WATER
SOLVED QUESTIONS

1. Give two examples of : (i) Underground water (ii) Surface water.

   Ans.

   (i) Underground water — Well water, spring water.

   (ii) Surface water — River and lake water

2. Briefly describe the water cycle in nature.

   Ans.

   An enormous amount of water evaporates in the air and rises up. In the upper regions of the atmosphere, water vapour condenses to form clouds. The clouds cause rain. Some rainwater flows over the earth's surface in the form of streams, rivers and sea. Some amount of rainwater collects within the earth. Thus, the balance of water on the earth is maintained due to the water cycle.

3. State five physical properties of water.

   Ans.

   (i) Water is colourless and odourless.

   (ii) Freezing point of water is 0°C and its boiling point is 100°C

   (iii) Specific heat of water is very high.

   (iv) Density of water is 1 g/cc at 4°C.

   (v) Water can dissolve a large number of substances. It is a good solvent.

4. (i) What is potable water?

   (ii) Why is distilled water not potable?

   (iii) State three chief qualities of potable water.

   Ans.

   (i) The water which is fit for human consumption is called potable water.

   (ii) Distilled water is not potable because it will dissolve essential salts present in our body. It may lead to the deficiency of vital salts which in turn can make us sick.

   (iii) The three chief qualities of potable water are—

   (a) It must be clear, colourless and odourless.

   (b) It must be free from harmful bacteria and suspended impurities.

   (c) It must contain small amount of mineral salts.

5. What do you understand by the following terms?
   (i) Soft water
   (ii) Hard water
   (iii) Temporary hard water
   (iv) Permanent hard water

   Ans.
   (i) Soft water — A sample of ground water which freely lathers with soap solution is called soft water.
   (ii) Hard water — A sample of ground water, which instead of freely forming lather with soap solution, forms sticky scum (or precipitate), is called hard water.
   (iii) Temporary hard water — A sample of ground water which ordinarily forms scum with soap solution, but on boiling and then treating with soap solution produces lather, is called temporary hard water.
   (iv) Permanent hard water — A sample of ground water which on boiling and then treating with soap solution does not lather but forms scum, is called permanent hard water.

6. Name two chemicals which are responsible for temporary hardness of water.
   Ans. Calcium hydrogen carbonate ($Ca(HCO_3)_2$) and magnesium hydrogen carbonate [$Mg(HCO_3)_2$].
7. (a) Name two gases which are commonly found in natural water.
   (b) State the importance of each gas named by you in (a) in nature.
   Ans.
   (a) The gases dissolved in natural water are oxygen and carbon dioxide.
   (b) Importance of dissolved oxygen in water :
      1. Water animals survive on account of dissolved oxygen in water. They remove oxygen from water with the help of their gills and use it for respiration.
      2. Dissolved oxygen kills germs and bacteria in water, and hence, keeps it fresh.

   Importance of dissolved carbon dioxide in water :
      1. It dissolves limestone to form calcium bicarbonate, which is used by shell bearing water animals to form hard shells.
      2. It acts as food for water plants. During photosynthesis, carbon dioxide is converted into carbohydrates and oxygen.
8. Name four chemicals which are responsible for permanent hardness of water.
   Ans.
   (i) Calcium chloride ($CaCl_2$)
   (ii) Magnesium chloride ($MgCl_2$)
   (iii) Calcium sulphate ($CaSO_4$)
   (iv) Magnesium sulphate ($MgSO_4$).

9. How does water become temporarily hard in nature?

   Ans.

   When rainwater flows over the surface of the earth, carbon dioxide dissolves in it. It reacts with the rocks containing calcium carbonate or magnesium carbonate to form the respective hydrogen carbonates. Thus, the water becomes temporary hard.

   $CaCO_3 + H_2O + CO_2 \rightarrow Ca(HCO_3)_2$

   $MgCO_3 + H_2O + CO_2 \rightarrow Mg(HCO_3)_2$

10. How can you remove temporary hardness of water?

    Ans.

    Temporary hardness of water can be removed by boiling. When hardwater is boiled, calcium hydrogen carbonate and magnesium hydrogen carbonate decompose to form the respective insoluble

    carbonates which can be filtered out and the water becomes soft.

11. How can you remove permanent hardness in water?

    Ans.

    Permanent hardness can be removed by treating the water with sodium carbonate when insoluble metal carbonates are precipitated which can be filtered out and the water becomes soft.

    $CaCl_2 + Na_2CO_3 \rightarrow CaCO_3 + 2NaCl$

    $MgSO_4 + Na_2CO_3 \rightarrow MgCO_3 + Na_2SO_4$

    $MgCl_2 + Na_2CO_3 \rightarrow MgCO_3 + 2NaCl$

    $CaSO_4 + Na_2CO_3 \rightarrow CaCO_3 + Na_2SO_4$

12. Explain the following :

    (a) Why does effervescence take place when a soft drink bottle at room temperature is opened?

    (b) A chilled soft drink bottle does not produce a lot of effervescence on opening. Why?

    Ans.

    (a) The solubility of a gas is directly proportional to pressure. When a soft drink bottle is opened the pressure suddenly decreases, which in turn lowers the solubility of carbon dioxide gas. Thus, the excess gas in the soft drink rapidly bubbles out thereby causing effervescence.

    (b) The solubility of a gas increases with the fall in temperature. Thus, when a chilled soft drink bottle is opened the gas does not bubble out rapidly because of increased solubility. Thus, it does not produce a lot of effervesence.

13. Why can fish and water plants live in river water, but not in a stoppered bottle of distilled water?

    Ans.

    River water contains dissolved oxygen which is absolutely essential for the survival of fish and water plants. Thus, fish and water plants can respire and hence survive. However, distilled water does not contain any dissolved oxygen. Thus, fish and water plants die in it for want of oxygen.

14. A china dish weighs 28 g when empty. When a saturated solution of sodium nitrate is poured in it at 20°C, the weight of the dish is 75 g. When the solution is evaporated to dryness, the china dish along with the crystals weigh 50 g. Find the solubility of sodium nitrate at 20°C.

Ans.

Wt. of saturated solution = (75 – 28) g = 47 g

Wt. of crystals = (50 – 28) g = 22 g

∴ Wt.of water in the saturated solution = (47 – 22) = 25 g

∴ Solubility of sodium nitrate = $\frac{\text{Wt.of crystals}}{\text{Wt.of water}} \times 100$

$= \frac{22}{25} \times 100$

= 88 g /100 g of water at 20 °C.

15. Solubility of potassium nitrate solution at room temperature (30 °C) is 60 g /100 g of water. 240 g of saturated solution of potassium nitrate are allowed to evaporate such that 80 g of water evaporates. Find the amount of crystals deposited due to evaporation?

Ans.

Wt. of saturated sol. of KNO3 at 30 °C containing 60 g of crystals

= (100 + 60) = 160 g

160 g of saturated solution of S contain crystals = 60 g

∴ 240 g of saturated solution of S contains crystals = $\frac{60}{160} \times 240$ = 90 g.

∴ Amount of water in 240 g of saturated solution of S = (240 – 90) = 150 g.

When 80 g of water evaporates, the amount of water left = (150 – 80) = 70 g.

150 g of water dissolve in it, KNO_3 crystals = 90 g.

70 g of water dissolve in it, KNO_3 crystals = $\frac{90 \times 70}{150}$ = 42 g

∴ Amount of KNO_3 crystals formed during evaporation = (90 – 42) = 48 g.