A. Multiple Choice Question:

1. The correct relation is:

A. Density = Mass x Volume

B. Mass = Density x Volume

C. Volume = Density x Mass

D. Density = Mass + Volume

Answer: Mass = Density x Volume

Reason — The density of a substance is its mass per unit volume.

2. The relative density of alcohol is 0.8. Its density is:

A. 0.8

B. 800 kg m^{-3}

C. 800 g cm^{-3}

D. 0.8 kg m^{-3}

Answer: 800 kg m^{-3}

Reason:

Relative density of alcohol= $\frac{\text{Density of alcohol}}{\text{Density of water}}$

0.8 = $\frac{\text{Density of alcohol}}{1000\ \text{kg m}-3}$

Density of alcohol= $0.8 \times 1000 = 800\ \text{kg m}^{-3}$

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

A. 60.8 g

B. 75 g

C. 48 g

D. 0.013 g

Answer : 48 g

Reason:

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

0. 8 = $\frac{\text{Mass}}{60}$

Density = 0.8 × 60 = 4.8g

4. The density of aluminium is 2.7 g cm^{-3} and that of brass is 8.4 g cm^{-3}. The correct statement is:

A. Equal masses of aluminum and brass have equal volumes.

B. The mass of a certain volume of brass is more than the mass of an equal volume of aluminum.

C. The volume of a certain mass of brass is more than the volume of equal mass of aluminum.

D. Equal volumes of aluminum and brass have equal masses.

Answer: The mass of a certain volume of brass is more than the mass of an equal volume of aluminum.

Reason:

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

So mass of certain volume of brass will be more than the mass of same volume of aluminium as density of brass is more than density of aluminium.

5. The correct statement is:

A. The buoyant force on a body is equal to the volume of the liquid displaced by it.

B. The buoyant force on a body is equal to the volume of the body.

C. The buoyant force on a body is equal to the weight of the liquid displaced by it.

D. The buoyant force on a body is always equal to the weight of the body.

Answer: The buoyant force on a body is equal to the weight of the liquid displaced by it.

Reason — According to the Principle of Floatation, the buoyant force is equal to the weight of the liquid displaced by the immersed part of the body.

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

A. sink

B. float with its some part outside the liquid.

C. floats just below the surface of a liquid.

D. floats with whole of its volume above the surface of a liquid.

Answer: sink

Reason — According to the Principle of Floatation, if the weight of the body is more than the buoyant force acting on the body the body will sink into the liquid.

7. The density of mercury is 13.6 gcm^{-3} in CGS system. Its density in SI system is :

A. 136 Kgm^{-3}
B. 1360 Kgm^{-3}
C. 13600 Kgm^{-3}
D. no change in density

Ans: (c)13600 Kgm^{-3}

8. When the air cools, its density :

A. **i**ncreases
B. decreases
C. does not change
D. none of these

Ans: (b) decreases

9. In coastal regions the density of air above the sea, during the night is :

A. more than that of land air
B. less than that of land air
C. same as that of land air
D. none of these

Ans: (b) less than that of land air

10. One liter is equivalent to:

a) 1000 cubic meters b) 100 cubic centimeters

c) 1000 cubic centimeters d) 100 cubic meters

Answer: c) 1000 cubic centimeters

Section B

C. Short Answer Questions:

Q1. Define the term density of a substance.

Answer: The density of a substance is its mass per unit volume i.e.

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

Q2. Name the S.I. unit of density. How is it related to g cm^{-3}.

Answer The S.I. unit of density is kg m^{-3} (kilogram per cubic metre).

1 g cm^{-3} = 1000 kg m^{-3}

Q3. The density of brass is 8.4 g cm^{-3}. What do you mean by this statement?

Answer: The statement means one cubic centimeter volume of brass has mass of 8.4 g.

Q4. Arrange the following substances in order of their increasing density:

Iron, Cork, Brass, Water, Mercury.

Answer: Cork < Water < Iron < Brass < Mercury.

