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Properties of fluids

(i) Density or mass density (ρ) :

$$\rho = \frac{Mass\ of\ fluid}{Volume\ of\ fluid}$$

- Density of water is 1 gm/cm^3 or 1000 Kg/m^3

(ii) Specific weight or weight density:

$$w = \frac{weight\ of\ fluid}{volume\ of\ fluid}$$

$$w = \frac{Mass\ of\ fluid \times Acceleration\ due\ to\ gravity}{Volume\ of\ fluid}$$

$$w = \frac{Mass\ of\ fluid \times g}{volume\ of\ fluid}$$

$$w = \rho \times g$$

- A commonly used value is the specific weight of water on Earth at 4°C, which is 9.807 kN/m^3

(iii) Specific volume :

$$v = \frac{Volume\ of\ fluid}{Mass\ of\ fuild}$$

$$v = \frac{1}{\rho}$$

- Unit of specific volume is m^3/kg

(iv) Specific gravity (relative density):

- Specific gravity is defined as the ratio of the density of a fluid to density of a standard fluid.
- For liquids ,the standard fluid is taken water and for gases the standard fluid is taken air.
- It is dimensionless quantity and is denoted by the symbol s.

$$S\ (for\ liquids) = \frac{density\ of\ liquid}{(density)of\ water}$$

$$S\ (for\ gases) = \frac{(density)of\ gas}{(density\ )\ of\ air}$$

(s of mercury = 13.6)

Question :

10 m^3 of mercury weight 136 × 10^4 N. calculate its specific weight ,mass density, specific volume and specific gravity.

(i) Specific weight = $\frac{weight}{volume}$ (volume = $10m^3$, weight = 136×10^4)

$$= \frac{136 \times 10^4}{10}$$

$$= 136000 N/m^3$$

(ii) Mass density $(\rho) = \frac{w}{g}$

$$= \frac{136000}{9.81}$$

$$= 13863.40 \text{ kg/ m 3}$$

(iii) Specific volume $= \frac{1}{\rho}$

$$= \frac{1}{13863.4}$$

$$= 72.13 \times 10^{-6} \ m^3/kg$$

(iv) Specific gravity = $\frac{Desity\ of\ mercury}{Density\ of\ water}$ = $\frac{13863.4}{1000}$ = 13.86

THANKYOU