

Objective

- Solvent extraction is a process:
 (A) Equilibrium (B) Non-equilibrium (C) Endothermic (D) Exothermic
- Chromatography in which the stationary phase is a solid is classified as:
 (A) Gas Chromatography (B) Adsorption Chromatography
 (C) Thin layer (D) Partition Chromatography
- The rate at which the solute moves in paper Chromatography depends upon:
 (A) Distribution coefficient (B) Distribution law
 (C) Low partial pressures (D) Boiling point of the solvent
- In paper Chromatography the point at which the solvent rises the maximum extent is called:
 (A) Solvent front (B) Base line (C) Chromatogram (D) Eluent
- Chromatography is the process which involves the distribution of a solute between:
 (A) Two stationary phases (B) stationary phase and mobile phase
 (C) Two, two stationary and mobile phases (D) Two mobile phases
- In paper Chromatography mobile phase is:
 (A) Solid (B) Liquid (C) Gas + Liquid (D) Gas
- Which of the following technique is useful in organic synthesis for separation, purification and identification of products?
 (A) Chromatography (B) Solvent extraction (C) Filtration (D) Sublimation
- The pattern of inks formed on paper in Chromatography is called:
 (A) Chromatograph and Chromatogram (B) Chromatograph
 (C) Chromatogram (D) Chromatophore
- The locating agent which cannot be used to identify colorless components in Chromatography is:
 (A) HCl (B) Ninhydrin (C) H₂S (D) Rubenic Acid
- Solvent extraction is an equilibrium process and it is controlled by:
 (A) The amount of solute (B) Distribution law
 (C) The amount of solvent used (D) Law of mass action
- Solvent extraction method is a particularly useful technique for separation when the product to be separated is:
 (A) Volatile or thermally stable (B) Volatile or thermally unstable
 (C) Non-volatile or thermally stable (D) Non-volatile or thermally unstable
- The comparative rates at which the solutes move in paper chromatography, depend on:
 (A) Size of the chromatographic tank used (B) R values Of solutes
 (C) Temperature of the experiment (D) The size of paper
- One of the following substances does not undergo sublimation:
 (A) Iodine (B) NH₄Cl (C) Naphthalene (D) KMnO₄

14. Which one of the following compound is purified by sublimation:
 (A) Benzoic acid (B) NaI (C) CS₂ (D) SiO₂
15. Direct conversion of solid into its vapour is called:
 (A) Distribution (B) Vapourization (C) Crystallization (D) Sublimation
16. Which of the following pairs can be separated by sublimation?
 (A) NaCl and KCl (B) Sand and naphthalene
 (C) Sand and broken pieces of glass (D) Sand and NaCl
17. Which of the following substances is a sublime material?
 (A) Acetic acid (B) Benzoic acid (C) NaCl (D) Potash alum
18. Which one is not sublimable in laboratory?
 (A) Naphthalene (B) Benzoic Acid (C) NH₄Cl (D) AlCl₃
19. In technique a solute distribute between two immiscible liquids:
 (A) Filtration (B) Solvent extraction
 (C) Distillation (D) Crystallization
20. Solvent extraction is an equilibrium process and it is controlled by:
 (A) The amount of solvent used (B) Distribution law
 (C) The amount of solute (D) Law of mass action
21. Solvent extraction method is particularly useful technique for separation when the product to be separated is:
 (A) Volatile or thermally stable (B) Volatile or thermally unstable
 (C) Non-volatile or thermally stable (D) Non-volatile or thermally unlabel
22. Equilibrium is established during the process of solvent extraction and the phenomenon obeys:
 (A) Law of chemical equilibrium (B) Distribution law
 (C) Le-chatelier's principle (D) Law of mass action
23. The iodine present in water can be separated by which one of the following techniques?
 (A) Chromatography (B) Filtration (C) Sublimation (D) Solvent extraction
24. If Solvent front is 10 cm and distance travelled by solute is 1.2 cm, what is its R_f value?
 (A) 8.3 (B) 1.2 (C) 0.83 (D) 0.12
25. The most common Solvent used for solvent extraction is:
 (A) Ethanol (B) Carbon tetrachloride (C) Ether (D) Water
26. Iodine is soluble in:
 (A) CCl₄ (B) Water (C) NaCl (D) Water and CCl₄
27. The liquid obtained after passing the mixture through filter paper is termed as:
 (A) filterate (B) solid (C) residue (D) none of these
28. Selection of filter paper depends on size of particles to be:
 (A) filtered (B) seen (C) unseen (D) none of these
29. The tip of the funnel should be along the beaker in order to avoid:

- (A) sampling (B) splashing (C) leakage (D) none of these
30. The filtration process is used to separate solid from:
(A) liquid (B) solid (C) none of these (D) gas
31. Detection of functional group is called:
(A) numerical analysis (B) qualitative analysis
(C) numerical analysis (D) none of these
32. The identification of a components of a sample is known as:
(A) numerical analysis (B) qualitative analysis
(C) quantitative analysis (D) none of these
33. For smooth filtration which one of the following precaution should be used:
(A) the stem of funnel should be small.
(B) the tip of funnel should touch the base of beaker.
(C) the filter paper should be small.
(D) the stem of the funnel should remain continuously full of liquid.
34. Identification of a substance, determination of its structure and quantitative analysis of its composition are the aspects covered by:
(A) biology (B) modern analytical chemistry
(C) modern analytical biology (D) modern analytical physics
35. In fluted filter paper, rate of filtration increases as compared to the cone shaped filter paper because:
(A) It has greater number of holding in it.
(B) Thickness of paper is more than cone shaped filter paper.
(C) Fluted filter paper has greater pore size than shaped filter paper.
(D) It has greater surface area for filtration.
36. Which one of the following substance is used as decolorizing agent:
(A) asbestos (B) animal charcoal (C) conc. H_2SO_4 (D) silica gel
37. Gooch crucible is used to filter the solution of:
(A) K_2SO_4 (B) $KMnO_4$ (C) $K_2Cr_2O_7$ (D) KOH
38. "The components of which mixture can be separated by sublimation:
(A) blue and green inks (B) sand and naphthalene
(C) calcium carbonate and NaCl (D) NaCl and $CaCl_2$
39. 95% ethanol is called:
(A) rectified spirit (B) petrol (C) diesel (D) crystal
40. The solution remaining after the formation of crystals is called:
(A) mother liquor (B) residue (C) crystal (D) None of these
41. $CaCl_2$ and P_2O_5 are used as:
(A) deluting agents (B) drying agents (C) residue agents (D) None of these
42. Which one of the following substances is not used as drying agent in desiccators:
(A) crystal (B) Phosphorous pentoxide (C) $CaCl_2$ (D) NaCl(50%)