The density of cork is the least and that of mercury is the most.

Q5. How does the density of a liquid (or gas) vary with temperature?

Answer: When temperature increases, the volume of most of the liquid increases, so density decreases. Similarly, when temperature decreases, the volume of liquids decreases so density increases. But the exception is water which contracts on heating from 0°C to 4°C and expands on heating above 4°C. Water has a maximum density of 4 degree Celsius.

Q6. A given quantity of a liquid is heated. Which of the following quantity will vary and how?

(a) mass
(b) volume
(c) density

Answer:

(a) Mass of the liquid remains unaffected on heating.

(b) Volume of the liquid increases with increase in temperature.

(c) Density of liquid decreases on heating because its volume increases and density is inversely proportional to volume.

Q7. Define the term relative density of a substance.

Answer: The relative density of a substance is defined as the ratio of the density of a substance to the density of water. The symbol used for relative density is R.D. Thus,

$$\text{R.D.} = \frac{\text{Density of Substance}}{\text{Density of Water}}$$

Q8. What is the unit of relative density?

Answer: Relative density has no unit because it is the ratio of two densities.

Q9. Distinguish between density and relative density.

Answer:

Sl. No.	Density	Relative Density
(i)	Density of a substance is defined as the mass of a unit volume of that substance.	The relative density of a substance is defined as the ratio of the density of a substance to the density of water.
(ii)	Units are kg m^{-3}, g cm^{-3}.	Relative Density has no units.

Q10. Explain the meaning of the statement 'Relative density of aluminium is 2.7.

Answer: Relative density of aluminium is 2.7 means a piece of aluminium of any volume has a mass 2.7 times that of an equal volume of water.

Q11. State the law of floatation.

Answer: The law of floatation states that — "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".

i.e., while floating

Weight of the floating body = Weight of the liquid displaced by its immersed part (i.e., buoyant force)

Q12. Why does a piece of ice float on water?

Answer: The density of ice is 0.9 g cm^{-3} and the density of water is 1.0 g cm^{-3}. Since density of ice is less than density of water, so ice floats on water.

Section C

Q13. How does the density of a liquid change with the rise in temperature?

Answer: On cooling a substance like liquid causes molecules to slow down and get slightly closer together, occupying a smaller volume that results in an increase in density. Therefore, with rise in temperature, the density decreases.

Q14. How is land breeze formed? Explain.

Answer: During night, the land gets cooled down quicker as compared to the sea. The air above the sea is thus hotter than the air above the land. This air rises up and is replaced from the relatively cooler air from the land in the form of Land breeze.

Q15. How is sea breeze formed? Explain.

Answer: The warm air expands due to lesser density, decreasing the pressure over the land near the coast. In comparison to the air above the land, the air above the sea has a relatively higher pressure, causing air to flow from the high pressure towards the lower pressure resulting in a sea breeze.

Q16. Describe a comparison of densities in the three states of matter.

Answer: The same number of particles in a gas spread further apart than in the liquid or solid states, thus the density is higher in case of solid than that of in the liquid and the least is in the gas. Increasing order of density of three states of matters is as follows: Gas < Liquid < Solid

---

Section D

Q1. Calculate the volume of wood of mass 6000 kg if the density of wood is 0.8 g cm^{-3}.

Answer:

Density of wood = 0.8 g cm^{-3} or 800 kg m^{-3}

Mass of wood = 6000 kg

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

Volume of Wood = $\frac{\text{Mass of Wood}}{Density\ of\ Wood}$= $\frac{6000}{800}$ =7.5 m^3

So, Volume of wood = 7.5 m^3.

Q2. Calculate the density of a solid from the following data:

(a) Mass of solid = 72 g

(b) Initial volume of water in measuring cylinder = 24 mL

(c) Final volume of water when solid is completely immersed in water = 42 mL

Answer:

Mass of solid = 72 g

Volume of solid = Final volume of water - Initial volume of water

Volume of solid = 42 - 24 = 18 mL

Density of Solid = $\frac{\text{Mass of Solid}}{Volume\ of\ Solid}$ = $\frac{72}{18}$ = 4

So, the Density of solid = 4.0 g cm^{-3}.

