SAMPLE CONTENT

Precise CHEMISTRY

Std. XI Science

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Precise CHEMISTRY

Std. XI Sci.

Salient Features

- Written as per the latest textbook
- Subtopic-wise segregation for powerful concept building
- Includes Textual Exercise Questions, Intext Questions, Textual Examples and Numericals
- 'Quick Review' of the chapter facilitates quick revision
- 'Important Formulae' and 'Solved Examples' provided to cover numerical aspect of the topic in detail
- 'Reading Between the Lines' prepare a solid foundation through constructivist learning
- Video/pdf links provided via QR codes for boosting conceptual retention

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PREFACE

"Everything should be made as simple as possible, but not simpler." - Albert Einstein.

Having this vision in mind we have created **'Precise Chemistry: Std. XI Sci.'** as per the latest textbook of Maharashtra State board. It is a compact yet complete guide designed to boost students' confidence and prepare them to face the conspicuous Std. XI final exam. Every chapter, **segregated subtopic-wise**, collates each and every important concept in Question and Answer format including complete coverage of *Textual Exercise questions, Intext questions and Textual Examples. 'Can you tell', 'Can you recall', 'Try this'* and *'Discuss'* which are deemed important from exam point-of-view are placed aptly amongst various additional questions in accordance with the flow of subtopic. For the students to gain a better understanding of the concept lying behind the answer, 'Reading between the lines' (*not a part of the answer*) has been provided as deemed necessary. Numericals along with their step-wise solutions are covered under the heading of '**Solved Examples'** at the end of each subtopic. Few selected numericals have also been solved using log-tables. Marks are allotted to give students insight about weightage of a question. **Quick Review** and **Important Formulae** are placed after covering last subtopic of the chapter. '**Exercise'** and '**Multiple Choice Questions'** sections are added to enable students assess their range of preparation and knowledge of each topic. **Notes** are introduced to cover additional bits of relevant information on each topic as seemed required.

While ensuring concise coverage of the syllabus in an effortless and easy to grasp format, emphasis is also given on active learning. To achieve this, we have infused ***QR Codes.***

The flow chart on the adjacent page will walk you through the key features of the book and elucidate how they have been carefully designed to maximize the student learning.

We hope the book benefits the learner as we have envisioned.

Publisher

Edition: Fourth

The journey to create a complete book is strewn with triumphs, failures and near misses. If you think we've nearly missed something or want to applaud us for our triumphs, we'd love to hear from you.
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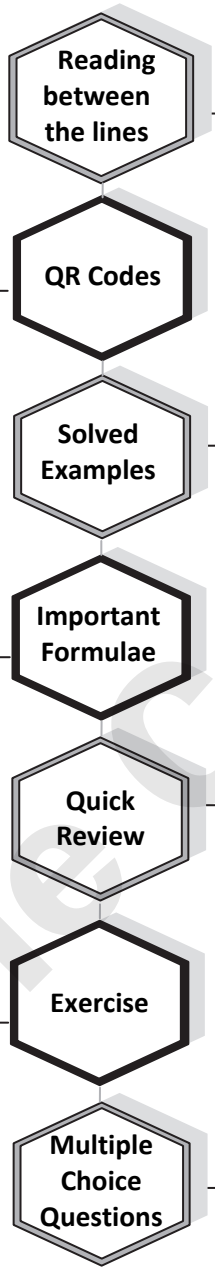
KEY FEATURES



Reading between the lines provides elaboration or missing fragments of concept essential for complete understanding of the concept.

QR code provides access to a video in order to boost understanding of a concept or activity

Solved Examples offer complete solution to numerical including log (as seemed required).

Important Formulae includes all of the key formulae in the chapter.

Quick review includes tables/ flow chart to summarize the key points in chapter.

Exercise includes subtopic-wise additional questions and problems.

Multiple Choice Questions includes textual as well as additional MCQs.

CONTENTS

[Reference: Maharashtra State Board of Secondary and Higher Secondary Education, Pune - 04**]**

Note:
1. * mark represents Textual question.
2. # mark represents Intext question.
3. + mark represents Textual examples and Numericals.
4. symbol represents textual questions that need external reference for an answer.

3 Some Analytical Techniques

Contents and Concepts

3.1 Introduction

Q.1. Give reason: Purification of a chemical substance is important before investigating its composition and properties. [2 Marks]

Ans:

i. Chemical substances occur in nature in impure stage.
ii. Also, chemical substances synthesized in the laboratory are obtained in crude and impure form.
iii. Impurities present in the chemical substances may interfere with the properties to be determined (**e.g.** melting point or boiling point).
iv. Therefore, before investigating composition and properties of a given chemical substance, it is important to obtain it in the pure form.

3.2 Purification of solids

Q.2. What are the different types of impurities that a solid may contain? [1 Mark]

Ans: A solid substance may contain two types of impurities:

i. Impurities which are soluble in the same solvent as the main substance.
ii. Impurities which are not soluble in the same solvent as the main substance.

