ch-2 Physical Quantities and Measurement

Date
Page

A1 a) False
b) False
c) True
d) True
e) False
f) False
g) True
h) False
i) True
j) True

2a) 1 kg is the mass of 1000 ml of water at 4°C.
b) Mass = Density x volume.
c) The S.I. unit of density is $kg\,m^{-3}$.
d) Density of water is 1000 $kg\,m^{-3}$.
e) $1g\,cm^{-3}$ = 1000 $kg\,m^{-3}$.
f) The density of a body which sinks in water is more than 1000 $kg\,m^{-3}$.
g) A body sinks in a liquid A, but floats in a liquid B. The density of liquid A is less than the density of liquid B.
h) A body X sinks in water, but a body Y floats on water. The density of the body X is more than the density of body Y.
i) The buoyant force experienced by a body when floating in salt-water is equal to that when

floating in pure water.

(i) The weight of a body floating in a liquid is zero.

3. Match the following

Column A	Column B
a) Kg m^{-3}	i) Relative density
b) No unit	ii) Sinks in alcohol
c) Relative density	iii) floats on water
d) Iron	iv) density
e) Wood	v) density bottle

4. Select the correct alternative:

a) The correct relation is

Ans- ii) Mass = Density × Volume

b) The relative density of alcohol is 0.8. Its density is

Ans - ii) 800 kg m^{-3}

c) A block of wood of density 0.8 g cm^{-3} has a volume of 60 cm^3. The mass of block is

Ans-ii) 48g

d) The density of alluminium is 2.7g cm^{-3} and that of brass 8.4g cm^{-3}. The correct statement is -

Ans - ii) The mass of a certain volume of brass is more than the mass of equal volume of alluminium.

e) A density bottle has a marking 25 ml on it. It means that:

Ans. ii) The density bottle will store 25ml of any liquid in it.

f) The correct statement is:

Ans - iii) The buoyant force on a body is equal to the weight of the liquid displaced by it.

g) - A piece of wood floats on water. The buoyant force on wood will be:

Ans - iii) Equal to the weight of the wood piece.

h) The weight of a body is more than the buoyant force experienced by it, due to a liquid. The body will:

Ans - i) Sink

B.) SHORT/LONG ANSWER QUESTION

1. Ans - The density of a substance is defined as the mass of a unit volume of that substance.

2. Ans - The S.I. unit of density is $1Kg\ m^{-3}$ and the C.G.S unit is $g\ cm^{-3}$.

$1g\ cm^{-3} = 1000Kg\ m^{-3}$

3. Ans - When we say density of brass is $8.4 g/cm^3$. It means that $1 cm^3$ of brass has a mass of 8.4g.

4. Ans - Cork < Water < Iron < Brass < Mercury

5. Ans - As the temperature increases, volume of most of the liquid also increased and when the volume increases density decreases.

(6.) Ans- a) mass - Doesn't change
b) Volume - Changes and increases with rise in temperature.
c) Density - Changes and decreases

(7.) Ans- $\text{Density} = \frac{\text{Mass}}{\text{Volume}}$

(8.) To Find the density of the material of a coin, we need to Find its mass by common beam balance and its volume by measuring cylinder.

To measure the mass of a coin

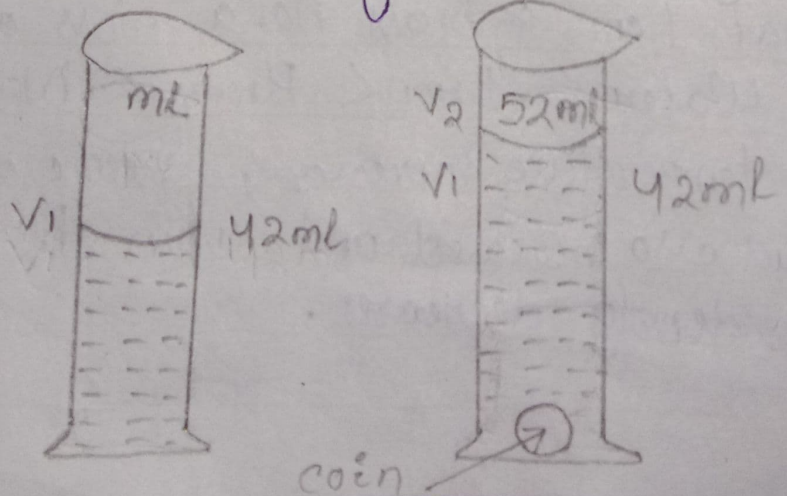
Let the mass of a coin shown by a beam balance = M (gram) = 50g (May)

To measure the volume of coin

Initial volume of water = $V_1 = 42mL$

Final volume of water, When a coin is added in the cylinder = $V_2 = 52mL$

Then volume of coin = $V_2 - V_1 = 52 - 42 = 10m$



(8) To determine the density of milk.