Q3. 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 the density bottle.

(b) the relative density of the liquid.

Answer:

Mass of empty density bottle (M_1) = 21.8 g

Mass of bottle with water (M_2) = 41.8 g

Mass of bottle with liquid (M_3)= 40.6 g

(a) Mass of water in bottle = M_2 - M_1 = 41.8 - 21.8 = 20 g

Density of water is 1 g cm^{-3}, so volume of density bottle = 20 mL

(b) Mass of liquid in bottle = M_3 - M_1 = 40.6 - 21.8 = 18.8 g

R.D. of liquid= $\frac{\text{Mass of Liquid}}{Mass\ of\ eq.vol.of\ water}$ = $\frac{18.8}{20}$ = 0.94

Relative density of liquid = 0.94.

Q4. From the following observations, calculate the density and relative density of a brine solution.

Mass of empty density bottle = 22 g

Mass of bottle + water = 50 g

Mass of bottle + brine solution = 54 g

Answer:

Mass of empty density bottle (M_1) = 22 g

Mass of bottle + water (M_2) = 50 g

Mass of bottle + brine solution (M_3) = 54 g

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

Density of water is 1 g cm^{-3}, so volume of density bottle = 28 cm^3.

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

Density of brine soln.= $\frac{\text{Mass of brine solution}}{Vol\ of\ brine\ solution}$ = .= $\frac{32}{28}$ = 1.14 g cm−3

So, density of brine solution = 1.14 g cm^{-3}.

R.D. of brine soln .= $\frac{\text{Mass of brine solution}}{Mass\ of\ equivalent\ Volume\ of\ water}$ = $\frac{32}{28}$ = 1.14

So, Relative density of brine solution is 1.14.

Q5. A piece of wood of mass 150 g has a volume of 200 cm^3 . Find the density of wood in

(a) CGS System

(b) SI System

Answer:

(a) Mass of wood (M) = 150 g
Volume of wood (V) = 200 cm^3
Density (D) =?

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

(b) In S.I. system = 0.75 × 1000 = 750 kg/ m^3

Q6. 5 litres of kerosene oil is found to weigh 4.40 kg. Find the density of kerosene oil in

(a) CGS System

(b) SI System

Answer:

(a) CGS system;

Step 1:Given data;

The volume of kerosene oil V = 5l

Mass of kerosene m = 4.40 kg = 4.4 × $10^3 g$

Step 2: formula used;

$Density\ of the\ kerosene\ oil = \frac{Mass\ of\ Kerosene\ oil}{Volume\ of\ Kerosene\ oil}$

Step 3: finding the value of density;

Substitute the given value in the above equation,

1$litre$ = 1000 cm^3

So, 5$litre$ = 5×$10^3 cm^3$

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

$Density$ = 4.40× $10^3 g$ / 5 × $10^3 cm^3$ = 0.88gcm^{-3}

Hence, the density of kerosene oil in the CGS system is 0.88gcm^{-3}

(b) In the SI system;

Step 1:Given data;

The volume of kerosene oil V = 5l

Mass of kerosene m = 4.40kg

Step 2: formula used;

$Density\ of\ the\ kerosene\ oil = \frac{Mass\ of\ Kerosene\ oil}{Volume\ of\ Kerosene\ Oil}$

Step 3: Finding the density of kerosene;

Substitute the given value in the above equation,

1$litre$ = $10^{-3} m^3$

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

$Density$ = 4.40kg / 5×10^{-3}m^3

= 0.88 ×10^3kgm^{-3} = 880kgm^{-3}

So the density of kerosene oil in the SI system = 880kgm^{-3}

Hence, the density in the SI system is 880kgm^{-3}