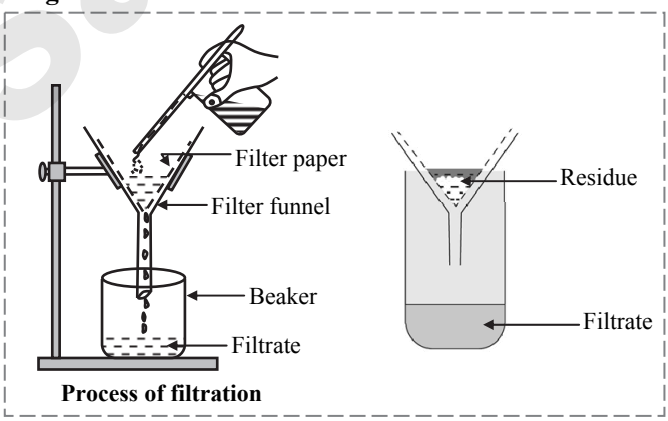
Q.3. Describe the process of filtration with a neat and labelled diagram. [3 Marks]

Ans:

i. Impurities which are not soluble in the same solvent as the main compound can be separated by a simple process called filtration.

ii. Procedure:

a. A circular piece of filter paper is folded to form a cone and fitted in the funnel.
b. The funnel is fixed on a stand and a beaker is kept below.
c. The mixture which has to be purified is added to a suitable solvent in which the main compound dissolves.
d. The paper is made moist, and the solution to be filtered is poured on the filter paper.
e. Diagram:



Process of filtration

iii. The insoluble part remaining on the filter paper is called residue and the liquid which pass through the filter paper and gets collected in the beaker is called filtrate.

***Q.4. What do you understand by the terms:**
i. Residue ii. Filtrate [2 Marks]

Ans:

i. Residue: *In the process of filtration, the insoluble (undissolved) impurities which remain on the filter paper are called* ***residue****.*

ii. Filtrate: *In the process of filtration, the liquid which pass through the filter paper and gets collected in a beaker is called* ***filtrate****.*

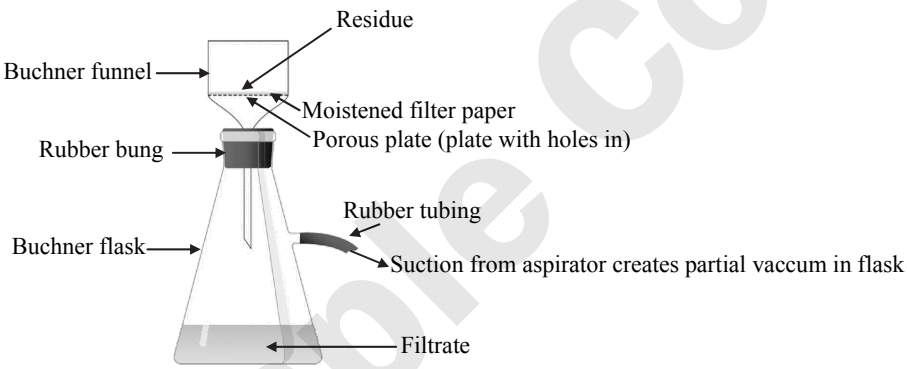
***Q.5. Label the diagram and explain the process in your words.**

OR

Describe the process of filtration under suction with a neat and labelled diagram. [3 Marks]

Ans:

i. *When filtration is carried out using a vacuum pump it is called* ***filtration under suction****.* It is a faster and more efficient technique than simple filtration. The diagram is as follows:



Setup for filtration under suction

ii. Procedure:

a. The assembly for filtration under suction consists of a thick wall conical flask with a side arm (Buchner flask).
b. The flask is connected to a safety bottle by rubber tube through the side arm.
c. Buchner funnel (a special porcelain funnel with a porous circular bottom) is fitted on the conical flask with the help of a rubber cork.
d. A circular filter paper of correct size is placed on the circular porous bottom of the Buchner funnel and the funnel is placed on the flask.
e. Filter paper is moistened with a few drops of water or solvent.
f. Suction is created by starting the pump and filtration is carried out.

iii. Crystals are collected on the filter paper and filtrate in the flask.

***Q.6. Why is paper moistened before filtration? [1 Mark]**

Ans: Before filtration, filter paper is moistened with appropriate solvent to ensure that it sticks to the funnel and does not let the air to pass through the leaks.

***Q.7. Define: Saturated solution [1 Mark]**

Ans: *A* ***saturated solution*** *is a solution which cannot dissolve additional quantity of a solute.*

Q.8. Explain the following steps with respect to the process of crystallization. **[4 Marks]**

i. Preparation of a saturated solution **ii. Hot filtration**

iii. Cooling of the filtrate **iv. Filtration**

Ans:

i. Preparation of a saturated solution:

a. A saturated solution of the crude solid is prepared by boiling it in a small but sufficient quantity of a suitable solvent.

b. On doing so the main solute forms an almost saturated solution, but the solution is not saturated with respect to the soluble impurities, as they are in small proportion.

ii. Hot filtration: The hot saturated solution is quickly filtered to remove undissolved impurities as residue. Filtration under suction can be employed for rapid filtration.

iii. Cooling of the filtrate:

a. The hot filtrate is allowed to cool.

b. On cooling, the filtrate becomes supersaturated with respect to the main dissolved solute because solubility of a substance decreases with lowering of temperature.

c. The excess quantity of the dissolved solute comes out of the solution in the form of crystals.

d. The dissolved impurities, however, do not supersaturate the solution, as their quantity is small.

e. These continue to stay in the solution in dissolved state even on cooling. Therefore, the separated crystals are free from soluble impurities.

iv. Filtration:

a. The crystals obtained on cooling are further purified by filtration to remove insoluble impurities.

b. The filtrate obtained is called as **mother liquor**.

c. The crystals obtained after filtration are free from soluble as well as insoluble impurities.

