Exercise :3 A **Page no: 36-37**

1. Water exists in all the three states. Discuss

Solution:

In free State, water is a liquid. When water gets freezes to 0^0c degree Celsius, it will turn to ice, which is in solid form. When we heat water to 100 ^{0}c, it vaporises into water vapours, which are the gaseous state of water; hence, it is said that water exists in all the three states.

2. Why water is considered a compound.
Solution:

Water is made up of two elements Hydrogen and Oxygen, which are in the ratio of 1:8 by mass; hence, water is considered as a compound.

3. a) Why does temperature in Mumbai and Chennai not fall as low as it does in Delhi.

b) Give the properties of water responsible for controlling the temperature of our body.

Solution:

The temperature in Mumbai and Chennai does not fall as low as it does in Delhi because Mumbai and Chennai are on the shores of the sea. This increase the specific heat capacity of the area and the presence of a large amount of water keeps the climate warmer in winter and cooler in summer.

b) Water has a high specific heat capacity. Presence of water in our body also gives stability to our body. These two reasons help in controlling our body temperature.

4. 'Water is a universal solvent' comment

Solution:

Water dissolves most of the compound to form a solution. Water can dissolve all three states of matter solids, liquids and gases. Hence water is called a universal solvent.

5. What causes the violence associated with torrential rain?

Solution:

Torrential rains release the latent heat of condensation suddenly this causes violence associated with torrential rain.

6. (a) Which property of water enables it to modify the climate ?
(b) Density of water varies with temperature. What are its consequences?
(c) What is the effect of impurities present in water on melting point and boiling point of water?

Solution:

a) Water's specific heat capacity enables it to modify the climate

b) Water when cooled till 4^0 c (maximum density level) it starts expanding and continues till it is cooled to Zero degree Celsius the point at which it turns to ice. This property of water enables marine life in cold regions where water freezes at the top will be liquid below the ice layer.

c) Impurities present in the water decreases the freezing temperature of the water, and in the same way, impurities increase the boiling point of the water.

7. How do fishes and aquatic animals survive when the pond gets covered with thick ice?

Solution:

Even though ponds covered with thick ice, beneath there will be water because of the maximum density level of water which helps the fishes and aquatic animals survive.

8. The properties of water are different from the properties of the elements of which it is formed. Discuss.

Solution:

Water is formed by the combination of Hydrogen and Oxygen in the ration of 2:1. When the two elements are joined, the atoms lose their individual properties and have different properties from the elements by which they are made. Water remains liquid in room temperature whereas Hydrogen and Oxygen are gases which when combine changes the state due to the chemical reaction.

9. How is aquatic life benefitted by the fact that water has maximum density at 4°C?

Solution:

Maximum density of water benefits aquatic life because in cold regions top layer of the water turn to ice but beneath that water will remain in liquid form which allows the existence of aquatic life even in cold regions.

10. What are your observations and conclusion when tap water is boiled and evaporated in watch glass?

Solution:

When tap water is boiled and evaporated in a watch glass, we can observe certain concentric rings of the dissolved matter remain in the watch glass which concludes that tap water contains dissolved salts in it.

11. What is the importance of dissolved salts in water?

Solution:

Importance of dissolved salts in water are as follows

- Dissolved minerals and salts are essential for the growth of plants
- Dissolved salts add taste to water
- Dissolved salts and minerals in water provide essential minerals required for our body.

12. State the importance of the solubility of CO, and 0, in water.

Solution:

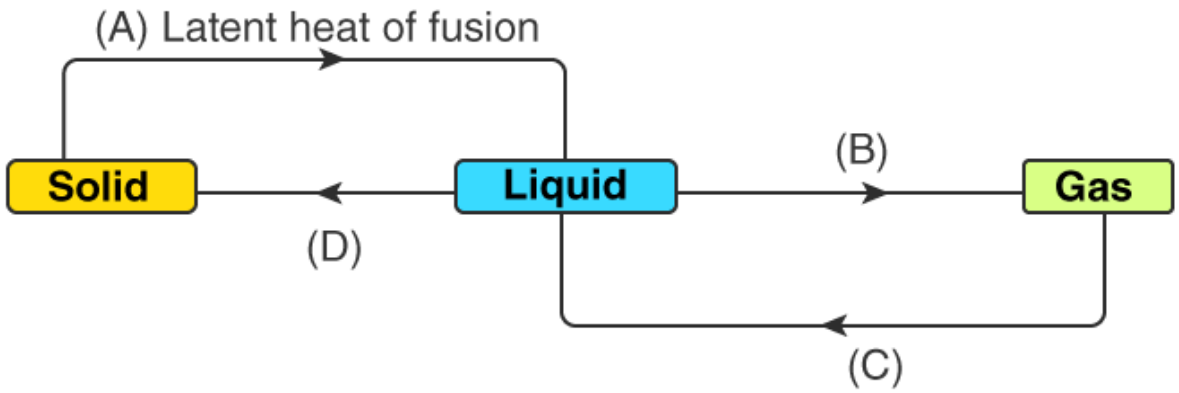
CO dissolved in water is used by aquatic plants to prepare their food by photosynthesis. Oxygen dissolved in water is used by aquatic animals for respiration and survive.

13. How is air dissolved in water different from ordinary air?

Solution:

Ordinary air consists of 78% Nitrogen, 21% oxygen and 0.01% carbondioxide. But Nitrogen is less soluble in water when compared to carbon dioxide and Oxygen. Hence the composition of air dissolved in different than ordinary air. Composition of air dissolved in water is 33% Oxygen when compared to 21% in ordinary air; Nitrogen is 66% when compared to 78% of ordinary air and carbon dioxide is 1% when compared to 0.01% in ordinary air.

14. Identify A, B, C and D; first one is done for you.



Solution:

B) Latent Heat of vaporisation
C) Condensation

15. Explain why:

(a) Boiled or distilled water tastes flat.
(b) Ice at zero degree centigrade has greater cooling effect than water at 0°C.
(c) Burns caused by steam are more severe than burns caused by boiling water.
(d) Rivers and lakes do not freeze easily?
(e) Air dissolved in water contains a higher proportion of oxygen.
(f) If distilled water is kept in a sealed bottle for a long time, it leaves etchings on the surface of the glass.
(g) Rain water does not leave behind concentric rings when boiled.

Solution:

a) Boiled or distilled water does not have any minerals, salts or dissolved gases in it hence it tastes flat.

b) Ice at zero degree centigrade has a greater cooling effect than water at 0°C because Ice at zero degree centigrade absorbs 336 J per gram of energy to melt to zero degrees centigrade water.

c) Burns caused by steam are more severe than burns caused by boiling water because 1 g of steam contains 2268 J more energy than 1 g of boiling water.

d) Ice is a good insulator and bad conductor of heat because of this portions of a lake or river that are exposed to the cold winter air will freeze into ice, and this ice insulates the water below from further rapid freezing.

e) Air consists of 78% Nitrogen and 21% oxygen. But oxygen dissolves in water easily than Nitrogen hence water contains a higher portion of oxygen.

f) If distilled water is kept in a sealed bottle for a long time, it leaves etchings on the surface of the glass because substances that are insoluble in water dissolve in trace amounts even small amounts of glass dissolves in water which will make etching on the glass surface.

g) Rainwater does not leave behind concentric rings when boiled because rainwater does not contain dissolved solvents.

Exercise :3 B **Page no: 47**

1. Explain the terms

a) Solution b) solute c) solvent

Solution:

a) The solution is a homogenous mixture of two or more components whose components cannot be seen separately.

b) The solute is a component which dissolves in the solvent to form the solution

c) The solvent is a medium in which solute dissolves

2. Explain why hot saturated solution of potassium nitrate forms crystals as it cools.

Solution:

With a decrease in temperature, the solubility of nitrate decreases. Hence when a saturated solution of potassium nitrates cools excess of nitrate separates from the solution to form crystals.

3. Give three factors which affect the solubility of a solid solute in a solvent.

Solution:

Size of solute particles, stirring and temperature, are the three factors which affect the solubility of a solid solute in a solvent.