1. Take a beaker. Measure the mass of the empty beaker using a common beam balance. Let the mass be M_1 gram.
2. Now take a measuring cylinder and pour milk into to a certain level say 50mL. Thus, volume of milk $V = 50\,mL$ or $50\,cm^3$.
3. Transfer the milk into the empty beaker. Measure its mass again. Let the mass of beaker with milk be M_2 gram.
4. Find the difference $M_2 - M_1$ which give the mass M of the milk. Thus, mass of the milk $M = (M_2 - M_1)$ gram. Let $M = 51.5$ gram.
5. Calculate the density of milk using the following formula:

$$\text{Density} = \frac{\text{Mass}}{\text{volume}} = \frac{M}{V}$$

$$= \frac{51.5\,g}{50\,cm^3} = 1.03\,g\,cm^{-3}.$$

(9). A density bottle is a specially designed bottle which is used to determine the density of a liquid.

To determine the density of a liquid using the density bottle, we have to measure the mass of liquid and mass of water taken in it by using the common

balance, the mass of water in the density bottle gives the volume of liquid.

(10) ans- The relative density of a substance is defined as the ratio of the density of the substance to the density of water.

(11) ans- Relative density is just a number. It has no unit. It is a dimensionless quantity. It is a ratio of same quantities.

(12) ans-

Density	Relative density
* It is defined as mass per unit volume.	* It is defined as the ratio of density of the substance to density of water at 4°.
* Its volume is different in different systems of measurement.	* Its value is the same all systems of measurement.
* Its units are $g\ cm^{-3}$ and $kg\ m^{-3}$.	* It has no units.

(13) ans- Relative density of aluminium is 2.7, means that a piece of aluminium of any volume has mass 2.7 times that of an equal volume of water.

(14) ans- If the density of a body is less than the density of liquid, the body will float on the surface of the liquid. Whereas if the density of a body is more than the density of liquid the body will sink in liquid.

(15) ans - If we place a piece of cork and an iron nail on the surface of water, we notice that the cork floats while the nail sinks. This is because the density of cork is less than the density of water, while the density of iron (of which the nail is made up of) is more than the density of water.

(16) ans - b) Body B having density 25 kg m^{-3} (c) Body C having density 1100 kg m^{-3} (sink)

a) Body A having density 500 kg m^{-3} (d) Body D having density 0.85 g cm^{-3} (float)

(17) ans - When a body floats in a liquid, the weight of the liquid displaced by its immersed part is equal to the total weight of the body. This is the law of floatation.

(18) ans - a) A piece of Iron sink in water.
b) A piece of Iron float in mercury.

(19) a) ans - Same in each
b) ans - A
c) ans - C

(20) ans - Weight of the liquid displaced by its immersed part is equal to the total weight of the body when a body floats in a liquid.

(21) ans - The reason is that the density of ice is 0.9 g cm^{-3} (or 900 kg m^{-3}) while the density of water is

$1\,g\,cm^{-3}$ (or $1000\,kg\,m^{-3}$). Hence, the weight of water displaced by $\frac{9}{10}$th part of ice immersed inside water becomes equal to the total weight of the ice piece.

(22) ans- A nail made of iron sinks of water, but a ship made of iron does not. The reason is that a nail is solid and the density of iron is greater than that of water. The weight of the nail is more than the buoyant force of water on it. So the nail sinks in water. On the other hand, the ship is hollow and its empty space contains air. This makes the average density of ship less than that of water. Therefore, a ship floats on water.

(23) ans- It is easier for a person to swim in sea water than in river water. The reason is that sea water contains salt and so its density is more that the density of river water. The weight of a man gets balanced by the less immersed part of his body in sea water as compared to that in river water. Thus, it is easier to swim in sea water than in river water.

(24) Ans- Icebergs are dangerous for ships. The reason is that the density of ice is less than the density of sea water. The density of ice is $0.9\ g\ cm^{-3}$ and the density of sea water is $1.02\ g\ cm^{-3}$. Hence, an iceberg floats in sea water with its large portion submerged inside the water and only a little portion of it is above the surface of water. Thus, a ship can collide with the invisible part of iceberg under the surface of water. Hence, it is dangerous for ships.

(25) Ans- In water, the stone experiences a buoyant force which counter balances the weight of the stone acting downward and this makes the stone lighter and thus easier to lift the stone in water.

(26) Ans- Submarine is a water-tight boat which can travel under water like a ship. A submarine is provided with water tanks. To make the submarine dive, the tanks are filled with water so that the average density of the submarine becomes greater than the density of sea water and it sinks. To make the submarine rise to the surface of water, these tanks are emptied. This submarine less than the density of sea water, so the submarine rises up to the surface of water.

(7) Ans- A hydrogen or helium filled balloon rises in air. The reason is that the density of these gases is less than the density of air. Therefore, the buoyant force experienced by the balloon due to air, becomes greater than the weight of the balloon. Hence, the balloon rises up under the influence of the net upward force.