43. Which one of the following property is suitable for good solvent:
- (A) It should dissolve impurities easily.
 (B) It should be expensive.
 (C) It should react chemically with solute.
 (D) It should dissolve solute at high temperature.
44. Direct conversion of solid into vapours is called:
- (A) impurities (B) sublimation (C) crystals (D) None of these
45. naphthalene, iodine and NH_4Cl can be purified by:
- (A) residuc (B) sublime (C) None of these (D) sublimation
46. In a better method, the process of sublimation is carried out in a:
- (A) normal finger (B) cold finger (C) hot finger (D) None of these
47. One of the following substances does not undergo sublimation:
- (A) iodine (B) NH_4Cl (C) naphthalene (D) KMnO_4
48. In CCl_4 solvent I_2 shows:
- (A) ping colour (B) purple colour (C) blue colour (D) brown colour
49. $\frac{[\text{I}_2\text{CC}_4]}{[\text{I}_3^- (\text{aq})]}$:
- (A) equilibrium constant (B) distribution co-efficient
 (C) rate constant (D) distrution constant
50. Paper chromatography was discovered by Consdon in:
- (A) 1944 (B) 1744 (C) 1844 (D) 1644
51. Proteins and amino acid can be separated by:
- (A) chromatography (B) mobile phase (C) mixed phase (D) stationary phase
52. Substances produced by body like urine can be separated by:
- (A) mixed phase (B) chromatography (C) stationary phase (D) mobile phase
53. Thin film of absorbed water on cellulose acts as:
- (A) stationary phase (B) sublimation (C) mixed phase (D) none of these
54. In paper chromatography the rate at which solute move depend on:
- (A) distribution law (B) distribution coefficients
 (C) law of partial pressure (D) law of definite proportions
55. Chromatography in which stationary phase is a solid is called:
- (A) partition chromatography (B) adsorption chromatography
 (C) decending chromatography (D) coloumn chromatography
56. In chromatography, the point at which solvent maximum rises called:
- (A) element (B) solvent front (C) chromatogram (D) base line
57. The components of which mixture can be separated by chromatography:
- (A) NaCl and CaCl_2 (B) blue and red inks
 (C) Cell potential (D) sand and naphthalene

Fill in the blanks

- Q1: A complete chemical characterization of a compound must include
- Q2: A solvent used for crystallization is required to dissolve of the substance at its boiling point and at the room temperature.
- Q3: Repeated solvent extractions using small portions of solvent are than using a single extraction with larger volume of the solvent.

Answers



1. Qualitative & quantitative analysis
2. Large amount , small amount
3. More efficient

Chapter : 02

Experimental techniques in chemistry

Subjective

Q1: Define analytical chemistry.

Ans: Analytical chemistry:

Analytical chemistry is the science of chemical characterization.

Q2: Give the major steps for the complete quantitative analysis?

Ans: Quantitative analysis involves following steps:

- ❖ *Measurement and calculations of results.*
- ❖ *Drawing conclusion.*
- ❖ *Measurement and calculations of results.*
- ❖ *Separation of desired constituent.*

Q3: Differentiate between qualitative and quantitative analysis?

Ans: Difference between qualitative and quantitative analysis is:

| Qualitative analysis | Quantitative analysis |
|--|--|
| <i>The analysis in which we detect or identify the elements present in a compound.</i> | <i>The analysis in which we determine the relative amount of elements in a compound.</i> |

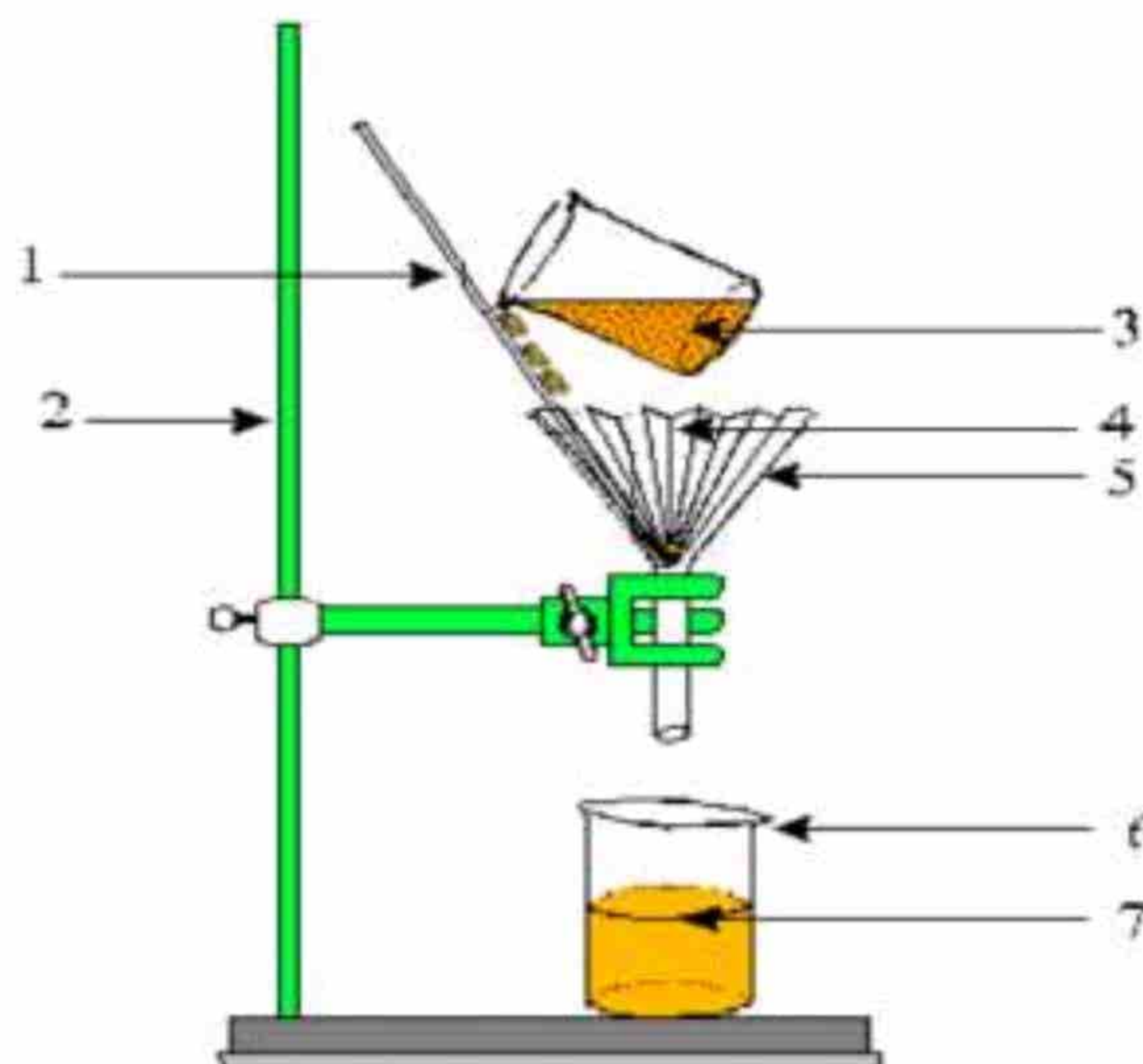
Q4: Concentrated HCl and KMnO₄ solutions cannot be filtered by Gooch crucible. Give reason?