***Q.9. List the properties of solvents which make them suitable for crystallization.** **[2 Marks]**

Ans: The solvent to be used for crystallization should have following properties:

i. The compound to be crystallized should be least or sparingly soluble in the solvent at room temperature but highly soluble at high temperature.

ii. Solvent should not react chemically with the compound to be purified.

iii. Solvent should be volatile so that it can be removed easily.

Q.10. Name the common solvents used in the process of crystallization. **[1 Mark]**

Ans: The commonly used solvents are water, ethyl alcohol, methyl alcohol, acetone, ether or their combinations.

Q.11. Describe the process of crystallization of common salt from impure sample with the help of a diagram. **[3 Marks]**

Ans:

i. Impure sample of a common salt is added to the required quantity of water and stirred with a glass rod.

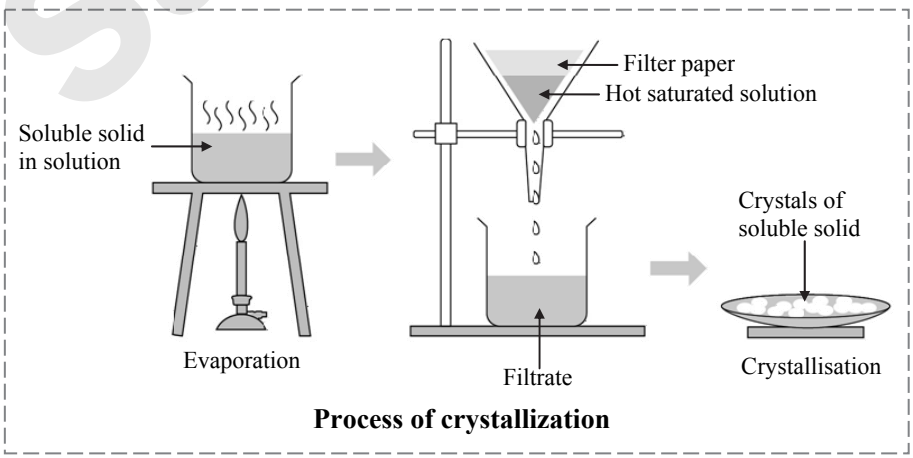
ii. More amount of salt is added and the solution is heated till no more salt dissolves.

iii. The hot saturated solution is filtered off to remove insoluble impurities while the filtrate is collected in an evaporating dish.

iv. The filtrate is allowed to cool which results in the formation crystals of pure salt (NaCl) leaving behind the soluble impurities.

v. The crystals are filtered and dried.

vi. The diagram is as follows:



Process of crystallization

Q.12. Which solvent is used for the purification of copper sulphate and benzoic acid? **[1 Mark]**

Ans: The solvent used for the purification of copper sulphate and benzoic acid is water.

***Q.13. Which of the following techniques is used for purification of solid organic compounds? Crystallization or distillation** **[1 Mark]**

Ans: Solid (crude/impure) organic compounds can be purified by crystallization.

Reading between the lines

Distillation technique is employed for purification of liquids (i.e., to separate volatile liquids from non-volatile impurities).

Q.14. Define: Fractional crystallization **[1 Mark]**

Ans: ***Fractional crystallization*** *is a process wherein two or more soluble substances having widely different solubilities in the same solvent at same temperature are separated by crystallization.*

Q.15. Describe the process of fractional crystallization. **[3 Marks]**

Ans: Fractional crystallization is based on the differences in solubilities of two or more compounds in the same solvent at the same temperature. That is, the substance which is least soluble crystallizes out first and the most soluble substance crystallizes out last.

e.g. Mixture of two solutes A and B can be purified by fractional crystallization as follows:

i. **Preparation of a saturated solution:** Mixture of two solutes A and B are dissolved in a suitable hot solvent to prepare a saturated solution.

ii. **Hot filtration:** The hot saturated solution is filtered to remove insoluble impurities.

iii. **Cooling of the filtrate:** Hot filtrate is allowed to cool. On cooling, the solute which is least soluble crystallizes out first leaving behind the most soluble substance in the mother liquor.

iv. **Filtration:** The crystals formed are filtered, washed with solvent and dried. Crystals obtained will be of a solute which is least soluble in a given solvent.

v. **Concentration of a mother liquor:** The mother liquor is concentrated by evaporating the solvent. These crystals are filtered and dried to obtain the second purified component (which was more soluble in given solvent).

3.3 Distillation

Q.16. Which types of impure liquids can be purified by the process of distillation? **[2 Marks]**

Ans: Distillation technique can be employed for the purification of

i. volatile liquids from non-volatile impurities.

ii. liquids having sufficient difference in their boiling point.

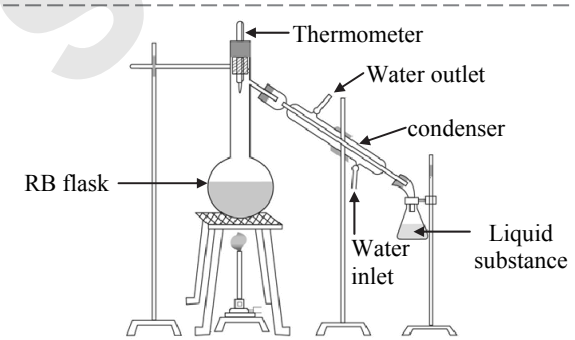
***Q.17. Define: Distillation** **[1 Mark]**

Ans: *The process in which liquid is converted into its vapour phase at its boiling point and the vapour is then condensed back to liquid on cooling is known as* ***distillation****.*

Q.18. Explain the construction of simple distillation unit using neat labelled diagram. **[3 Marks]**

Ans:

i. The apparatus used for simple distillation is shown in the figure below:



Simple distillation

ii. It consists of round bottom flask fitted with a cork having a thermometer.

iii. The flask has a side arm through which it is connected to a condenser.
iv. The condenser has a jacket with two outlets through which water is circulated.
v. The liquid to be distilled is taken in the round bottom flask fixed by clamp.
vi. The flask is placed in a water bath or oil bath or sometimes wire gauze is kept on a stand as shown in the figure.

