

**Exercise :3 B**

**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:  $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$

ii. Blue vitriol:  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

b)

i. Table salt:  $\text{NaCl}$

ii. Nitre:  $\text{KNO}_3$

c) Sulphuric acid:  $\text{H}_2\text{SO}_4$

d) Quick lime:  $\text{CaO}$

**8. What is the effect of temperature on solubility of  $\text{KNO}_3$  and  $\text{CaSO}_4$  in water'?**

**Solution:**

With an increase in temperature Solubility of potassium nitrate ( $\text{KNO}_3$ ) in water increases. In the same way, Solubility of calcium sulphate ( $\text{CaSO}_4$ ) in water decreases with an increase in temperature.

**9. Solubility of  $\text{NaCl}$  at is  $40^\circ\text{C}$  is 36.5 g. What is meant by this statement**

**Solution:**

The solubility of  $\text{NaCl}$  at  $40^\circ\text{C}$  is 36.5 g which means 36.5 g of  $\text{NaCl}$  dissolves in 100 g of water at  $40^\circ\text{C}$ .

**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  $\text{CO}_2$  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  $\text{CaCl}_2$  or conc.  $\text{H}_2\text{SO}_4$  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  $\text{CaCl}_2$  or conc.  $\text{H}_2\text{SO}_4$  are deliquescent and they absorb moisture. Hence, 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  $\text{CO}_2$  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 absorb moisture from other substances without altering their chemical nature. Ex: Conc. Sulphuric acid, alumina-  $\text{Al}_2\text{O}_3$ , phosphorus pentoxide  $\text{P}_2\text{O}_5$ .

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	H <sub>2</sub> SO <sub>4</sub>	Acid	Hygroscopic substance
Washing soda	Hygroscopic substance	Na <sub>2</sub> CO <sub>3</sub> .10H <sub>2</sub> O	Salt	Efflorescent substance
Solid caustic soda	Sodium hydroxide	NaOH	Base	Deliquescent substance
Blue vitriol	Copper sulphate	CuSO <sub>4</sub>	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.