9 The Amazing World of Solutes, Solvents, and Solutions

Fill in the Blanks

1. The volume of a solid can be measured by the method of _____, where the solid is immersed in water and the rise in water level is measured.
2. The maximum amount of solute dissolved in solvent at a particular temperature is called _____.
3. Generally, the density decreases with increase in _____.
4. A solution in which no more solute can dissolve at a given temperature is called a _____ solution.
5. The amount of matter present in an object is called its _____.
6. The space occupied by an object is called its _____.
7. A mixture of gases like air is a _____.
8. The _____ of ice is less than that of water; hence, ice floats.

True or False

1. Oxygen gas is more soluble in hot water than cold water. _____
2. A mixture of sand and water is a solution. _____
3. The amount of space occupied by an object is called its mass. _____
4. An unsaturated solution has more solute dissolved than a saturated solution. _____
5. The mixture of gases in the atmosphere is also a solution. _____

Multiple Choice Questions (MCQs)

1. The substance that dissolves in a solvent is called:

a) Solvent b) Solution c) Solute d) Concentrate

2. Air is a:

a) Compound b) Solution c) Element d) Suspension

3. Which of the following increases solubility of solids?

a) Increasing temperature b) Decreasing temperature c) Shaking d) Cooling

4. The unit of density in SI is:

a) kg/m^3 b) g/cm^3 c) g/mL d) m^3/kg

5. The solution that cannot dissolve any more solute is:

a) Saturated solution b) Unsaturated solution c) Concentrated solution d) Dilute solution

6. Ice floats on water because:

a) It is less dense b) It is heavier c) It melts d) It expands

7. Density = ?

a) Volume / Mass b) Mass / Volume c) Force / Area d) None

8. Solubility of gases in liquids _____ with increase in temperature.

a) Decreases b) Increases c) Remains same d) Doubles

9. A 1 L bottle has 500 mL of water. It can hold _____ more water.

a) 500 mL b) 1 L c) 250 mL d) 750 mL

10. Which property helps explain floating or sinking?

a) Density b) Mass c) Volume d) Pressure

Short Answer Questions

1. Define solute, solvent, and solution with examples.

_____

_____

2. Differentiate between saturated and unsaturated solutions.

_____

_____

3. What happens to solubility of a solid when temperature increases?

_____

_____

4. Why does ice float on water?

_____

_____

5. What is density and its formula?

_____

_____

6. What happens to density when temperature increases?

_____

_____

7. What does it mean when oil floats on water?

_____

_____

Long Answer Questions

1. Explain the effect of temperature on solubility of solids and gases.

Ans:

_____

_____

_____

_____

2. Describe the steps to measure the density of an irregular solid.

Ans:

_____

_____

_____

_____

3. What is relative density? How is it useful?

Ans:

_____

_____

_____

_____

Answers

Fill in the Blanks

1. displacement
2. solubility.
3. temperature.
4. saturated
5. mass.
6. volume.
7. solution.
8. density

True or False

1. **False** It is more soluble in cold water.
2. **False** It is a non-uniform mixture.
3. **False** It is called volume.
4. **False** A saturated solution has more solute.
5. **True**

Multiple Choice Questions (MCQs)

1. c) Solute
2. b) Solution
3. a) Increasing temperatureg
4. a) kg/m³
5. a) Saturated solution
6. a) It is less dense
7. b) Mass / Volume
8. a) Decreases
9. a) 500 mL
10. a) Density

Short Answer Questions

1. Define solute, solvent, and solution with examples.

→ Solute: The substance that dissolves.

Solvent: The substance in which the solute dissolves.

Solution: Uniform mixture (e.g., Salt + Water → Salt solution).

2. Differentiate between saturated and unsaturated solutions.

→ Saturated solution cannot dissolve any more solute; extra solute settles at the bottom. While unsaturated solution can still dissolve more solute at same temperature.

3. What happens to solubility of a solid when temperature increases?

→ When the temperature increases, the particles of the solvent gets more energy and moves faster to break the bonds between the solute particles. Therefore, solubility of a solid increases when temperature increases.

4. Why does ice float on water?

→ Ice has lower density than liquid water. Thus it floats on water.

5. What is density and its formula?

→ Density is the amount of mass contained in a unit volume of a substance. It tells us how tightly the particles of a substance are packed together. Density = Mass ÷ Volume.

6. What happens to density when temperature increases?

→ As temperature increases, the density of a substance generally decreases because its volume increases while mass remains constant.

7. What does it mean when oil floats on water?

→ When oil floats on water, it means that oil is less dense than water.

Long Answer Questions

1. Explain the effect of temperature on solubility of solids and gases.

Ans:

- For most solids: Solubility increases with temperature.
- For gases: Solubility decreases with temperature.
- Example: Oxygen dissolves more in cold water than warm water.

2. Describe the steps to measure the density of an irregular solid.

Ans:

- Measure its mass using a balance.
- Measure volume by water displacement method.
- Use formula Density = Mass / Volume.

3. What is relative density? How is it useful?

Ans:

- Ratio of density of a substance to density of water.
- Helps predict floating and sinking.
- Explain why hot air balloons rise.
- Heated air expands, becomes less dense, and rises above cooler air.

Chapter Notes

The world around us is full of mixtures — from the air we breathe to the juice we drink. Some mixtures are uniform like saltwater, while others, such as sand and water, are not. In this chapter, we explore **how solutes dissolve in solvents** to form solutions, the **factors affecting solubility**, and how density determines whether **things float or sink**. Students also learn to **measure mass, volume, and density** and understand how **temperature and pressure influence** these properties.

9.1 What Are Solute, Solvent, and Solution?

- A solution is a uniform mixture of two or more substances.
- The solute is the substance that dissolves.
- The solvent is the substance that dissolves the solute.
- Example: Salt (solute) + Water (solvent) → Salt solution.
- Air is a gaseous solution where nitrogen is the solvent and other gases are solutes.

9.2 Solubility and Types of Solutions

- The maximum amount of solute that dissolves in a fixed amount of solvent is called solubility.
- Unsaturated solution: More solute can be dissolved.
- Saturated solution: No more solute can dissolve.
- Concentration describes how much solute is present.
- Dilute solution: Less solute.
- Concentrated solution: More solute.

9.2.1 Effect of Temperature on Solubility

- For most solids, solubility increases with temperature.
- For gases, solubility decreases with temperature.
- Example: Hot water dissolves more sugar but less oxygen.

9.3 Solubility of Gases

- Oxygen dissolves slightly in water.
- Dissolved oxygen supports aquatic life.
- Cold water holds more oxygen than warm water.

9.4 Why Do Objects Float or Sink?

- Whether an object floats or sinks depends on its density.
- Less dense than water → floats
- More dense than water → sinks

9.5 Density

- Density = Mass / Volume
- Units: SI unit: kg/m^3