4. a) If you are given some copper sulphate crystals, how would you proceed to prepare its saturated solution at room temperature?

b) How can you show that your solution is really saturated?

Solution:

a) Take 100 g of distilled water in a beaker. To this add one gram of copper sulphate crystals.
Stir this mixture with the help of a glass rod and dissolve copper sulphate crystals. Similarly, go on dissolving more of copper sulphate, (1 gram) at a time with constant and vigorous stirring. A stage is reached when no more copper sulphate dissolves. It is called a saturated solution at this temperature.

b) Take this saturated solution of copper sulphate some solution in a test tube and add some copper sulphate crystals. The crystals do not dissolve but settle down, which indicates that the solution is saturated.

5. a) Define i) Henry's law ii) Crystallization iii) Seeding

b) State any three methods of crystallization.

Solution:

a)
i) Henry's law states that at any given temperature, the mass of gas dissolved by a fixed volume of liquid is directly proportional to the pressure on the surface of the liquid.
ii) Crystallisation is a process by which crystals of a substance are obtained.

iii) Seeding is a process in which a small quantity of crystals are used to produce more amount of crystals of the same material.

b) Crystals can be made by following methods in a laboratory

1. By cooling a hot saturated solution gently
2. By sublimation
3. By cooling a fused mass

6. What would you observe when crystals of Copper(II) sulphate are heated in a test-tube strongly.

Solution:

Following observations are observed when crystals of Copper(II) sulphate are heated in a test-tube strongly

- The crystals are converted to a powdery substance.
- The crystals lose their blue colouration on further heating.
- Steaming vapours are produced inside the tube which condenses near the mouth of the tube to form a colourless liquid.
- On further heating, steam escapes from the mouth of the tube and water get collected in a beaker placed under the mouth of the tube.
- On further heating, the residue changes to white powder and steam stop coming out.

7. Give the names and formulae of two substances in each case

a) Hydrated substance b) anhydrous substance
c) liquid drying agent d) a basic drying agent

Solution:

a)
i. Washing soda crystals: $Na_2CO_3.10H_2O$
ii. Blue vitriol: $CuSO_4.5\ H_2O$

b)

i. Table salt: NaCl
ii. Nitre: KNO_3

c) Sulphuric acid: H_2SO_4
d) Quick lime: CaO

8. What is the effect of temperature on solubility of KNO_3 and $CaSO_4$ in water'?

Solution:

With an increase in temperature Solubility of potassium nitrate (KNO3) in water increases. In the same way, Solubility of calcium sulphate (CaSO4) in water decreases with an increase in temperature.

9. Solubility of NaCl at is 40^0 c is 36.5 g. What is meant by this statement

Solution:

The solubility of NaCl at 40^0 c is 36.5 g which means 36.5 g of NaCldissolves in 100 g of water at 40^0 c.

10. Which test will you carry out to find out if a given solution is saturated or unsaturated or supersaturated?

Solution:

To test a given solution is saturated or unsaturated or supersaturated one should carry out these tests

Add a few drops of solute like salt in the solution and try to stir by keeping the temperature constant.
If more solute does not dissolve in the given solution, then it will be a saturated solution.

If the solution gets dissolved, then it is an unsaturated solution.

If we heat and add solute to find it dissolved but excess dissolved salt forms precipitate then the solution is supersaturated solution.

11. What is the effect of pressure on solubility of gases? Explain with an example.

Solution:

Solubility of the gases increases with an increase in the pressure. For example: Solubility of water under normal circumstances is low, but when subjected to high pressure, Solubility of CO2 in water increases to multiple folds.

12. State the term : (Do not give examples)

(a) A solution where solvent is a liquid other than water.
(b) When a substance absorbs moisture on exposure to moist air and dissolves in the absorbed water and turned to solution.
(c) A substance which contains water of crystallisation.
(d) When a substance absorbs moisture from the atmosphere, but does not form solution.
(e) When a compound loses its water of crystallisation on exposure to dry air.
(f) The substance that can remove hydrogen and oxygen atoms in the ratio of 2 : 1 (in the form of water) from the compounds.

