} \Rightarrow \dfrac{5}{d_2} = \dfrac{1}{2}$

$\Rightarrow d_2 = 10\ kg/m^3$.

(16)

$m_1 = 5\ kg; \quad V = 2\ m^3$

$d_{sphere} = \dfrac{m}{V} = \dfrac{5}{2} = 2.5\ kg/m^3$

(17)

$m = 20\ gm \quad ; \quad vol = 4cm^3 \quad ; \quad d_w = 1\ gm/cc$

$R.d = \dfrac{d_b}{d_w} = \dfrac{\frac{m}{V}}{d_w} = \dfrac{\frac{20}{4}}{1} = 5 \qquad \dfrac{m}{V\,d_w}$

$R.d < 1 \qquad \Rightarrow d_b < d_w$

volume of body = $\dfrac{m}{d_w} \neq \dfrac{m_b}{R.1}$

Here $R.d < 1$ If we take V value as 25 $R.d = \dfrac{20}{25 \times 1} = \dfrac{4}{5} < 1$

(18)

Side = 0.5 m   m = 2 kg

$$density = \frac{m}{vol} = \frac{2m}{(side)^3}$$

$$= \frac{2}{(0.5)^3} = \frac{2}{125 \times 10^{-3}} = \frac{2 \times 10^{3}}{125}$$

$$= 2 \times \frac{1000}{125} = 16 \ kg/m^3$$

(19)

density = 20 kg/m3

volume = 4 m^3

∴ mass = density × volume = 20 × 4 = 80 kg

L Task

SAQ's

(1)

vol = 3 m^3 ;   mass = 30 kg

$$density = \frac{m}{V} = \frac{30}{3} = 10 \ kg/m^3$$

(2)

m = 400 kg;   vol = 2 m^3 ; d_w = 1000 kg/m^3

$$d_b = \frac{m}{V} = \frac{400}{2} = 200$$

$$R.d = \frac{d_{body}}{d_w} = \frac{200}{1000}$$

R.d = 0.2

(3)

$vol = 10\ cm^3$; $d = 2\ gm/cm^3$

$mass = d \times vol = 2 \times 10 = 20\ gm$

(4)

$m_{cube} = 2\ kg$; $m_{cuboid} = 5\ kg$

∴ we know density ∝ mass

$$\Rightarrow \frac{d_{cube}}{d_{cuboid}} = \frac{m_{cube}}{m_{cuboid}} = \frac{2}{5}$$

(5)

$V_1 = 6\ cm^3$; $V_2 = 9 cm^3$

$$\text{Relative density} = \frac{d_{body}}{d_{water}} = \frac{\frac{m_{body}}{Vol_{body}}}{d_{water}}$$

$$\frac{R.D_1}{R.D_2} = \frac{V_2}{V_1} = \frac{9}{6} = \frac{3}{2}$$

(6)

$mass = 300\ kg$; $R.d = 0.03$; $d_w = 10^3\ kg/m^3$

$$\text{Relative density} = \frac{m_{body}}{V_{body} \times d_{water}}$$

$$V_{body} = \frac{m_{body}}{R.D \times d_w} = \frac{300}{0.03 \times 10^3} = 10\ kg$$

(7)

l = 5m ; r = 1m , density = ? mass = 20 kg.

volume of cylinder = $\pi r^2 h$

$= \frac{22}{7} \times 1^2 \times 5$

$= \frac{110}{7}$

density = $\frac{\text{mass}}{\text{volume}} = \frac{20}{\frac{110}{7}} = \frac{2 \times 7}{11} = \frac{14}{11}$

= 1.27 kg/m3

(8)

l = 5m ; r -

vol_{liquid} = 125 cm^3 m_l = 250 gm

$m_{empty\ beaker}$ = 100 gm. $\therefore m_{liquid} + m_{empty\ beaker}$ = 250 gm

$\Rightarrow m_{liquid}$ = 250 − $m_{empty\ beaker}$

= 250 − 100 = 150 gm

density of liquid = $\frac{m_{liquid}}{vol} = \frac{150}{125} = \frac{30}{25} = \frac{6}{5}$ = 1.2 cm^3

(9)

m = 0.2 gm ; vol = 2 cm^3 ; d_w = 1 gm/cc

if the brick sink in water $d_b > d_w$

$d_b = \frac{m}{vol} = \frac{0.2}{2}$ = 0.1 gm/cc < d_w so if the volume of body < it's original volume then $d_b > d_w$

For V = 0.02   we will get $d_b = \frac{0.2}{0.02}$ = 10 > d_w

(12)

$d_{cube} = 0.8$ kg/m³ ; $m = 10$ kg

If the cube wants to sink in water

$d_b > d_w$.

we know $d_w = 1$ gm/cc $= 10^3$ kg/m³

∴ $d_b = 2000$ kg/m³ then only it can sink in water.

(13)

$l \times b \times h = 4cm \times 1cm \times 5cm$; $m = 50$ gm.

$= 20 \times cm^3$; $d_w = 1$ gm/cc

Relative density $= \frac{m_b}{vol_b \times d_w} = \frac{50}{20 \times 1} = 2.5$ gm/cc.

(14)

$m = 10$ gm ; vol $= 20$ cm³ , $d_w = 1$ gm/cc

Relative density $= \frac{m_b}{vol_b \times d_w} = \frac{10}{20 \times 1} = \frac{1}{2} = 0.5$

(15)

$d = 50$ kg/m³ ; volume $= 5$ m³

mass $= d \times vol = 50 \times 5 = 250$ kg

(16)

$m = 20$ kg ; vol $= 10$ m³ density $= \frac{m}{V} = \frac{20}{10} = 2$ kg/m³

(17)

$m = 1$ kg ; $d = 2$ kg/m³ volume $= \frac{m}{density} = \frac{1}{2} = 0.5$

$= 5 \times 10^{-1}$ m³

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