Q.19. State the principle involved and describe the process to separate acetone and water from their mixture. **[3 Marks]**

Ans:

i. Acetone and water can be separated from their mixture by simple distillation.

ii. Principle: Acetone and water are two miscible liquids having an appreciable difference (more than 30 K) in their boiling points. Acetone boils at 56 °C while boiling point of water is 100 °C. When the mixture of acetone and water is heated and temperature of the mixture reaches 56 °C acetone will distil out first. Once all acetone distils out, and when the temperature rises to 100 °C water will distil out.

iii. Process to separate acetone and water from their mixture:

a. Take the mixture of water and acetone in the distillation flask.
b. Heat the flask on a water bath carefully. At 56 °C acetone will distil out, collect it in receiver.
c. After all acetone distilled, change the receiver. Discard a few mL of the liquid. As the temperature reaches 100 °C water will begin to distil. Collect this in another receiver.

***Q.20. Why is a condenser used in distillation process?** **[1 Mark]**

Ans: In the process of distillation, a liquid is converted into its vapour and the vapour is then condensed back to liquid on cooling. The condenser has a jacket with two outlets through which water is circulated. Hence, to provide efficient cooling, a condenser is used.

***Q.21. What will happen if the upper outlet of the condenser is connected to the tap instead of the lower outlet?** **[2 Marks]**

Ans:

i. If water enters through upper outlet of condenser, the water will quickly flow down under the influence of gravity. This allows only a small section of the condenser to be cooled enough.
ii. If water enters through lower outlet of condenser, the entire condenser will be filled with water before it leaves out providing maximum cooling to the condenser. This results in maximum recovery of purified liquid.

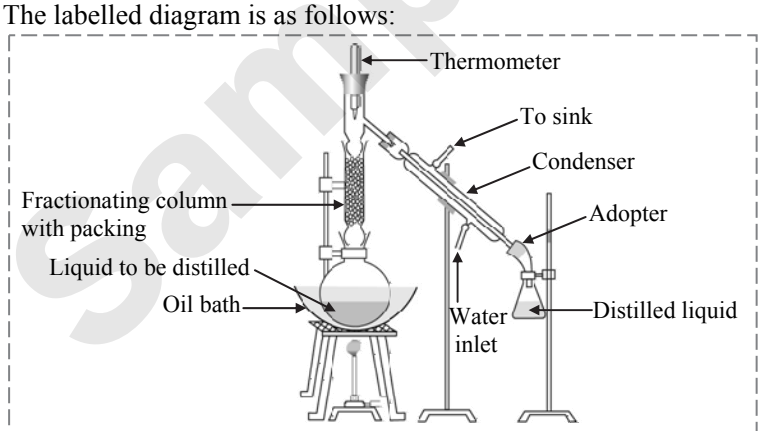
Hence, water must be allowed to enter through lower outlet of condenser during distillation process.

Q.22. What is the advantage of fractional distillation over simple distillation? **[1 Mark]**

Ans: If in a mixture, the difference in boiling points of two liquids is not appreciable/large, they cannot be separated using simple distillation. To separate such liquids, fractional distillation is used.

Q.23. Describe the process of fractional distillation with a neat labelled diagram. **[4 Marks]**

Ans: The labelled diagram is as follows:



Fractional distillation

i. In fractional distillation, vapours first pass through the fractionating column.
ii. Vapours of more volatile liquid with lower boiling point rise up more than the vapours of liquid having higher boiling point.

e.g. a. Suppose we have a mixture of two liquids such as acetone 'liquid A' and methyl alcohol 'liquid B' having boiling points 329 K and 337.7 K respectively.
b. 'A' is more volatile and 'B' is less volatile. As the mixture is heated, vapours of 'A' along with a little vapours of 'B' rise up and come in contact with the large surface of the fractionating column.

c. Vapours of 'B' condense rapidly into the distillation flask. While passing through the fractionating column, there is an exchange between the ascending vapours and descending liquid. The vapours of 'B' are scrubbed off by the descending liquid, this makes the vapours richer in 'A'.
d. This process is repeated each time the vapours and liquid come in contact with the surface in the fractionating column.
e. Rising vapours become richer in 'A' and escape through the fractionating column and reach the condenser while the liquid in the distillation flask is richer in 'B'.
f. The separated components are further purified by repeating the process.

Q.24. Give two examples of a mixture that can be separated by fractional distillation. [1 Mark]
Ans:
i. Mixture of acetone (b.p. 329 K) and methyl alcohol (b.p. 337.7 K)
ii. Mixture of acetone (b.p. 329 K) and benzene (b.p. 353 K)

Q.25. Give two examples of types fractionating columns that can be used to carry out fractional distillation.
Ans: Simple packed column and bubble plate column.

Q.26. Give one industrial application of fractional distillation. [1 Mark]
Ans: Fractional distillation is used in petroleum industry to separate different fractions of crude oil.