Solution:

a) Non-aqueous solution
b) Deliquescence
c) Hydrated substance
d) Hygroscopy
e) Efflorescence
f) Dehydrating agent

13. Explain why :
a) water is an excellent liquid to use in cooling systems.
b) a solution is always clear and transparent.
(c) lakes and rivers do not suddenly freeze in the winters.
(d) the solute cannot be separated from a solution by filtration.
(e) Fused CaCl2 or conc. H_2SO_4 is used in a desiccator.
(f) effervescence is seen on opening a bottle of soda water.
(g) Table salt, becomes stricky on exposure to humid air during the rainy season.

Solution:

a) High specific heat of water makes it suitable for use in cooling systems.

b) Water-soluble substances dissolve completely in water and remain disappeared. After this water retains its property, hence solution remain clear and transparent in a solution.

c) Water has high specific latent heat of solidification because of this property lakes and rivers do not suddenly freeze in the winters.

d) Solute is a substance which gets dissolved in solvent. Since it is dissolved in the solvent, it cannot be separated by filtration. However, if the solute is partially dissolved it can be separated by filtration.

e) Fused $CaCl_2$ or conc. H_2SO_4 are deliquescent and they absorb moisture. Hnece, they are used as the desiccator.

f) Carbon dioxide is dissolved in soda water under high pressure. When we open the bottle pressure gets released; therefore, the solubility of CO_2 in water decreases and the gas rapidly bubbles out.

g) Table salt contains small impurities like magnesium chloride and calcium chloride, which are deliquescent. This will make the table salt absorb moisture in rainy season to turn it stricky.

14. Normally, solubility of a crystalline solid increases with temperature. Does it increase uniformly in all cases ? Name a substance whose solubility :

(a) increases rapidly with temperature.

(b) increases gradually with temperature.

(c) increases slightly with temperature.

(d) initially increases then decreases with rise in temperature.

Solution:

a) Potassium nitrate
b) Potassium chloride
c) Sodium chloride
d) Calcium sulphate

15. What are drying or desiccating agents. Give examples.

Solution:

Drying or desiccating agents are those who readily absorbs moisture from other substances without altering their chemical nature. Ex: Conc. Sulphuric acid, alumina- Al_2O_3, phosphorus pentoxide P_2O_5.

16. Complete the following table :

Common Name	Chemical Name	Formula	Acid, base or salt	Efflorescent, hygroscopic or deliquescent substance
Solid caustic potash				
Quick lime				
Oil of vitriol				
Washing soda				
Solid caustic soda				
Blue vitriol				

Solution:

Common Name	Chemical Name	Formula	Acid, base or salt	Efflorescent, hygroscopic or deliquescent substance
Solid caustic potash	Potassium hydroxide	KOH	Base	Deliquescent substance
Quick lime	Calcium oxide	CaO	Base	Hygroscopic substance
Oil of vitriol	Sulphuric acid	H2SO4	Acid	Hygroscopic substance
Washing soda	Hygroscopic substance	Na2CO3.10H2O	Salt	Efflorescent substance
Solid caustic soda	Sodium hydroxide	NaOH	Base	Deliquescent substance
Blue vitriol	Copper sulphate	CuSO4	Salt	Efflorescent substance

17. In which of the following substances will there be :
(a) increase in mass (b) decrease in mass
(c) no change in mass when they are exposed to air ?
1. Sodium chloride 2. Iron
3. Conc. sulphuric acid 4. Table salt
5. Sodium carbonate crystals

Solution:

a) Increase in mass: Iron and conc. sulphuric acid
b) Decrease in mass: Sodium carbonate crystals
c) No change in mass: Sodium chloride

18. State the methods by which hydrated salts can be made anhydrous

Solution:

Hydrated salts can be made anhydrous by heating or by exposing them to dry air.

Exercise :3 C **Page no: 52**

1. What is the composition of water ? In what volume its elements combine ?

Solution:

The composition of water is two atoms of hydrogen with one atom of oxygen (H2O). They combine in the ratio of 2:1.

2. What is the use of solubility of oxygen and carbon dioxide in water ?

Solution:

Oxygen dissolved in water is used by aquatic animals for respiration and survive. CO_2 dissolved in water is used by aquatic plants to prepare their food by photosynthesis.

