

3. Will it significantly change the density of solids or liquids?

KEY TERMS



- **Mixture:** It is made by combining two or more substances, where each retains its properties
- **Solution:** A uniform mixture of two or more substances
- **Concentration:** Amount of solute present in a fixed quantity of solution (or solvent)
- **Solubility:** The maximum amount of solute that can dissolve in a fixed amount of solvent at a given temperature
- **Pressure:** The force applied per unit area on a surface
- **Relative density:** The ratio of the density of a substance to the density of water at the same temperature
- **Float:** When an object stays on the surface of a liquid, usually because it is less dense than the liquid
- **Sink:** When an object goes to the bottom of a liquid, usually because it is denser than the liquid
- **Dissolved oxygen:** Oxygen gas that mixes uniformly in water and helps support aquatic life
- **Mass:** Amount of matter present in an object (measured in grams or kilograms)
- **Digital weighing balance:** A device used to measure the mass of objects accurately
- **Weight:** The force with which the Earth attracts an object towards itself (measured in newtons)
- **Meniscus:** The curved surface of a liquid in a measuring cylinder
- **Crust (Earth):** The outermost and least dense layer of the Earth
- **Expansion:** Increase in volume of a substance

TEXT BOOK ANSWERS

Objective Type Questions

1. Name the following:

- (a) Solvent (b) Solution (c) Solubility (d) Density
(e) Mass (f) Volume (g) Meniscus

2. Fill in the following blanks with suitable words:

- (a) immersed, rise (b) solute, solvent
(c) decreases (d) saturated

3. State whether the following statements are true or false:

- (a) False (b) False (c) False
(d) False (e) True

Subjective Type Questions

Short Answer Type Questions

1. A solution is a homogeneous mixture formed by dissolving a solute in a solvent.

Examples: Salt in water, sugar in water, air.

2. Solute: The substance that is dissolved in a solution. Solvent: The substance in which the solute dissolves.

Example: In salt solution, salt is the solute and water is the solvent.

3. Saturated solution: A solution in which no more solute can dissolve at a given temperature.

Unsaturated solution: A solution in which more solute can still dissolve at a given temperature.

4. The solubility of a substance mainly depends on temperature.

5. $\text{Density} = \text{Mass} \div \text{Volume}$
 $= 225 \text{ g} \div 90 \text{ cm}^3$
 $= 2.5 \text{ g/cm}^3$

Since the density of stone (2.5 g/cm^3) is greater than the density of water (1 g/cm^3), the stone will sink in water.

6. The density of a substance depends on temperature and pressure. On heating, a substance expands, its volume increases while mass remains the same, so its density decreases. On cooling, the volume decreases and the density increases. Pressure also affects density, especially in gases, where an increase in pressure decreases volume and increases density.

7. First, we have to convert litres to millilitres:

$$2 \text{ litres} = 2 \times 1000 \text{ mL} = 2000 \text{ mL.}$$

The bottle can hold 2000 mL in total. We have already poured 500 mL. Amount of water the bottle can still hold

$$= \text{Total Volume} - \text{Poured Volume}$$

$$= 2000 \text{ mL} - 500 \text{ mL}$$

$$= 1500 \text{ mL.}$$

The bottle can hold 1500 mL more water (or 1.5 Litres).

8. $\text{Density} = \text{Mass} \div \text{Volume}$
 $= 400 \text{ g} \div 40 \text{ cm}^3$
 $= 10 \text{ g/cm}^3$

9. The unpeeled orange floats because its peel is full of tiny air pockets. This trapped air increases the orange's total volume significantly without adding much mass. This makes the overall density of the unpeeled orange less than the density of water, causing it to float.

When you peel the orange, we remove the peel and all the trapped air. The remaining orange flesh is denser than water, so it sinks.

10. The relative density of a substance is the ratio of its density to that of water.

As relative density is a ratio of two similar quantities, it has no units. Thus, relative density is a pure number.

11. Add salt to the water and stir it well to make a salt solution. The salt increases the density of water, and when the density of water becomes greater than that of the egg, the egg will float.

Long Answer Type Questions

1. A solution is a homogeneous mixture of a solute dissolved in a solvent. Solutions can be saturated or unsaturated based on the amount of solute they contain.