Ans: *Gooch crucible is made up of porcelain and its bottom is covered with filter paper or paper pulp. Conc. HCl and KMnO₄ solution react with filter paper. Hence it is not separated by using Gooch crucible.*

Q5: Media which are used for filtration should be selected on the basis of precipitates. Explain?

Ans: *Different precipitates have different sizes. Filter medium is decided by the size of particles. Mostly two media are used for filtration.*

This diagram is just for information.



- ❖ Filter paper
- ❖ Crucibles

Q6: **What is filter medium. Name two?**

Ans: **Filter medium:**

The porous substance used for filtration is called filter medium.

Names are as follows:

- ❖ Sintered glass.
- ❖ Gooch crucible.
- ❖ Filter paper.

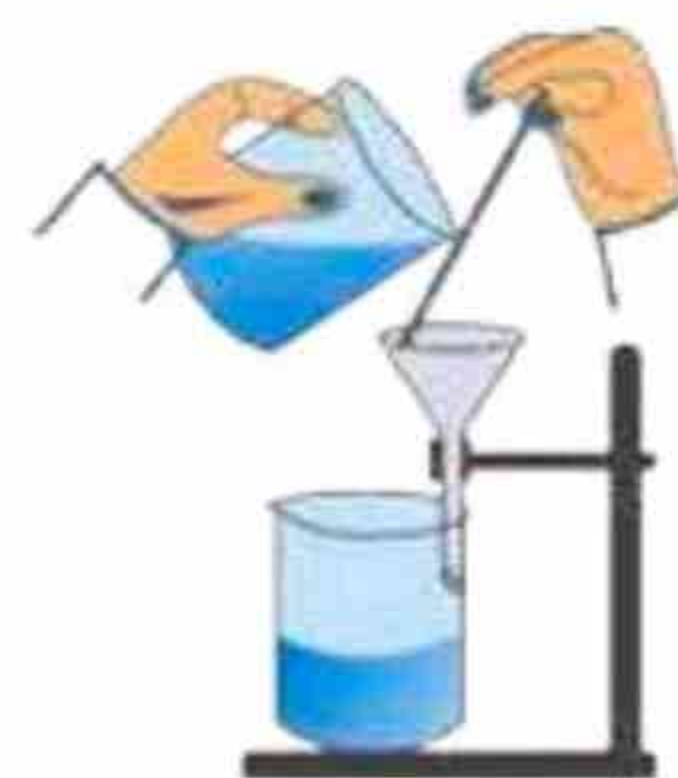


Fig. Filtration assembly

Q7: **What is fluted filter paper? Give its advantages?**

Ans: **Fluted filter paper:**

The filter paper is folded in such a way that a fan like arrangement with alternate elevations and depressions at various folds is obtained. By using fluted filter paper rate of filtration is increased.

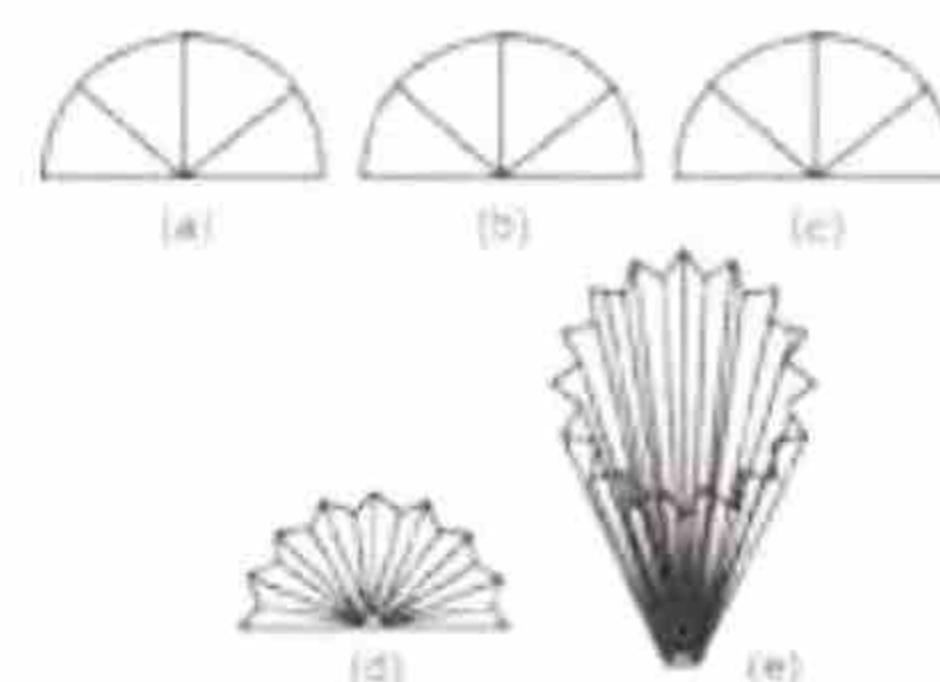


Fig. Fluted filter paper

Q8: **Why sintered glass crucible is preferred to Gooch crucible?**

Ans: In Gooch crucible filter medium is prepared itself. Filter medium may be many folds of filter paper or asbestos mat. In sintered glass crucible no filter medium is prepared.

