1st YEAR CHAPTER 2

EXPERIMENTAL TECHNIQUES IN CHEMISTRY

1. **What is difference between qualitative analysis and quantitative analysis?**

Qualitative analysis:

The analysis which deals with the detection or identification of the elements present in a compound is called qualitative analysis. It includes salt analysis and detection of functional groups.

Quantitative analysis:

The analysis in which the relative amounts of constituents are estimated is called quantitative analysis. For example combustion analysis.

2. **How chemical characterization of compound is done?**

The chemical characterization of a compound is done by qualitative and quantitative analysis.

Qualitative analysis:

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Quantitative analysis:

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FILTRATION

3. **Why concentrated HCl and KMnO4 solutions cannot be filtered by Gooch's crucible?**

Concentrated HCl and $KMnO_4$ solution react with filter paper. Due to this reason, the perforation of Gooch crucible is first covered with asbestos matt and then this solution is filtered with Gooch crucible.

CRYSTALLIZATION

1. **Write methods of drying of crystals.**
   - i. **Through filter paper:**
     Pressing in between several folds of filter paper and repeating the process several times to dry the crystals.
   - ii. **Drying in an oven**
     The crystals are dried in an oven.
   - iii. **Vacuum Desiccator:**
     The safe and reliable method of drying crystals is through vacuum desiccator. In this process crystals are placed in vacuum desiccator along with some drying agent.

4. **How is desiccator used to dry the crystal?**

OR

How crystals are dried by reliable method?

Vacuum Desiccator:

The safe and reliable method of drying crystals is through vacuum desiccator. In this process,

Crystals are spread on watch glass and kept in vacuum desiccator along with some drying agent. Drying agents used in desiccator are $CaCl_2$, silica gel, P_2O_5 and sometimes H_2SO_4.

5. **Why is there a need to crystallize the crude product?**

When a chemical compound is prepared, the crude product may contain soluble and insoluble impurities. Insoluble impurities are removed by filtration while soluble impurities are removed by fractional crystallization process. Crystallization also gives a definite geometrical shape to the crystals of crude product. Hence it is necessary to crystallize the crude product.

6. **Write down the name of eight solvents used in crystallization.**

The commonly used solvents in crystallization are:

- Water (H_2O)
- Acetic acid (CH_3COOH)
- Carbon tetra chloride (CCl_4)
- Acetone (CH_3COCH_3)
- Ethanol (C_2H_5OH)
- Chloroform ($CHCl_3$)
- Diethyl ether ($C_2H_5OC_2H_5$)
- Petroleum Ether

7. **Write names of major steps involved in crystallization?**

The major steps involved in crystallization are as follow.

i. Choice of solvent
ii. Preparation of saturated solution
iii. Filtration
iv. Cooling
v. Collecting of crystals
vi. Drying of crystals
vii. Decolourization of crystals

8. **Write down the four main characteristics of solvent selected for crystallization of a compound.**

- It should dissolve large amount of solute at its boiling point and very small amount at room temperature.
- It should not chemically react with the solute.

- It should not dissolve impurities or impurities should not crystallize out along with the solute.
- On cooling, it should give well-formed crystals of a pure compound.
- It should cheap and safe to use.

9. How undesirable colors are removed from the crystals?

Sometimes during the preparation, impurities may impart colour to the crystals. Such impurities are removed by boiling the substance in a solvent with sufficient quantity of finely powdered animal charcoal and then filtering the hot solution. The coloured impurities are adsorbed by animal charcoal and pure decolorized substance crystallizes out from the filtrate on cooling.

10. What is the basic principle of Crystallization?

Basic Principle:

The basic principle of crystallization is that solute should be soluble in suitable solvent at high temperature and excess amount of solute is separated as crystals when it is cooled.

SUBLIMATION

11. Define sublimation. Give one example.

Sublimation:

A process of changing a solid directly into gas on heating and changing of gas into solid on cooling without passing through liquid state is called sublimation.

For example: Naphthalene, benzoic acid, iodine, ammonium chloride.

12. Define sublimation. What type of a substance can be purified by this technique?

Sublimation:

A process of changing a solid directly into gas on heating and changing of gas into solid on cooling without passing through liquid state is called sublimation.

Sublimation is shows by the compounds which have higher vapour pressure than atmospheric pressure and melting has not happened yet because it is not hot enough.

13. Define sublimand and sublimate.

Sublimand:

The compound which is sublimed is called sublimand. e.g In the mixture of benzoic acid in sand, benzoic acid is Sublimand.

Sublimate:

The pure solid obtained after sublimation is called sublimate.

14. How mixture ofNH_4Cl and NaCI can be separated?

The mixture of NH4Cl and NaCl can be separated by sublimation. In this process, the mixture is taken on watch glass covered with an inverted funnel. The mixture is then slowly heated

over a sand bath and funnel is cooled with wet cotton. The pure NH_4Cl solid deposits on the inner wall of funnel.

SOLVENT EXTRATION

15. Solvent extraction follows the Distribution law Justify.

Distribution law:

This law states that a solute distributes itself between two immiscible liquids in a constant ratio of concentration irrespective of the amount of solute added.

The solvent extraction is the technique in solute can be separated from solution by shaking the solution with a solvent in which the solute is more soluble and the added solvent does not mix with the solution. So solvent extraction follows distribution law.

16. State distribution law.

Distribution law: (Partition Law)

This law states that a solute distributes itself between two immiscible liquids in a constant ratio of concentration irrespective of the amount of solute added.

17. What is solvent extraction?

Solvent Extraction:

The solvent extraction is the technique in solute can be separated from solution by shaking the solution with a solvent in which the solute is more soluble and the added solvent does not mix with the solution.

18. Iodine is more soluble in water in the presence of KI. Why?

The distribution of iodine between two immiscible solvents, water in the presence of KI and CCl_4. Iodine reacts with iodide ion in a reversible reaction. The following dynamic equilibrium is established.

$$I_2 + I^{-1} \rightleftharpoons I_3^{-1}$$

Soluble in CCl_4 — Soluble in water

CHROMATOGRAPHY

2. Write down the uses of chromatography or paper chromatography.

- It is used for the separation and purification of coloured pigments.
- It is used for qualitative and quantitative analysis.
- It is used for identification of amino acids.
- It is used for the analysis of urine.
- Purity of substances can be checked by chromatography. Pure substances give one spot
- It separates mixture of very small quantity at a very low concentration.

3. Differentiate between stationary phase and mobile phase in chromatographic technique?

Mobile phase	Stationary phase
• The phase that moves over the stationary phase are called mobile phases. • It may be solvent or mixture of solvents used for the separation of components. It is gas or liquid. • For Example: water, ethyl alcohol	• The phase over which mobile phase flows is called stationary phase. • Stationary phase may be liquid or solid. • For Example: silica gel.

19. What is R_f value and why it has no unit?

R_f Value:
It is the ratio of distance travelled by the component of the mixture to the distance travelled by the solvent from the original line.
It is given by

$$R_f = \frac{\text{Distance travelled by a component from the original spot}}{\text{Distance travelled by solvent from a original line}}$$

Each component has specific retardation factor which depends upon its distribution coefficient and is called R_f value.

20. Differentiate between adsorption chromatography and partition chromatography.

Adsorption Chromatography	Partition Chromatography
In adsorption chromatography, the stationary phase is solid.	In partition chromatography, the stationary phase is liquid supported on an inert solid.
In this chromatography, solute particles are adsorbed on the solid stationary phase, during their separation.	In this chromatography, solute distributes itself between stationary and mobile phase.
Example: thin layer chromatography (TLC)	Example: Paper chromatography