3. Hot saturated solution of sodium nitrate forms crystals, as it cools. Why?

Solution:

A hot saturated solution of sodium nitrate forms crystals, as it cools because of its solubility decrease with decrease in temperature.

4. What are hydrous substances? Explain with examples.

Solution:

Substances which contain water with salts as known as hydrous substances. In hydrous substances waters helps the crystal structure. Ex: Sodium carbonate decahydrate: $Na_2CO_3.10H_2O$, Copper sulphate pentahydrate: $CuSO_4.5H_2O$

5• Name the three methods by which hydrous substances can be made anhydrous.

Solution:

a) By heating
b) By evaporation
c) By exposing to dry air

6. What is the importance of dissolved impurities in water ?

Solution:

Importance of dissolved impurities in water are as follows

- Dissolved minerals and salts are essential for the growth of plants
- Dissolved salts add taste to water
- Dissolved salts and minerals in water provide essential minerals required for our body.

7. State two ways, by which a saturated solution can be changed to unsaturated solution.

Solution:

a) A saturated solution can be changed to an unsaturated solution by heating.

b) A saturated solution can be changed to an unsaturated solution by adding more solvent.

8. What do you understand by

(a) Soft water
(b) Hard water
(c) Temporary Hard water
(d) Permanent hard water.

Solution:

a) Water is said to be soft water if it readily gives foam with soap.

b) Water is said to be hard water if it does not readily give foam with soap.

c) Water that contains only hydrogen carbonates of Calcium and Magnesium is called temporary hard water.

d) Water that contains sulphates and chlorides of Magnesium and Calcium is known as Permanent hard water.

9. What are the causes for
(a) Temporary hardness (b) Permanent hardness

Solution:

a) The presence of hydrogen carbonates of calcium and magnesium makes water temporarily hard.
b) The presence of sulphates and chlorides of magnesium and calcium makes water permanently hard.

10. What are the advantages of (i) soft water (ii) Hard water

Solution:

a) Advantages of soft water

i) With soft water soaps and cleansing agents are consumed less, which will save you money.
ii) Soft water does not leave deposits of minerals on pipes which will make plumbing works easy.
iii) Clothes washed using soft water lasts long and remain bright

b) Advantages of hard water

i) Presence of salts and ions in hard water makes it tasty
ii) Calcium and Magnesium ions present in hard water are essential for the growth of our bones.
iii) hard water checks poisoning of water by lead pipes.

11. What are stalagmites and stalactites`' How are they formed?

Solution:

In some limestone caves we sometimes see conical pillar-like objects hanging from the roof of the caves and some rising from the floors. These conical pillars which grow upward from the floor of the caves are known as stalagmites, and the structures which grow downwards from the roof are called stalactites.

These structures are formed by water dropping from the cracks in the rocks containing calcium hydrogen carbonate. Calcium hydrogen carbonate converts to calcium carbonate when pressure is released. Over some time, calcium carbonate deposits to form stalagmites and stalactites.

12. Name the substances which give water (i) temporary hardness (ii) permanent hardness.

Solution:

i) **Hydrogen carbonates of calcium and magnesium** turn water temporarily hard.
ii) **Sulphates and chlorides of magnesium and calcium** make water permanently hard.

13. Give equations to show what happens when temporary hard water is

(a) boiled (b) treated with slaked lime

Solution:

a) $Ca(HCO_3)_2 \xrightarrow{Boil} CaCO_3 + H_2O + CO_2\uparrow$

$Mg(HCO_3)_2 \xrightarrow{Boil} MgCO_3 + H_2O + CO_2\uparrow$

b) $Ca(HCO_3)_2 + Ca(OH)_2 \xrightarrow{Boil} 2CaCO_3 + 2H_2O$

$Mg(HCO_3)_2 + Ca(OH)_2 \xrightarrow{Boil} MgCO_3 + 2H_2O$

14. State the disadvantages of using hard water.

Solution:

Hard water is unfity for washing as it is difficult to form lather with soap.

Scum may form in a reaction with soap, wasting the soap.