(C) Numericals:

(1) a) $1 g/l = 0.001 g/cm^3$

$1.28 g/l = 1.28 \times 0.001$

$= 0.00218 \ kg/m^3$

b) $1 g/l = 1 kg/m^3$

$= 1.28 g/l = 1.28 \times 1$

$= 1.28 \ kg/m^3$

(2) Dimensions of a hall,

volume $= 10m \times 7m \times 5m$

$= 350 m^3$

Density of air $= 1.11 \ kg/m^3$

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

Mass of air in the hall = Density × Volume

$= 350 \times 1.11$

$= 388.5 \ kg$

③. Density of Aluminium = $2.7 g/cm^3$

$1 kg/cm^3 = 1000 kg/m^3$

$2.7 g/cm^3 = 2.7 \times 1000$

$= 2700.0$

$= 2700 kg/m^3$

④. Density of alcohol = $600 kg/m^3$

$1 kg/m^3 = \frac{1}{1000} g/cm^3$

$600 kg/m^3 = \frac{600}{1000} g/cm^3$

$= 0.6 g/cm^3$

⑤. For a piece of zinc,

Mass = 438.6 g

volume = $86 cm^3$

Density = $\frac{\text{Mass}}{\text{volume}} = \frac{438.6}{86}$

$= 5.1 g/cm^3$

⑥. For a piece of wood,

Mass = 150 g

volume = $200 cm^3$

a) Density = $\frac{\text{Mass}}{\text{volume}}$

$= \frac{150}{200} = 0.75 g/cm^3$

b) $1 g/cm^3 = 1000 kg/m^3$

$0.75 g/cm^3 = 0.75 \times 1000$

$= 750 kg/m^3$

(7). For a wood,

Mass = 6000 kg

Density = $0.8 g/cm^3$

$1 kg/cm^3 = 1000 kg/m^3$

$0.8 g/cm^3 = 0.8 \times 1000$

$= 8000$

$= 800 kg/m^3$

$$\text{Density} = \frac{\text{Mass}}{\text{volume}}$$

$$\text{volume} = \frac{\text{mass}}{\text{Density}}$$

$$= \frac{6000 kg}{800 kg/m^3}$$

$= 7.5 m^3$

(8) For a solid,

Mass = 72g

Initial volume = (V_1) = 24 ml

Final volume = (V_2) = 42ml

Density = $\frac{\text{mass}}{\text{volume}}$

$= \frac{\text{Mass}}{V_2 - V_1}$

$= \frac{72}{42-24} = \frac{72}{18} = 4 g/cm^3$

(9) Mass of an empty density bottle = 21.8g (M_1)

Mass of bottle filled with water = 41.8g (M_2)

Mass of bottle filled with liquid = 40.6g (M_3)

a) Mass of water in bottle

$= M_2 - M_1 = 41.8 - 21.8 = 20g$

Density of water = $1 g/cm^3$

Density = $\frac{\text{Mass}}{\text{volume}}$

Volume = $\frac{\text{Mass}}{\text{density}} = \frac{20}{1} = 20 cm^3 = 20ml$.

b) Mass of liquid in bottle = $M_3 - M_1$

$= 40.6 - 21.8$

$= 18.8g$

Density = $\frac{\text{Mass}}{\text{volume}}$

$= \frac{18.8}{20} = 0.94 g/cm^3$.

Relative Density of liquid

$= \frac{\text{Density of liquid}}{\text{Density of water}}$

$= \frac{0.94}{1} = 0.94$

10) Mass of empty density bottle = 22g (M_1)

Mass of bottle + water = 50g (M_2)

Mass of bottle + Brine solution = 54g/cm³

b) Relative density of brine solution

$= \frac{\text{Mass of brine solution}}{\text{mass of equal volume of water.}}$

$= \frac{M_3 - M_1}{M_2 - M_1}$

$= \frac{54 - 22}{50 - 22}$

$= \frac{32}{28} = 1.14$

a) Relative density = $\frac{\text{Density of brine solution}}{\text{Density of water}}$

Density of Brine solution

= Density of water × Relative density of Brine soln

= $1 g/cm^3 \times 1.14$

= $1.14 g/cm^3$

ii) Mass of empty density bottle = 30g

Mass of bottle filled with water = 75g

Mass of bottle filled with liquid = 65g

a) Mass of water in bottle

= 75 - 30

= 45g

Density of water = $1 g/cm^3$

So, Volume of density bottle is 45 ml

b) Density of liquid = $\frac{\text{Mass of liquid}}{\text{Volume}}$

= $\frac{65 - 30}{45}$

= $\frac{35}{45}$ = $0.77 g/cm^3$

C) Relative density of liquid = $\frac{\text{Density of liquid}}{\text{Density of water}}$

$= \frac{0.77\,g/cm^3}{1\,g/cm^3}$

$= 0.77$