Q9: **What do you mean by Gooch crucible?**

Ans: **Gooch crucible:**

It is made up of porcelain having a perforated bottom which is covered with paper pulp or filter paper or asbestos mat. For quick filtration it is placed on suction apparatus.

Q10: **How can rate of filtration be increased?**

Ans: Rate of filtration can be increased by using fluted filter paper. Fluted filter gives greater surface area for filtration.

Q11: **Explain filtration through Gooch crucible?**

Ans: It is made up of porcelain having a perforated bottom. The bottom is covered with filter paper. It is useful for filtration of precipitates which need to be ignited at high temperature.

Q12: **How does Gooch Crucible increases the rate of Filtration?**

Ans: Quick filtration can be done by placing the Gooch crucible in a suction filtering apparatus. It is useful for the filtration of precipitates, which need to be ignited a high temperature.

Q13: **What is sintered glass crucible? Give its significance.**

Ans: **Sintered glass crucible:**

Sintered glass crucible is the glass crucible with a porous glass disc sealed into the bottom.

Significance:

It is very convenient to use because no preparation is needed as with Gooch crucible.

This diagram is just for information.

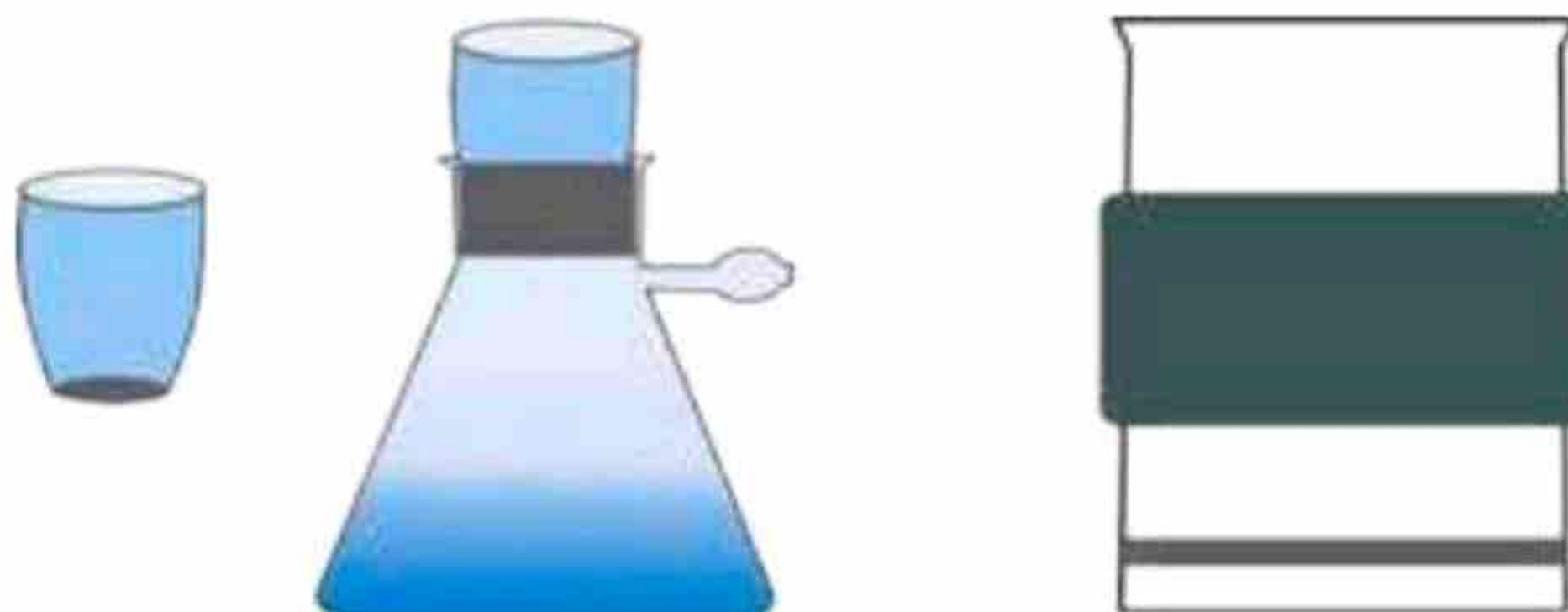


Fig. Gooch Crucible with filtering apparatus

Fig Sintered glass Crucible

Q14: **Define crystallization?**

Ans: Crystallization:

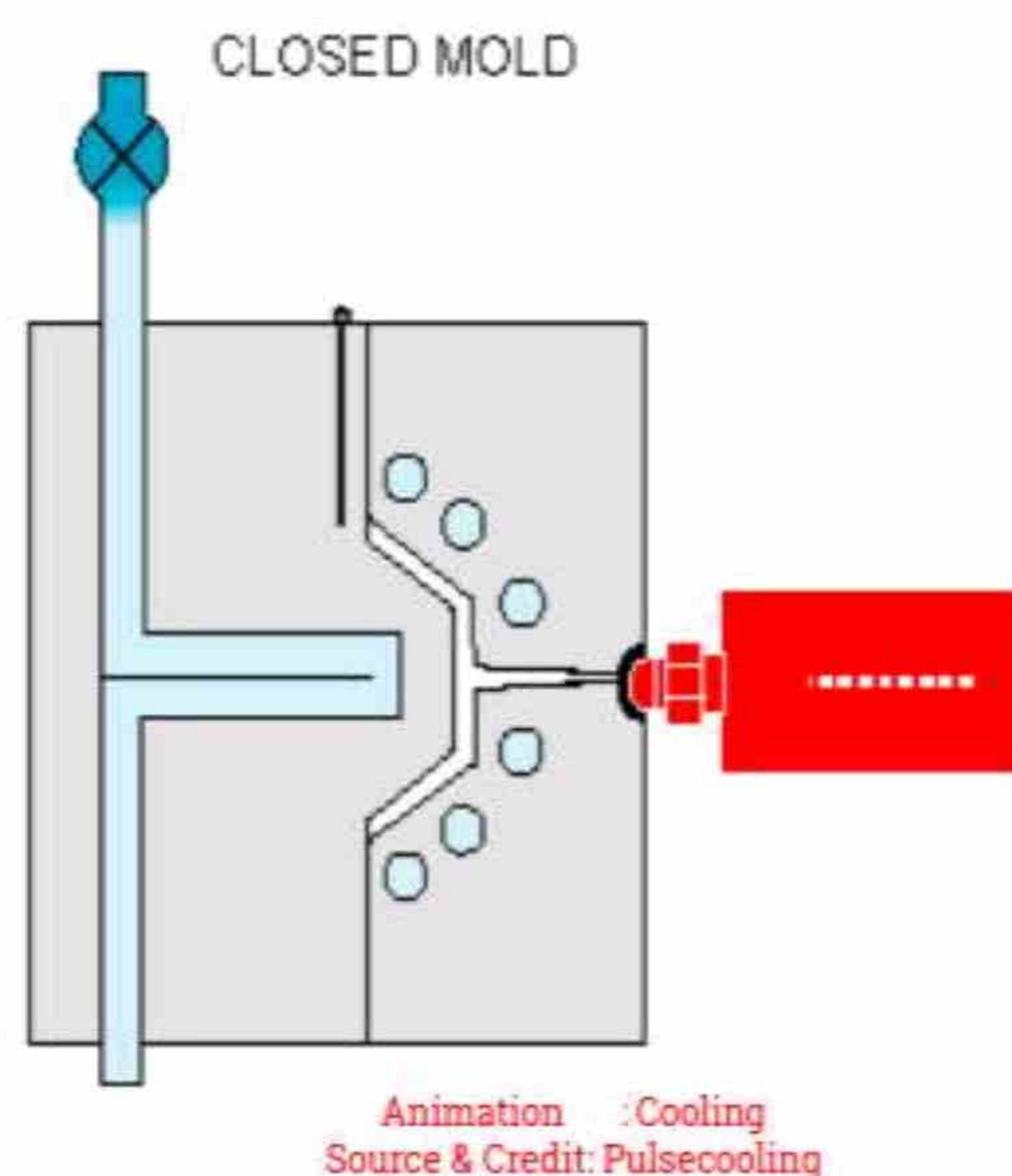
The process of obtaining crystals by cooling its hot saturated solution is called crystallization.

Q15: **Give the main characteristics of the solvent used for crystallization?**

Ans: The main characteristics of the solvent used for crystallization:

- ❖ It should be safe to use.
- ❖ It should be cheap.
- ❖ It should be easily removable.
- ❖ It should not react chemically with solute.

This diagram is just for understanding.



On cooling it should deposit will form crystals of pure substance.

Q16: **Name the steps which are used in crystallization?**

Ans: Following steps are involved in crystallization:

- ❖ Choice of solvent.
- ❖ Filtration.
- ❖ Drying the crystals.
- ❖ Preparation of saturated solution.
- ❖ Cooling.
- ❖ Collecting the crystals.
- ❖ Decolourization of undesirable colour.

Q17: **What is a disadvantage of slow crystallization?**

Ans: Slow cooling gives bigger sized crystals which usually contain solvent with impurities. Such crystals are difficult to dry.

Q18: **Name four important solvents chosen for crystallization?**

Ans: Water, rectified spirit, absolute alcohol, diethyl ether, chloroform, carbon tetrachloride, petroleum ether and acetone and acetic acid.

Q19: **State solvent extraction and give its importance?**

Ans: Solvent extraction:

The gain of a substance from a solution with the help of an immiscible solvent is called solvent extraction. This method of separation is mostly used to separate organic compounds from water.

Q20: **Describe method to collect crystals from its mother liquor?**

Ans: When crystals are prepared, the solution left behind is called mother liquor. Crystals are removed from mother liquor by filtration. Those crystals are then washed with small amount of cold solvent.

Q21: **Name chemicals which are used as drying agents in the desiccators?**

Ans: The most common drying agents are:

- ❖ Phosphorous pentaoxide.
- ❖ Silica gel.
- ❖ CaCl₂

Q22: **The vacuum desiccator is a safe and reliable method for drying the crystals. Explain?**

Ans: A safe and reliable method of drying crystals is through vacuum desiccator. In this method crystals are spread on a watch glass and kept in a vacuum desiccator for several hours. The drying agent is mostly CaCl₂, silica gel, P₂O₅ etc.

Q23: How undesirable colours are removed from crystals?

Ans: Colouring impurities are removed by boiling the substance in the solvent with animal charcoal. The solution is then filtered. The impurities are adsorbed by animal charcoal.

Q24: Write down any two methods of drying of crystals?

Ans: Two methods of drying of crystals:

- ❖ By the use of vacuum desiccator. In this process the crystals are spread over a watch glass and kept in vacuum desiccator for several hours. The drying agents used in desiccator are CaCl_2 , silica gel and phosphorous penta-oxide.
- ❖ Drying can be done in an oven, provided the substance does not melt or decompose on heating at 100°C .

Q25: Why is there a need to crystallize the crude product?

Ans: The crude product has soluble and insoluble impurities. The insoluble impurities are removed by filtration and to remove soluble impurities we have to use the process of crystallization. Pure crystals of this product are obtained.

Q26: How crystals are dried using filter paper? Give its two disadvantages?

Ans: Crystals are pressed between different folds of filter papers and repeating the process several times dries the crystalized substances.