Furring of tea kettles will takes place due to the formation of Carbonates of calcium and magnesium.

Hard blocks hot water pipes. This is due to the formation of layers of Carbonates of calcium and magnesium.

15. What is a soap, what for is it used?

Solution:

Soap is chemically a sodium salt of stearic acid (an organic acid with the formula C17H35COOH) and has the formula C17H35COONa. Soap is used for domestic washing purposes.

16? What is the advantage of a detergent over soap ?

Solution:

Detergent readily forms lather with hard water and it is more soluble in water.

17? Why does the hardness of water render it unfit for use (i) boiler (ii) for washing purposes?

Solution:

i) The dissolved substance present in the hard water fail to get converted into steam and gets deposited on the inner walls of the tube. Over time this narrows the tubes which stop the water flow, and less steam is produced. When bore of the tube becomes very narrower boiler itself bursts due to the pressure of the steam. Hence, hard water is not used in boilers.

ii) If hard water is used, calcium and magnesium ions of the water combine with the negative ions of the soap to form a slimy precipitate of insoluble calcium and magnesium usually called soap curd (scum).
Formation of soap curd will go on as long as calcium and magnesium ions are present. Till then, no soap lather will be formed and cleaning of clothes or body will not be possible. Moreover, these precipitates are difficult to wash from fabrics and sometimes form rusty spots if iron salts are present in water.

18. Explain with equation. what is noticed when permanent hard water is treated with (a) slaked lime (b) washing soda

Solution:

a) Slaked lime is first mixed with water and then fed into another tank containing hard water. Then mix this solution thoroughly by using revolving paddles. This process will make calcium carbonate to settle down, and the leftover solid is removed by filtration.

$$Ca(HCO3)2 + Ca(OH)2 \xrightarrow{Boil} 2CaCO3 + 2H2O$$

$$Mg(HCO3)2 + Ca(OH)2 \xrightarrow{Boil} MgCO3 + CaCO3 + 2H2O$$

b) Washing soda is added to hard water, which results in settling down of insoluble carbonates which can be removed by filtration.

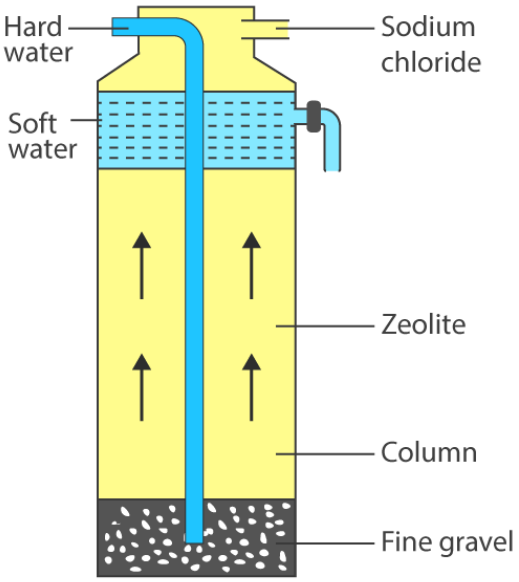
$$Ca(HCO_3)_2 + Na_2CO_3 \xrightarrow{Boil} CaCO_3 + 2NaHCO_3$$

$$Mg(HCO_3)_2 + Na_2CO_3 \xrightarrow{Boil} MgCO_3 + 2NaHCO_3$$

19. What is permutit method, how can it be used for softening hard water ?

Solution:

Permutit is an artificial zeolite. Chemically, it is hydrated sodium aluminium orthosilicate with the formula Na2Al2Si2O8.XH2O. For the sake of convenience, let us give it the formula Na2P.



A tall cylinder is loosely filled with lumps of permutit. Ions ghets exchanged when hard water containing calcium and magnesium ions percolates through these lumps. Sodium permutit is slowly changed into calcium and magnesium permutit, and the water becomes soft with the removal of calcium and magnesium ions.
When no longer active, permutit is regenerated by running a concentrated solution of brine over it and removing calcium chloride formed by repeated washing.

$CaP + 2NaCl \rightarrow Na_2P + CaI_2$