Saturated Solution: A solution is said to be saturated when it contains the maximum amount of solute that can dissolve in a given amount of solvent at a particular temperature. No more solute can dissolve in it.

Example: If you keep adding sugar to water and keep stirring, at a certain point, no more sugar will dissolve, and it will settle at the bottom. The water at this stage is a saturated sugar solution.

Unsaturated Solution: A solution is unsaturated if it contains less solute than the maximum amount that can dissolve in the solvent at a given temperature. More solute can still be dissolved.

Example: If you add 2 teaspoons of sugar to a glass of water and all of it dissolves easily, the solution is unsaturated, because more sugar can still dissolve.

2. Activity to show that solubility of solids increases with rise in temperature:

Materials:

Glass beaker, water, baking soda, laboratory thermometer, heat source, stirring rod

Procedure:

- Half-fill a glass beaker with water and measure its temperature using a laboratory thermometer. Let it be 25°C .
- Add baking soda to the water and stir continuously. Keep adding until some baking soda settles at the bottom. The solution is now saturated at 25°C .
- Heat the solution gradually to 50°C while stirring. You will notice that the undissolved baking soda dissolves in water. Keep adding more baking soda until no more dissolves at this temperature.
- Further heat the solution to 70°C with continuous stirring. The remaining undissolved baking soda dissolves again, showing that water at 70°C can dissolve more baking soda than at 50°C .

Observation:

The amount of baking soda that can dissolve increases with rise in temperature.

Conclusion:

This activity demonstrates that the solubility of solids increases as the temperature of the solvent rises.

3. (a) Icebergs float on water because the density of ice is less than the density of water. The density of ice is about 0.9 g/cm^3 , which is lower than water's density of 1.02 g/cm^3 . Since less dense substances float on denser substances, icebergs float on water, with a small part above the surface and the rest submerged.

(b) Formula:

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

Rearranging to find volume:

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

Substitute the values:

$$\text{Volume} = 600 / 7.9$$

$$\text{Volume of the iron block} \approx 76\text{ cm}^3$$

4. The volume of a metal key can be measured using the displacement method:

Materials: A measuring cylinder, water, metal key.

Procedure:

- Take a measuring cylinder and fill it with some water. Note the initial water level (say V_1).
- Carefully drop the metal key into the water. Ensure it is fully submerged.

- Note the new water level (V_2) after the key is immersed.
- The volume of the metal key is equal to the increase in water level:
- Volume of key = $V_2 - V_1$

This method works because the key displaces an amount of water equal to its own volume.

Multiple Choice Questions (MCQ)

1. (b) water is denser than oil
2. (c) no more solute can be dissolved into the saturated solution at that temperature
3. (d) both a and b
4. (b) concentrated solution
5. (d) decrease
6. (d) log of wood and block of ice
7. (c) kg/m^3
8. (a) meniscus
9. (d) hot air is lighter
10. (b) beam balance
11. (a) unitless
12. (d) oxygen
13. (b) mL
14. (b) The pebble must be submerged in water



21st Century Skills

1. (a) Ice floats because its density (0.9 g/cm^3) is less than that of water (1.02 g/cm^3). Less dense substances float on denser substances.
 - (b) If ice were denser than water, it would sink instead of floating, covering the bottom of lakes and rivers. This would freeze aquatic habitats, making it difficult for fish and other aquatic organisms to survive in winter.
 - (c) When ice melts, it converts to water of the same mass, and since the ice had displaced its own weight in water, the water level remains the same i.e., as the ice contracts on melting, the volume of water produced is equal to the volume of water the ice displaced while floating,
2. (a) Hot air inside the balloon is less dense than the cooler air outside. Being less dense than surrounding air, the balloon rises.
 - (b) If the air inside cools down, it becomes denser, reducing the balloon's buoyancy. As a result, the balloon will start to descend.
3. (a) Solubility of solids increases with temperature, so sugar dissolves faster in hot tea than in cold tea.
 - (b) When the solution contains the maximum amount of sugar it can dissolve at that temperature, no more sugar dissolves. This condition is called a saturated solution.