***Q.27. What is the difference between simple distillation and fractional distillation? [2 Marks]**
Ans:

No.	Simple distillation	Fractional distillation
i.	If in a mixture the difference in boiling points of two liquids is appreciable/large, they are separated from each other using the simple distillation.	If in a mixture the difference in boiling points of two liquids is not appreciable/large, they are separated from each other using the fractional distillation.
ii.	Simple distillation assembly is used.	Fractionating column is fitted in distillation assembly.
e.g.	Mixture of acetone (b.p. 329 K) and water (b.p. 373 K) can be separated by this method.	Mixture of acetone (b.p. 329 K) and methanol (b.p. 337.7 K) can be separated by this method.

Q.28. Write a short note on distillation under reduced pressure. [2 Marks]
Ans:
i. Liquids having very high boiling points or which decompose on heating are purified by the method of distillation under reduced pressure.
ii. In this method, the liquid is made to boil at a temperature lower than its normal boiling point by reducing the pressure on its surface.
iii. The external pressure is reduced using a water pump or vacuum pump.
e.g. Glycerol can be separated from soap by using this method.

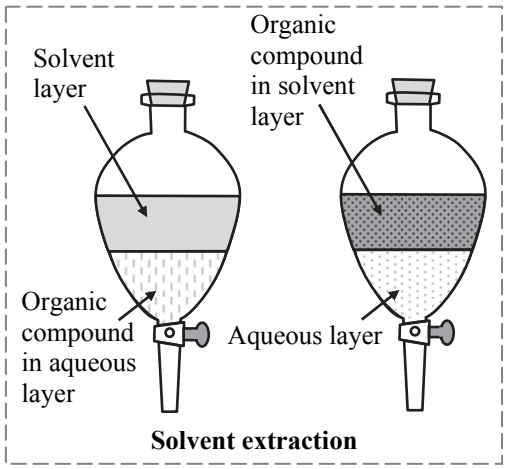
3.4 Solvent extraction

***Q.29. Define: Solvent extraction [1 Mark]**
Ans: ***Solvent extraction*** *is a method used to separate an organic compound present in an aqueous solution, by shaking it with a suitable organic solvent in which the compound is more soluble than water.*

***Q.30. Which properties of solvents are useful for solvent extraction? [1 Mark]**
Ans:
i. Organic compound must be more soluble in the organic solvent, than in water.
ii. Solvent should be immiscible with water and be able to form two distinct layers.

Q.31. Write the principle of solvent extraction and explain the process with labelled diagram. [3 Marks]
Ans: **Principle:** Extraction of compound takes place based on the difference in solubility of compound in two liquids.
i. In this process, the solute distributes itself between two immiscible liquids. From the aqueous phase the solute gets extracted in the organic phase.
ii. On shaking for a few times with small volumes of organic phase, most of the solute gets extracted into the organic phase.
iii. Then solute is then recovered from organic solvent either by evaporation of organic solvent or distillation.

iv. Diagram:



Solvent extraction

Q.32. Write a short note on continuous extraction method. [2 Marks]

Ans:

i. During solvent extraction, if the solute is found to be less soluble in organic phase, then continuous extraction method is employed.

ii. In this method, the same amount of organic solvent is used repeatedly for extraction.

iii. This ensures that the most of the solute gets extracted in the organic phase.

iv. This technique involves continuous distillation of the solvent within the same assembly. Hence, the use of large quantity of organic solvent is avoided.

Q.33. Match the following: [½ Mark Each]

	Process		Used in the purification/separation of
i.	Crystallization	a.	Acetone and benzene
ii.	Simple distillation	b.	Benzoic acid and water
iii.	Fractional distillation	c.	Impure copper sulphate
iv.	Solvent extraction	d.	Acetone and water

Ans: i – c, ii – d, iii – a, iv – b

3.5 Chromatographic techniques

Q.34. What is chromatography? State the principle behind it. [2 Marks]

Ans: ***Chromatography*** *is a technique used to separate components of a mixture, and also purify compounds.*

Principle: The principle of separation of substances in chromatography is based on the distribution of the solutes in two phases. i.e., stationary phase and mobile phase.

***Q.35. Define: Stationary phase [1 Mark]**

Ans: ***Stationary phase*** *is a solid or a liquid phase used in chromatographic technique on which different solutes are adsorbed to different extent.*

***Q.36. Name the different types of chromatographic techniques and explain the principles underlying them. [3 Marks]**

Ans: Depending on the nature of the stationary phase i.e., whether it is a solid or a liquid, chromatography is classified into adsorption chromatography and partition chromatography.

i. Adsorption chromatography: This technique is based on the principle of differential adsorption. Different solutes are adsorbed on an adsorbent to different extent.

Adsorption chromatography is further classified into two types:

a. Column chromatography b. Thin-layer chromatography

ii. Partition chromatography: This technique is based on continuous differential partitioning of components of a mixture between stationary and mobile phases. For example, paper chromatography

***Q.37. Give names of two materials used as stationary phase in chromatography. [1 Mark]**

Ans:

i. Alumina ii. Silica gel

Q.38. Give a brief description of column chromatography with an illustration. **[4 Marks]**

Ans: Column chromatography involves the separation of components over a column of stationary phase. The stationary phase material can be alumina, silica gel.

