GRAVITATION DENSITY

Density

Density of a substance is defined as its mass per unit volume.

density(d) = $\frac{Mass(m)}{Volume(V)}$

Unit of density

Since mass (M) is measured in kilogram (kg) and the volume (V) is measured in metre³(m³), the unit of density is kg/m³. In cgs system, the unit of density is g cm⁻³. These units are related as : $1 \text{ g cm}^{-3} = 1000 \text{ kgm}^{-3}$.

Pressure in fluids

A substance which can flow is called a fluid. All liquids and gases are thus fluids. We know that a solid exerts pressure on a surface due to its weight. Similarly, a fluid exerts pressure on the container in which it is contained due to its weight. However, unlike a solid, a fluid exerts pressure in all directions. A fluid contained in a vessel exerts pressure at all points of the vessel and in all directions. All the streams of water reach almost the same distance in the air.



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In an enclosed fluid, if pressure is changed in any part of the fluid, then this change of pressure is transmitted undiminished to all the other parts of the fluid.

Relative density

Relative density (R.D.) of a substance is the ratio of the density of the substance to the density of water at 4°C.

Thus,

Relative density = $\frac{Density \ of \ subs \tan ce}{Density \ of \ water \ at \ 4^{\circ}C}$

Unit of Relative Density Since relative density is a ratio of two similar quantities, it has no unit. Further,

relative density = $\frac{Density \ of \ subs \tan ce}{density \ of \ water \ at \ 4^{\circ}C}$

 $= \frac{mass \ of \ subs \tan ce \ / \ volume \ of \ subs \tan ce}{mass \ of \ water \ / \ volume \ of \ water \ 4^{\circ}C}$

If the volume of a given substance is equal to the volume of water at 4°C,

relative density = $\frac{mass \ of \ subs \tan ce}{mass \ of \ equal \ volume \ of \ water \ 4^{\circ}C}$

Relative density can also be defined as the ratio between the mass of the substance and the mass of an equal volume of water at 4° C.

Relative Density for solids

$$R.D = \frac{W_1}{W_1 - W_2}$$

Where

 W_1 = weight of solid body in air

 W_2 = weight of solid body in water

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Relative Density for liquids

$$R.D = \frac{W - W"}{W - W'}$$

Where

W' = weight of the body fully immersed in water

W" = weight of the body fully immersed in liquid.

W = weight of the body in air