

HW

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Physical Quantities and Measurement

Home Assignment

1. The mass of a density bottle is 35g when empty, 65g when filled with water, and 59g when filled with alcohol. Find the relative density of alcohol.

Ans - When it is filled with alcohol = 59g
Mass of Alcohol = $59 - 35 = 24\text{g}$

$$\text{Density of Alcohol} = \frac{\text{Mass}}{\text{Volume of Bottle}} = \frac{24}{30} = 0.8$$

Relative:

$$\text{R.N} = \frac{\text{Density of alcohol}}{\text{Density of water}} = 0.8$$

Let V be the volume of bottle whose mass is 35gm

When filled with water the bottle
 $m_w = 65 - 35 = 30\text{gm}$

$$\begin{aligned} \text{Density of water} &= \frac{m_w}{V} = 1 \\ &= \frac{30}{V} = 1 \\ &= \frac{V}{30} = V \end{aligned}$$

2. What is a density bottle? How is it used to find the density of a liquid?

Ans- Density bottle is a small glass bottle having a glass stopper at its neck. The bottle can store a fixed volume of a liquid. Generally the volume of bottles is 25 ml or 50 ml. Stopper has a narrow hole through it. When bottle is filled with liquid and stopper is inserted, THE EXCESS LIQUID RISES THROUGH THE HOLE and drains out. Thus the bottle will contain the same of liquid each time when it is filled. It is used to determine the density of a liquid.

3) Distinguish between density and relative density.

Ans- Density
i) Mass per unit volume of a substance is called density.

ii) $\text{Density} = \frac{\text{Mass}}{\text{Volume}}$

Relative Density
i) The ratio between density of a substance and density of water is called relative density.

ii) $\text{Relative Density} = \frac{\text{Density of the substance}}{\text{Density of water at } 4^\circ\text{C}}$

(ii) SI unit of density is Kg/m^3 & CGS unit of density is g/cm^3 .

(iii) Units: ~~Relative~~ Relative density has no units because it is the ratio between the similar physical quantities (density)

4) Explain the meaning of the statement 'Relative density of aluminium is 2:7.'

Ans- The statement 'Relative density of aluminium is 2:7' means.

A piece of aluminium of any volume has mass 2:7 times that of equal volume of water.

i.e. Aluminium is 2:7 times heavier than water.

5) The mass of an empty density bottle is 21.8 g, when filled completely with water it is 41.8 g and when filled completely with liquid it is 40.6 g. Find

a) The volume of density bottle.

~~Ans~~ Volume of water = 20 g = 20 cm³

Ans Density of water is 1 g cm^3

\therefore Volume of density bottle = weight of water in grams completely filling the bottle.

Volume of density bottle:

Mass of empty density bottle =

$$M_1 = 21.8 \text{ g}$$

Mass of bottle + water = M_2 41.8 g

\therefore Mass of water completely filled in the density bottle

$$M_2 - M_1$$

$$= 41.8 - 21.8$$

$$= 20 \text{ g}$$

But 1 g of water has volume = 1 cc

\therefore Volume of bottle (density bottle) = volume of water = 20 c.c. = 20 ml

b) The relative density of liquid
 Ans- The relative density of liquid:
 Mass of 20c.c. of liquid = (mass of density bottle + mass of 20c.c. of liquid - mass of density bottle)
 $= 40.6 - 21.8$
 $= 18.8g$

Mass of 20c.c. of water = 20g
 Relative density of liquid

$$R.D = \frac{\text{Mass of 20c.c. of liquid}}{\text{Mass of 20c.c. of water}} = \frac{18.8}{20}$$

$$= \frac{1.88}{2} = 0.94$$

c) From the following observations calculate the density and relative of a brine solution.

a) Mass of empty density bottle = 22g

b) Mass of bottle + water = 50g

c) Mass of bottle + brine solution = 54g

Ans- Mass of empty bottle, $M_1 = 22g$

Mass of bottle + water, $M_2 = 50g$

Mass of bottle + brine solution, $M_3 = 54g$

Mass of water = $M_2 - M_1 = 50 - 22 = 28g$

Mass of brine solution = $M_3 - M_1 = 54 - 22 = 32g$

Density of brine solution = $\frac{\text{Mass of brine solution}}{\text{Mass of water}}$

$\frac{32}{28} = 1.14$
 $(= 1.14 \text{ g/cm}^3)$

Mass of 200 cc of water = 200g
 Relative density of liquid

$\frac{220}{200} = 1.1$
 $\frac{\text{Mass of 200 cc of liquid}}{\text{Mass of 200 cc of water}} = 1.1$

(a) From the following observations calculate the density and relative density of a brine solution.
 (i) Mass of empty bottle = 28g
 (ii) Mass of bottle + water = 50g
 (iii) Mass of bottle + brine solution = 52g
 (iv) Mass of empty bottle = 28g
 (v) Mass of bottle + water = 50g
 (vi) Mass of bottle + brine solution = 52g
 (vii) Mass of water = 50g - 28g = 22g
 (viii) Mass of brine solution = 52g - 28g = 24g
 (ix) Relative density = $\frac{24}{22} = 1.09$