Disadvantages:

This process has the disadvantages that the crystals are crushed to a fine powder and sometimes the fibers of filter paper contaminate the product. Moreover, this drying process is time consuming.

Q27: Name the various experimental techniques which are used for purification of substances?

Ans: Name of the various experimental techniques which are used for purification of substances:

- ❖ Chromatography.
- ❖ Crystallization.
- ❖ Filtration.

Q28: How crystals are dried in vacuum desiccator?

Ans: A safe and reliable method of drying crystals is through a vacuum desiccator. In this process the crystals are spread over a watch glass and kept in a vacuum desiccator for several hours. The drying agents used in a desiccator are CaCl_2 silica gel or phosphorus ptaoxide.

Q29: Define filtration and crystallization.

Ans: Filtration:

The process of filtration is used to separate insoluble particles from liquid. It can be performed with several types of filter media. Nature of precipitate and other factors dictate which filter medium must be used.

Crystallization:

The preparation of chemical compound affords a crude product and there is a need of purify it by crystallization from suitable solvent. The basic principle of crystallization is the fact that the solute should be soluble in a suitable solvent at high temperature and the excess of the solute is thrown out as crystals when it is cooled.

Q30: How saturated solution for crystallization can be prepared?

Ans: After selecting suitable solvent, the substance is then dissolved in a minimum amount of solvent and is heated directly or on a water bath with constant stirring. Add more solvent to the boiling solution if necessary until all the solute has dissolved.

Q31: How crystals are dried in an oven?

Ans: Crystals are dried in an oven provided the substance does not melt or decompose on heating at 100 °C.

Q32: **Define sublimation with two examples?**

This diagram is just for information.

Ans: **Sublimation:**

The process in which a solid is directly converted into vapors without passing through the liquid phase, and then it can be condensed to obtain solid again is called sublimation.

Examples:

- ❖ Ammonium chloride
- ❖ Iodine, benzoic acid.



Fig SUBLIMATION

Q33: **Define sublimation and partition law?**

Ans: Sublimation is a process in which a solid, when heated vaporizes directly without passing through the liquid state.

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

Q34: **How mixture of NH_4Cl and NaCl can be separated?**

Ans: Mixture of NH_4Cl and NaCl can be separated by sublimation process, because ammonium chloride sublime while NaCl cannot.

The potential setup when an electrode is in contact with one molar solution of its own ions at 298K is called standard electrode potential. It is denoted by E° .

Q35: **How purification is carried out by Sublimation?**

Ans: Sublimation is a process in which a solid, when heated, vaporizes directly without passing through the liquid phase and these vapours can be condensed to form the solid again.

To carry out the process, the substance is taken in a watch glass covered with an inverted funnel. The substance is then heated slowly over a sand-bath and, the funnel is cooled with wet cotton.

Q36: **How mixture of sand and naphthalene can be separated?**

Ans: Mixture of sand and naphthalene can be separated by sublimation process, because naphthalene can sublime upon heating the mixture and sand cannot.

Q37: **Write names of substances purified by sublimation.**

Ans: The names of substances purified by sublimation:

- ❖ Naphthalene.
- ❖ Ammonium chloride.
- ❖ Iodine.
- ❖ Benzoic acid.

Q38: **Write names of substances purified by sublimation.**

Ans: The names of substances purified by sublimation:

- ❖ Naphthalene.
- ❖ Ammonium chloride.
- ❖ Iodine.
- ❖ Benzoic acid.