Procedure:

i. A slurry of the stationary phase material is filled in a long glass tube provided with a stopcock at the bottom and a glass wool plug at the lower end.

ii. The mixture to be separated is dissolved in a suitable solvent and then it is loaded on top of adsorbent column.

iii. A suitable mobile phase which could be a single solvent or a mixture of solvents is then poured over the adsorbent column.

iv. The mixture along with the mobile phase slowly moves down the column.

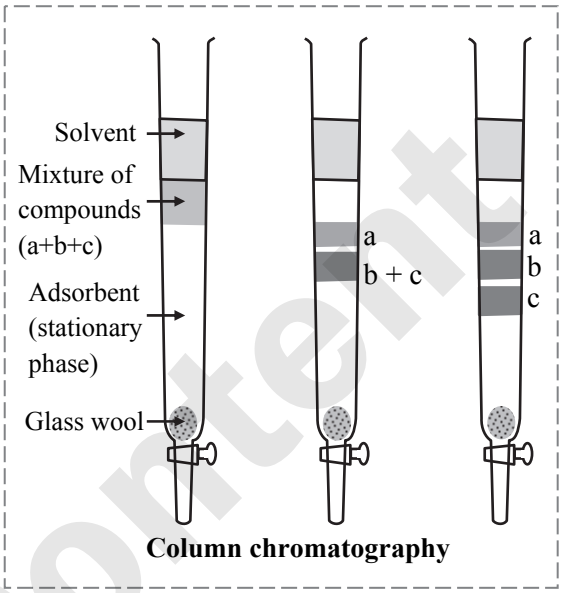
v. The solutes get adsorbed on the stationary phase and depending on the degree to which they are adsorbed, they get separated from each other.

vi. The component which is readily adsorbed is retained on the column and others move down the column to various distances forming distinct bands.

vii. The component which is less strongly adsorbed is desorbed first and leaves the column first, while the strongly adsorbed component is eluted later.

viii. The solutions of these components are collected separately.

ix. These different components can be recovered by evaporating the solvent.



Column chromatography

***Q.39. Why do we see bands separating in column chromatography?** **[2 Marks]**

Ans:

i. In column chromatography, the solutes get adsorbed on the stationary phase and depending on the degree to which they are adsorbed, they get separated from each other.

ii. The component which is readily adsorbed is retained on the column and others move down the column to various distances forming distinct bands.

Hence, we see bands separating in column chromatography.

Q.40. Describe the process of thin layer chromatography (TLC) and separation of components in it. **[4 Marks]**

Ans:

i. Process:

a. A thin layer (about 0.2 mm thick) of an adsorbent like silica gel or alumina is spread over a thin glass plate (called chromplate or TLC plate). This plate acts as a stationary phase.

b. With the help of a capillary tube, the solution of the mixture to be separated is spotted at above 2 cm (on base line) from one end of the TLC plate.

c. The TLC plate is then placed in a closed jar containing a suitable solvent (mobile phase or eluent).

d. As the mobile phase rises up the plate, the components of the mixture move up along with the mobile phase to different distances depending upon their degree of adsorption, thus resulting in complete separation.

ii. Separation of components:

a. If the components are coloured, they appear as separated coloured spots on the plate.

b. If the components are not coloured but have property of fluorescence, they can be visualised under UV light, or the plate can be kept in a chamber containing a few iodine crystals. The Iodine vapours are adsorbed by the components and the spots appear brown.

c. Amino acids are visualised by spraying the plate with a solution of ninhydrin. This is known as spraying agent.

***Q.41. Why should spotting of mixture be done above the level of mobile phase? [1 Mark]**

Ans:

i. If spotting of a mixture is done at the level of mobile phase, then solvent will come in contact with the sample spot.

ii. Sample spot will dissolve in the mobile phase and its components will move all over the plate resulting in no distinct separation.

Hence, spotting of mixture should be done above the level of mobile phase.

Q.42. Name the physical state each of stationary phase and mobile phase in partition chromatography. [1 Mark]

Ans: In partition chromatography, both stationary and mobile phases are in liquid state.

***Q.43. What is the stationary phase in paper chromatography? [1 Mark]**

Ans: In paper chromatography, the water trapped in the fibres of a special quality paper (Whatman paper 1) acts as stationary phase.

***Q.44. How do you visualize colourless compounds after separation in TLC and paper chromatography? [3 Marks]**

Ans:

i. Thin-layer chromatography (TLC): If components are colourless but have the property of fluorescence then they can be visualized under UV light, or the plate can be kept in a chamber containing a few iodine crystals. The iodine vapours are adsorbed by the components and the spots appear brown. Also, spraying agent like ninhydrin can also be used (for amino acids).

ii. Paper chromatography: The spots of the separated colourless components may be observed either under ultra-violet light or by the use of an appropriate spraying agent.

Q.45. Name the following: [1 Mark Each]

i. A glass plate coated with a thin layer of silica gel.

ii. A spraying agent used for the visualization of amino acids.

iii. Paper strip used/developed in paper chromatography.

Ans:

i. Chromplate/TLC plate ii. Ninhydrin iii. Chromatogram

***Q.46. Compare TLC and paper chromatography techniques. [3 Marks]**

Ans:

Chromatography technique	TLC	Paper chromatography
Principle	It is based on the principle of differential adsorption. Different solutes are adsorbed on an adsorbent to different extent.	It is based on continuous differential partitioning of components of a mixture between stationary and mobile phases.
Stationary phase	Solid (adsorbent like silica gel or alumina over a glass plate)	Liquid (water trapped in the fibres of a paper)
Mobile phase	Liquid (single solvent/mixture of solvents)	Liquid (single solvent/mixture of solvents)
Visualization of components of a mixture	Similar to TLC the coloured components are visible as coloured spots and the colourless components are observed under UV light or using a spraying agent.	

