ESTD: 2001

AEP

STUDY CIRCLE

UNIT OF ACCENTS EDUCATIONAL PROMOTERS

OFFLINE-ONLINE LEARNING PLATFORM

IS MATTER AROUND US PURE CBSE IXTH

IS MATTER AROUND US PURE : QUESTIONS AND ANSWERS NCERT EXEMPLARS AND FOUNDATIONS

IS MATTER AROUND US PURE : QUESTIONS AND ANSWERS NCERT EXEMPLARS AND FOUNDATIONS

HELPLINE:
+91-9939586130 ; +91-773965050

email:
aepstudycircle@gmail.com

IS MATTER AROUND US PURE
A E P-CHEMISTRY

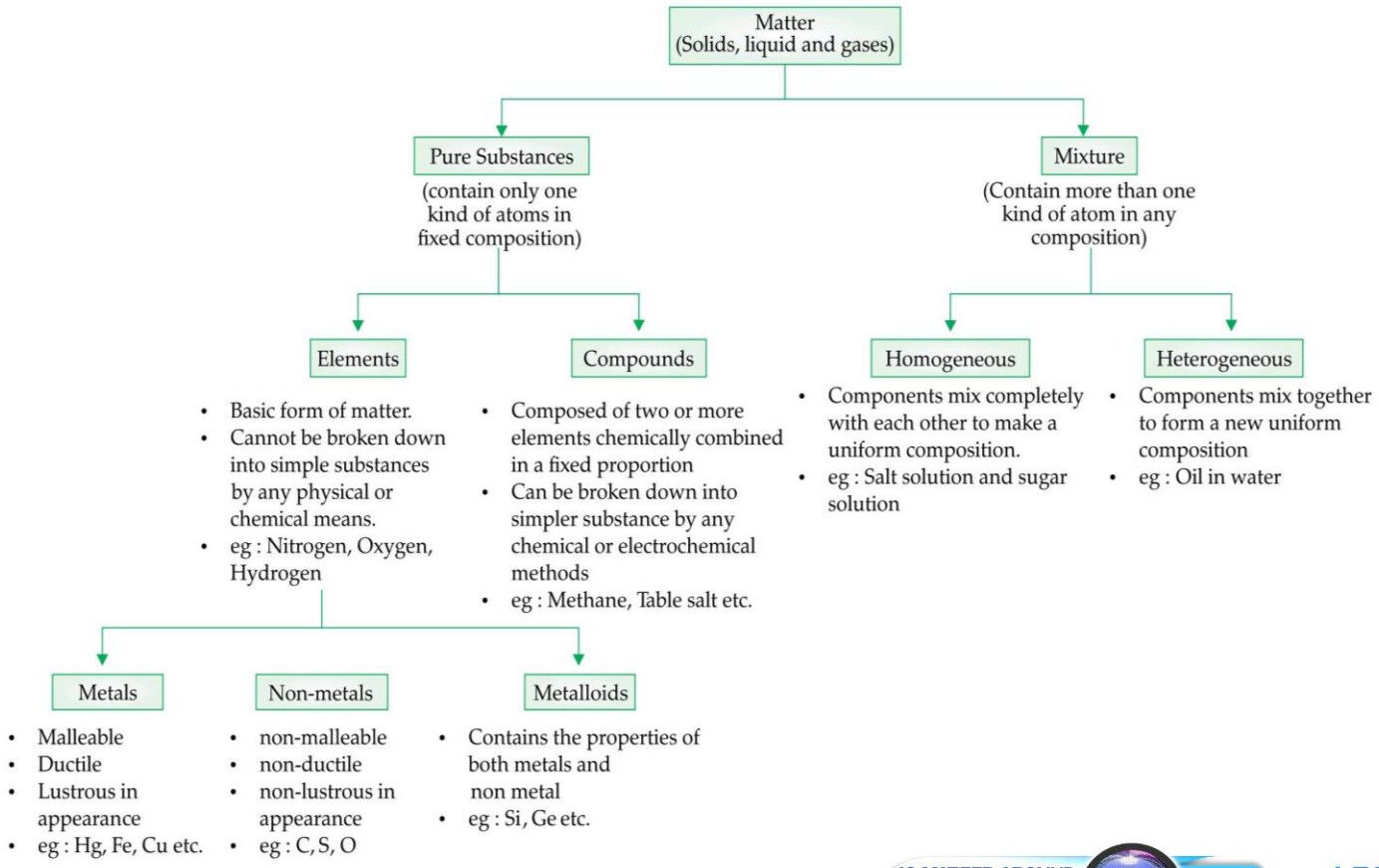
Syllabus

Elements, compounds and mixtures. Heterogeneous and homogeneous mixtures, colloids and suspension.

TOPIC-1
Elements, Compound and Mixtures : Its type and characteristics; colloids and suspensions

Revision Notes

- Matter can be classified into solids, liquids and gases. Depending upon the chemical constituents, matter is classified into pure substances (elements and compounds) and mixtures.
- The following flowchart can clearly explain matter and its classification.