Q39: **Iodine is more soluble in water in the presence of KI . Discuss?**

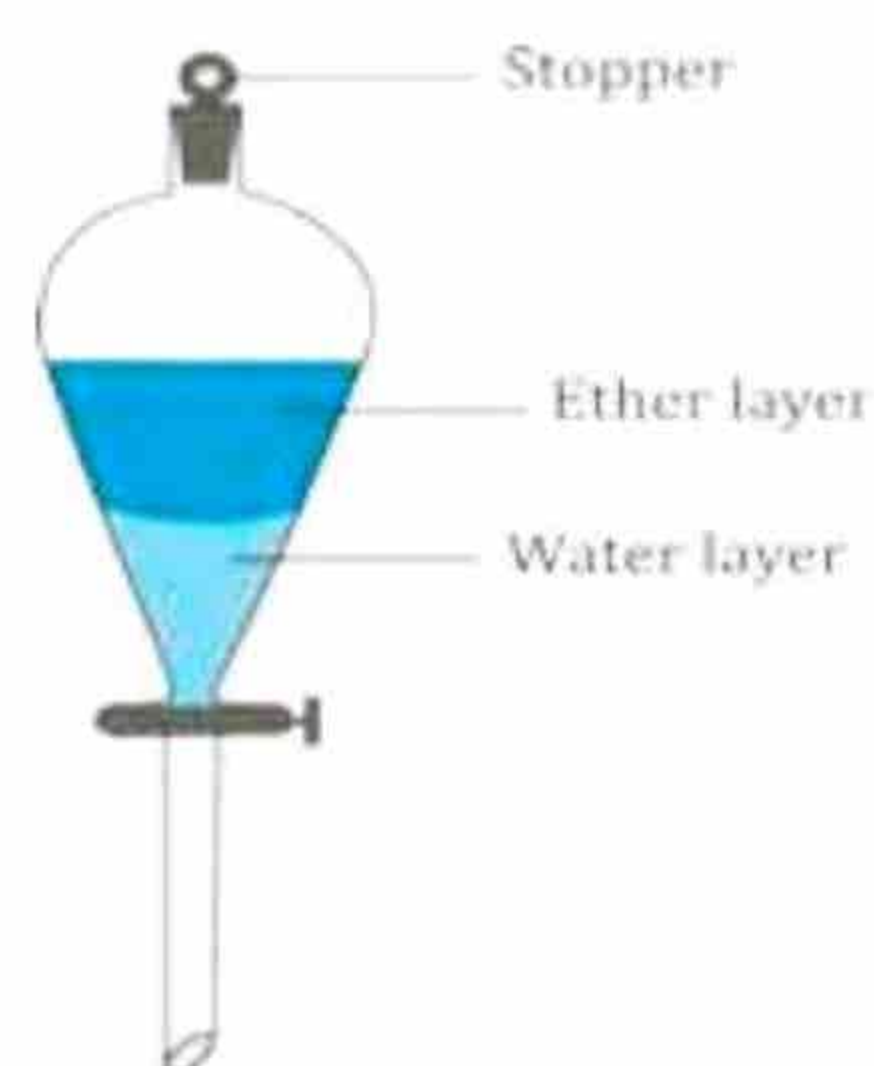
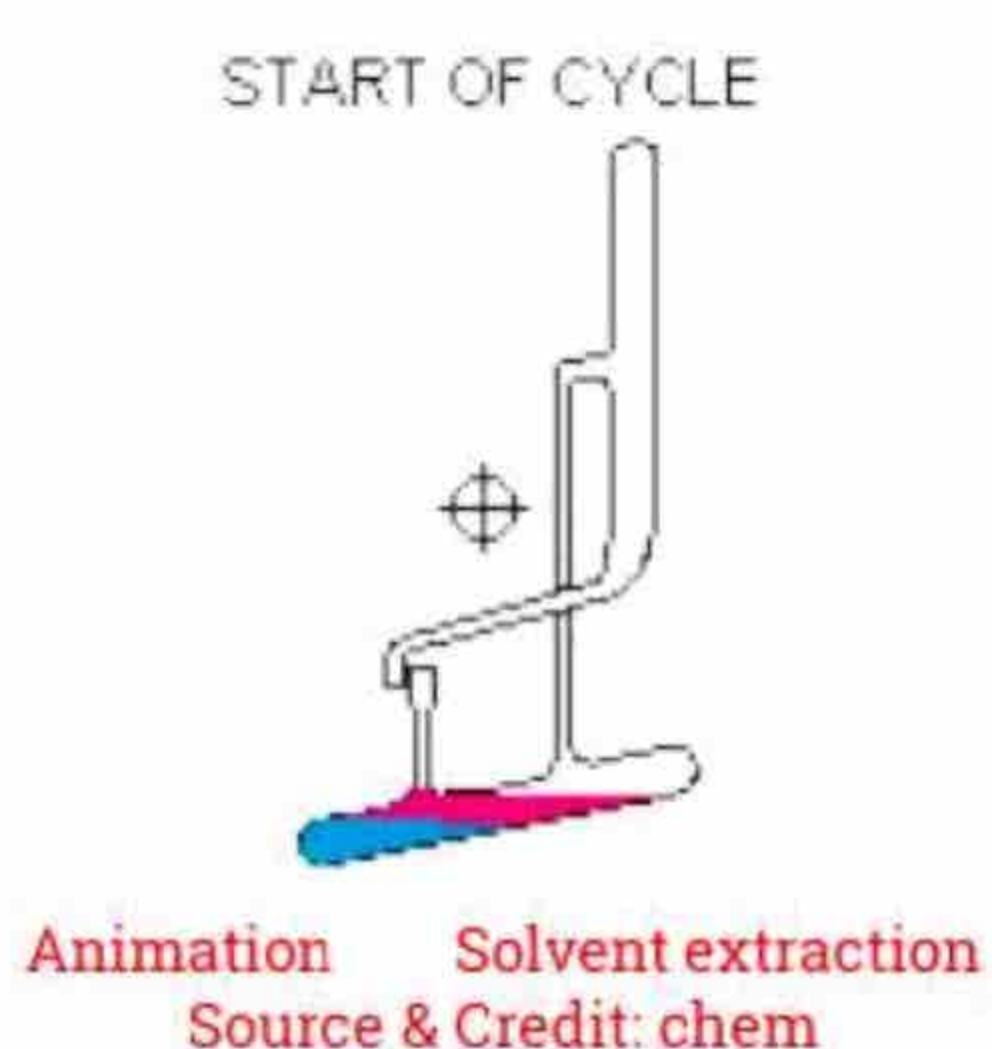
Ans: As we know that like dissolve like so KI when dissolve in H_2O give iodide ion which is soluble in H_2O . But I_2 is a non-polar compound and is not dissolved in H_2O . Iodine in presence of I^- ion is converted to I_3^- . Which is water soluble.

Q40: **Define Solvent Extraction and Partition Law?**

Ans: Solvent extraction is a technique in which a solute can be separated from a 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.

Solvent extraction is an equilibrium process and follows the distribution law or 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.

This diagram is just for information.



Q41: **State distribution law or partition law?**

Ans: **Distribution law:**

At constant temperature a solute distributes itself between two immiscible liquids in a constant ratio of concentration independent of the amount of solute added.

Q42: **Define distribution law and partition law?**

Ans: Solvent extraction is an equilibrium process and follows the distribution law or 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.

Q43: **Describe Ether Extraction.**

Ans: The most common laboratory example of solvent extraction is ether extraction. This is used to separate the products of organic synthesis from water. In a typical organic synthesis, the aqueous solution containing the organic product is shaken up with ether in a separating funnel and allowed to separate.

The inorganic impurities remain in aqueous phase, whereas the organic compound goes to the ether layer. The ether layer is separated and organic product is obtained by evaporating the ether.

Q44: **What do you mean by solvent extraction? Which law controls it?**

Ans: Solvent extraction is a technique in which solute can be separated from a 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.

Usually it is done by placing the solution and the second liquid into a separating funnel. The funnel is stoppered and the two liquids are shaken together. This process is controlled by distribution law.

Q45: **State Law of distribution constant.**

Ans: Solvent extraction is done by placing the solution and the second liquid into a separating funnel. The funnel is stoppered and the two liquids are shaken together. This process is controlled by distribution law.

The ratio of the final concentration at equilibrium is constant. This is called distribution coefficient, K . In case of distribution of iodine in CCl_4 , K is given by:

$$K = \frac{[I_2CC_4]}{[I_3^- (aq)]}$$

Q46: **What is solvent extraction. Give its importance.**

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

Solvent extraction is an important technique of chemical analysis. It is used when substance to be separated is volatile or thermally unstable.

Q47: **In solvent extraction technique, why repeated extraction using small portions of solvent are more efficient than using a single extraction but larger volume of solvent.**

Ans: Because a solute distributes itself between solvent and solution in a constant ratio of concentrations irrespective of the amount of solute added. Using small amount of fresh solvent, a greater extent of solute is extracted out, so repeated extraction is more efficient.

