Physical Quantities and Measurement.

Chapter — 2

Q.1) Define the term density of a substance.

⇒ The density of a substance is its mass per unit volume i.e,

$$\text{Density of a substance} = \frac{\text{Mass of the substance}}{\text{Volume of the substance}}$$

Q.2) Name the S.I. unit of density. How is it related to $g\ cm^{-3}$?

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

$$1\ kg\ m^{-3} = 10^{-3}\ g\ cm^{-3}$$

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

⇒ This statement means when the volume of brass is $1\ cm^3$, its mass is 8.4 g.

Q.4) Arrange the following substances in order of their increased density:
Iron, cork, Brass, water, Mercury.

⇒ Cork, water, Iron, Brass, Mercury.

Q.5) How does the density of a liquid (or gas) vary with temperature?

⇒ With increase in temperature, the volume of liquid (or gas) increases, and as a result their density decreases and with the decrease

in temperature, their density increases.

Q.6) A given quantity of a liquid is heated. Which of the following quantity will vary and how?

a) mass b) volume or c) density.

⇒ a) The mass remains unchanged.
b) With increase in temperature, the volume of the liquid increases.
c) Density of liquid decreases with increase in temperature.

Q.7) Describe an experiment to determine the density of the material of a coin.

⇒ Activity 1 or activity 2 of pg-22. (along with figure)

Q.8) Describe an experiment to determine the density of a liquid.

⇒ Activity 3 of pg- No.- 23

Q.9) What is a density bottle? How is it used to find the density of a liquid?

⇒ Density bottle is a specially designed bottle which is used to determine the density of a liquid. It is a small glass bottle having a glass stopper at its neck.

To determine the density of a liquid using density bottle, we have to measure the mass of the 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. Then we shall find the density by dividing mass of the liquid by volume.

Q.10) Define the term relative density of a substance.

⇒ Relative density of a substance is defined as the ratio of density of the substance to the density of water.

$$R.D = \frac{\text{Density of the substance}}{\text{Density of water}}$$

Q.11) What is the unit of relative density?

⇒ Relative density is just a number and has no unit. It is a dimentionless quantity and a ratio of same quantities.

Q.12) Distinguish between density and relative density.

⇒

Density	Relative Density
i) Density is the mass per unit volume of a substance.	i) Relative density is the ratio of density of the substance to the density of water.
ii) Its S.I. unit is kg/m^3.	ii) It has no unit.

Q.13) Explain the meaning of the statement 'Relative density of aluminium is 2.7'.

⇒ This statement means that a piece of aluminium of any volume has mass 2.7 times that of equal volume of water.

Q. 14) How does the density of a body and that of a liquid determine whether the body will float or sink into that liquid?

⇒ A body of density greater than the density of liquid sinks inside the liquid, while a body of density equal or less than the density of liquid, floats on the liquid.

Q. 15) A cork piece floats on water surface while an iron nail sinks in it. Explain the reason.

⇒ A small piece of cork will float on water because the density of cork is less than the density of water, whereas an iron nail will sink in water because the density of iron nail is more than the density of water.

Q. 16) Which of the following will sink or float on water? Density of water = 1 g cm^{-3})
a) Body A having density 500 kg m^{-3}
b) Body B having density 2520 kg m^{-3}.
c) Body C having density 1100 kg m^{-3}.
d) Body D having density 0.85 g cm^{-3}.

⇒ Density of water = 1 g cm^{-3} = 1000 kg m^{-3}.
Thus body B and C sinks and body A and D (density 0.85 g cm^{-3} = 850 kg m^{-3}) will float.

Q. 17) State the law of floatation.

⇒ 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.

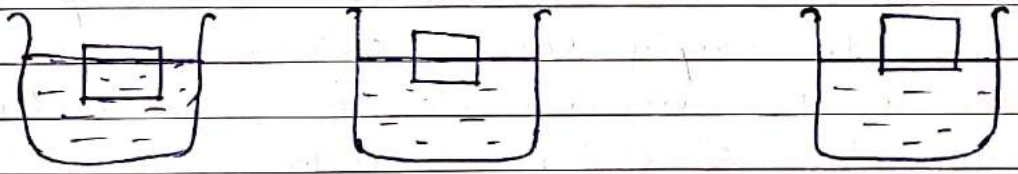
Q.18) The density of water is $1.0\ g\,cm^{-3}$. The density of iron is $7.8\ g\,cm^{-3}$. The density of mercury is $13.6\ g\,cm^{-3}$. Answer the following:

a) Will a piece of iron float or sink in water?
b) Will a piece of iron float or sink in mercury?

⇒ a) A piece of iron (more density) will sink in water.
b) A piece of iron will float in mercury (more density)

Q.19) The diagram shows a body floating in three different liquids A, B and C at different levels.

a) In which liquid does the body experience the greatest buoyant force?
b) Which liquid has the least density?
c) Which liquid has the highest density?



⇒ a) Liquid C c) Liquid C
b) Liquid A

Q.20) For a floating body, how is its weight related to the buoyant force?

⇒ If the weight of the floating body is more than the buoyant force, the body sinks where as if the weight is less than buoyant force, the body floats.

Q.21) Why does a piece of ice float on water?

⇒ A piece of ice, floats on water with its 9/10th part inside the water and only 1/10th part of

it outside the water. 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 9/10 th part of ice immersed inside water becomes equal to the total weight of the ice piece.

Q. 22) Explain why an iron needle sinks in water, but a ship made of iron floats on water.

⇒ The reason is that a nail is solid and the density of iron ($7.8\ g\ cm^{-3}$) is greater than water ($1\ g\ cm^{-3}$). The weight of the nail is greater than the buoyant force of water on it. So the nail sinks in water.

On the other hand, the ship is hollow and the empty space contains air. This makes the average density of ship less than that of water. Therefore a ship floats on water.

Q. 23) It is easier to swim in sea water than in river water. Explain the reason.

⇒ The reason is that sea water contains salt and so its density ($1.02\ g\ cm^{-3}$) is more than the density of river water ($1\ g\ cm^{-3}$). 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.

Q. 24) Icebergs floating on sea water are dangerous for ships. Explain the reason.

⇒ 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.

Q.25) Explain why is it easier to lift a stone under water than in air.

⇒ In water, the stone experiences a buoyant force which counterbalance the weight of stone acting downwards and this makes the stone lighter.

Q.26) What is a submarine? How can it be made to dive in water and come to the surface of water?

⇒ A 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 water and it sinks. To make the submarine rise to the surface of water, these tanks are emptied. This makes the average density of the submarine less than the density of sea water, so the submarine rises up to the surface of water.

Q.27.) A balloon filled with hydrogen rises in air. Explain the reason.

⇒ A hydrogen filled balloon rises in air. The reason is that the density of this gas 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.

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