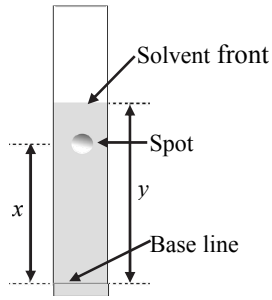
Q.47. Write a short note on R_f value. [2 Marks]

Ans:

i. In chromatography, migration of the solute relative to the solvent front gives an idea about the relative retention of the solutes (or components of the mixture) on the stationary phase.

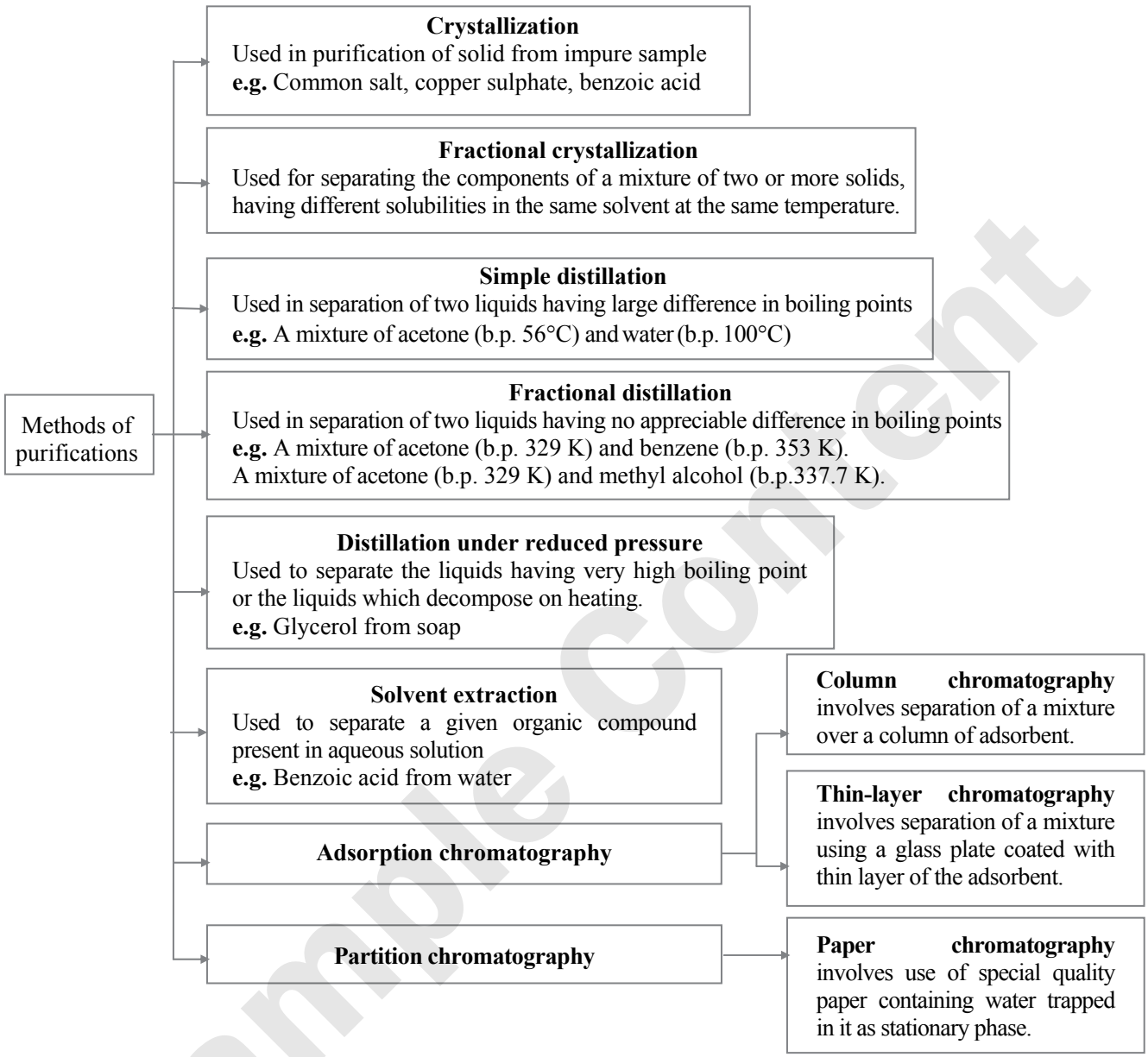
ii. The relative adsorption of solutes is expressed in terms of its R_f value. The symbol R_f stands for Retardation Factor.

$$\therefore \quad R_f = \frac{\text{Distance travelled by the solute from the base line}}{\text{Distance travelled by the solvent from the base line}} = \frac{x}{y}$$



Retention factor

Quick Review



Important Formulae

$$R_f \text{ value} = \frac{\text{Distance travelled by the substance or solute}}{\text{Distance travelled by the solvent}}$$