Q48: **In solvent extraction technique, repeated extraction using small portions of solvent are more efficient than using a single extraction, but larger volume of solvent?**

Ans: Separation of solute depends upon the distribution ratio of solute in mobile and stationary phase.

$$K = \frac{[C_m]}{[C]}$$

Repeated extraction with small portion of solvents gives better separation because again and again equilibrium is established between two phases. More amount of solute is distributed among the mobile phase using small portion.

Q49: **What do you mean by (a). chromatogram (b). Filtrate?**

Ans: **(a) Chromatogram:**

The dried paper at which various components have been separated is called chromatogram. From chromatogram R values are determined.

(b) Filtrate:

The liquid which is obtained after passing through the filter medium is called filtrate.

Q50: **Differentiate between stationary phase and mobile phase?**

Ans: Difference between stationary phase and mobile phase:

| Stationary phase | Mobile phase |
|--|--|
| It may be a solid or liquid supported by an inert solid. | It may be a liquid or a gas. It flows over stationary phase. |

Q51: **Define chromatography and give formula of distribution coefficient?**

Ans: It is an analytical technique used for the separation of a mixture due to different distribution of substances between stationary and mobile phase.

$$K = \frac{[\text{Concentration of a component in mobile phase}]}{[\text{Concentration of a component in stationary phase}]}$$

Q52: **Differentiate between adsorption and partition chromatography? Or**

What are different types of chromatography?

Ans: Difference between adsorption and partition chromatography is:

| Adsorption Chromatography | Partition Chromatography |
|--|--|
| ❖ Chromatography in which stationary phase is a solid is called adsorption chromatography. | ❖ Chromatography in which stationary phase is a liquid is called partition chromatography. |

❖ Example: Column chromatography.

❖ Example: Paper chromatography.

Q53: Define R_f value and why it has no unit?**Ans: R_f value:**

R_f value is defined as the ratio of the distance travelled by a component from a base line to the distance travelled by solvent from base line.

$$R_f = \frac{\text{[Distance travelled by a component from base line]}}{\text{[Distance travelled by solvent from base line]}}$$

It has no units because it is ratio of distance to distance.

Q54: Give two application of paper chromatography?**Ans: Two application of paper chromatography:**

- ❖ It is used for qualitative and quantitative analysis.
- ❖ It is used for separation and purification of substances from a mixture.

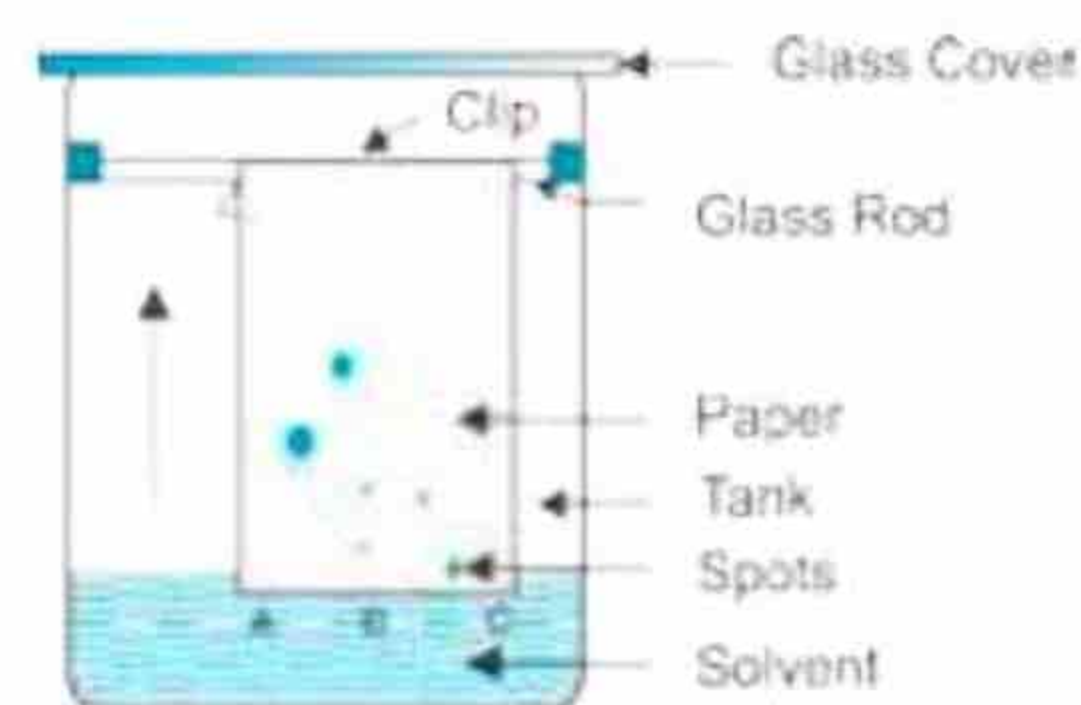


Fig. Paper chromatography

Q55: Give two uses of chromatography?**Ans: Two uses of chromatography:**

- ❖ They are equally important in qualitative and quantitative analysis and for determination of the purity of a substance.
- ❖ The techniques of chromatography are very useful in organic synthesis for separation, isolation and purification of the products.

Q56: What do you mean by partition chromatography?

Chromatography, in which the stationary phase is a liquid, is called partition chromatography. In this type, the substances being separated are distributed throughout both the stationary and mobile phases.

Example:

Paper chromatography.

Q57: Why crystallization is a better technique for separation and purification?

In crystallization process, the extent of purification of solute is large without decomposition. The amount of solute dissolved in minimum quantity of suitable solvent, more and more with increase in temperature and this process does not require very high temperature conditions.

At the end, we get pure crystals of solid substance. That's why crystallization is a better technique for separation and purification.

Q58: Define macro chromatography with example.**Ans: Macro chromatography:**

When a column chromatography is carried out on large scale using large column packed with sand or beads to purify the substance or for separation of component of a mixture.

Example:

The vaporization of frozen carbon dioxide (dry ice) at ordinary atmospheric pressure and temperature.