Exercise

3.2 Purification of solids

1. What are the different types of impurities that a solid may contain? **[1 Mark]**

Ans: *Refer Q.2.*

2. Explain the process of filtration. **[3 Marks]**

Ans: *Refer Q.3.*

3. Explain the process of filtration under suction. **[3 Marks]**

Ans: *Refer Q.5.*

4. Describe in detail how impure solid can be purified by crystallization. **[4 Marks]**

Ans: *Refer Q.8.*

5. What are the criteria for the selection of solvent for the process of crystallization? **[2 Marks]**

Ans: *Refer Q.9.*

6. Name any two solvents used in the crystallization process. **[1 Mark]**

Ans: *Refer Q.10.*

7. State and explain the method of purification you will employ for a sample of impure salt. **[3 Marks]**

Ans: *Refer Q.11.*

8. Define fractional crystallization. **[1 Mark]**

Ans: *Refer Q.14.*

9. Explain: Fractional crystallization. **[3 Marks]**

Ans: *Refer Q.15.*

3.3 Distillation

10. Draw a neat labelled diagram for the process of simple distillation. **[2 Marks]**

Ans: *Refer Q.18.*

11. Describe fractional distillation of acetone (b.p. 329 K) and methyl alcohol (b.p. 337.7K). **[3 Marks]**

Ans: *Refer Q.23.*

12. Draw a neat labelled diagram for the process of fractional distillation. **[2 Marks]**

Ans: *Refer Q.23.*

3.4 Solvent extraction

13. State the principle behind solvent extraction process. **[1 Mark]**

Ans: *Refer Q.31. (Principle)*

14. Explain: Use of large quantity of solvent is avoided in continuous extraction method. **[2 Marks]**

Ans: *Refer Q.32.*

3.5 Chromatographic techniques

15. Write the principle behind partition chromatography. **[1 Mark]**

Ans: *Refer Q.36.*

16. Write formula for calculating the R_f value. **[1 Mark]**

Ans: *Refer Q.47. (ii)*

Multiple Choice Questions

[1 Mark Each]

1. If a crude solid is made of mainly one substance and has some impurities then it is purified by _____.
   (A) crystallization (B) distillation
   (C) extraction (D) sublimation

2. Impure common salt can be purified by _____.
   (A) crystallization (B) distillation
   (C) extraction (D) sublimation

*3. Which of the following methods can be used to separate two compounds with different solubilities in the same solvent?
   (A) Fractional crystallization
   (B) Crystallization
   (C) Distillation
   (D) Solvent extraction

4. Which of the following solvents is most commonly used for the crystallization of copper sulphate?
   (A) Water (B) Acetone
   (C) Ether (D) Methanol

5. In distillation of liquid, water condenser is used _____.
   (A) to boil the liquid
   (B) to collect the liquid
   (C) to condense hot vapours of the liquid
   (D) to adsorb the liquid

*6. A mixture of acetone and benzene can be separated by the following method _____.
   (A) simple distillation
   (B) fractional distillation
   (C) distillation under reduced pressure
   (D) sublimation

7. Separation of binary mixture of acetone and methyl alcohol is done by _____.
   (A) simple distillation
   (B) fractional distillation
   (C) fractional crystallization
   (D) re-crystallization

8. Which of the following method is used to separate different fractions of crude oil?
   (A) Solvent extraction
   (B) Simple distillation
   (C) Fractional distillation
   (D) TLC

*9. Which of the following techniques is used for separation of glycerol from soap in soap industry?
   (A) Distillation under reduced pressure
   (B) Fractional distillation
   (C) Filtration
   (D) Crystallization

10. The method used to separate a given organic compound present in aqueous solution by shaking with a suitable solvent in which the compound is more soluble than water is called _____.
   (A) simple distillation
   (B) fractional distillation
   (C) solvent extraction
   (D) crystallization

*11. Which technique is widely used in industry to separate components of mixture and also to purify them?
(A) Steam distillation
(B) Chromatography
(C) Solvent extraction
(D) Filtration

12. Adsorption chromatography is a chromatographic technique based on the principle of _____.
(A) differential adsorption
(B) differential solubility
(C) differential extraction
(D) all of these

13. The stationary phase and mobile phase in TLC are _____ respectively.
(A) solid and liquid
(B) solid and gas
(C) liquid and solid
(D) liquid and liquid

14. Which of the following is most commonly used for the visualization of amino acids in chromatography?
(A) Ultraviolet light
(B) Spraying agent
(C) Sunlight
(D) X-rays

15. The stationary phase and mobile phase in partition chromatography are _____ respectively.
(A) solid and liquid
(B) solid and gas
(C) liquid and solid
(D) liquid and liquid

*16. Colourless components on chromatogram CANNOT be observed by which of the following?
(A) Using UV light
(B) Using iodine chamber
(C) Using the spraying reagent
(D) Using infrared light

17. Paper chromatography is based on the principle of _____.
(A) adsorption
(B) partition
(C) solubility
(D) volatility

18. In paper chromatography, the mobile phase rises up the chromatography paper due to _____.
(A) evaporation of volatile solvent
(B) capillary action
(C) gravitational force
(D) differential adsorption

19. Which of the following is a type of partition chromatography?
(A) Column chromatography
(B) Thin layer chromatography
(C) Paper chromatography
(D) Both (B) and (C)

20. The principle of differential adsorption is applicable for which of the following chromatographic technique?
(A) Column chromatography
(B) Thin layer chromatography
(C) Paper chromatography
(D) Both (A) and (B)

Answers to Multiple Choice Questions

1.	(A)	2.	(A)	3.	(A)	4.	(A)
5.	(C)	6.	(B)	7.	(B)	8.	(C)
9.	(A)	10.	(C)	11.	(B)	12.	(A)
13.	(A)	14.	(B)	15.	(D)	16.	(D)
17.	(B)	18.	(B)	19.	(C)	20.	(D)

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