- A mixture contains two or more elements or compounds, which are mixed together in any proportion. From a mixture, no new compound is formed. It shows the properties of the constituent substances.
- A pure substance may either contain constituent particles of one kind or of different kinds.

Activity 1.1

- Let us divide the class into groups A, B, C and D.
- Group A takes a beaker containing 50 mL of water and one spatula full of copper sulphate powder. Group B takes 50 mL of water and two spatula full of copper sulphate powder in a beaker.
- Group C and D can take different amounts of copper sulphate and potassium permanganate or common salt (sodium chloride) and mix the given components to form a mixture.
- Report the observations on the uniformity in colour and texture.
- **Observations : (a)** Groups A and B have obtained a mixture which has a uniform composition throughout. Such mixtures are called homogeneous mixtures or solutions. Some other examples of such mixtures are : (i) salt dissolved in water and (ii) sugar dissolved in water. Compare the colour of the solutions of the two groups. Though both the groups have obtained copper sulphate solution but the intensity of colour of the solutions is different. This shows that a homogeneous mixture can have a variable composition.

  (b) Groups C and D have obtained mixtures, which contain physically distinct parts and have non-uniform compositions. Such mixtures are called heterogeneous mixtures. Mixtures of sodium chloride and iron fillings, salt and sulphur, and oil and water are examples of heterogeneous mixtures.

- **Types of Mixtures :** Mixtures are classified as homogeneous and heterogeneous.

  (i) Homogeneous mixture : A mixture whose components are uniformly distributed forms the homogeneous mixture. The components cannot be seen with naked eyes or under a microscope.

  For eg : Sugar in water, salt in water, sulphur in carbon disulphide etc.

  (ii) Heterogeneous mixture : A mixture whose components are not uniformly distributed forms the heterogeneous mixture. The components can be observed with naked eyes or under a microscope.

  For eg : Sand and salt, sugar and salt, water in oil.

- **Solution :**

  A homogeneous mixture of two or more substances is called solution. The examples are :

  (1) Salt solution (2) Sugar solution (3) Lemonade (4) Soda water

- **Solubility :** The ability of a substance to dissolve in another substances is called a solubility.
- **Solution :** The homogeneous mixture of two or more substances is called a solution.
- **Solute :** The component of a solution present in small quantity is called solute. It is termed as dissolved phase.
- **Solvent :** The component of a solution present in large quantity is called solvent. It is termed as dissolving phase.
- **Properties of a solution :**

  1. Particles of a solution are smaller than 1 mm in diameter. (10^{-9}m).
  2. They cannot be seen by naked eyes.
  3. Particles of solution do not scatter beam of light.
  4. Solute particles cannot be separated from the mixture by filtration.

- **Concentration of a solution**

  The concentration of a solution is the amount of solute present in a given amount (mass or volume) of solvent or solution.

  $$\text{Concentration of a solution} = \frac{\text{Amount of solute}}{\text{Amount of solution}}$$

Alloys are a mixture of two or more metals and non metals that cannot be separated by any physical methods. For eg. Brass is a mixture of 30% zinc and 70% copper.

- **Concentrated solution :** Solution with higher solute concentration.
- **Dilute solution :** Solution with less solute concentration.
- **Expressing the concentration of solution**

  (1) Mass by mass percentage $= \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$

  Example : A solution contains 40 g of common salt in 320 g of water. Calculate the concentration in terms of mass by mass percentage of the solution.

Solution :

Mass of solute (salt) = 40 g
Mass of solvent (water) = 320 g
We know,
Mass of solution = Mass of solute + Mass of solvent
= 40 g + 320 g
= 360 g
Mass percentage of solution = (Mass of solute/Mass of solution) × 100
= (40/360) × 100 = 11.1 %

(2) Mass by volume percentage $= \frac{\text{Mass of solute}}{\text{Volume of solution}} \times 100$

- Depending upon the amount of solute present in a given amount of solvent, solutions can be classified as :
  - **(i) Saturated solution** : It is a solution which contains the maximum amount of the solute dissolved in a given quantity of the solvent at the given temperature and which cannot dissolve any more solute at that temperature.
  - **(ii) Unsaturated solution** : It is a solution which can dissolve more amount of solute in it at a given temperature.
  - **(iii) Supersaturated solution** : It is a solution which temporarily contains more solute than the saturation level.
- Two kinds of heterogeneous mixture are : colloids and suspension.
- **Suspension** : It is a heterogeneous mixture in which the solute particles do not dissolve but remain suspended throughout the bulk of the medium.
- **Properties of suspension :**
  1. Suspension is a heterogeneous mixture.
  2. Particle of suspension are visible to naked eyes.
  3. Particle size is greater than 1000 nanometres.
  4. The particles of a suspension scatter a beam of light passing through it and make its path visible.
  5. The solute particles settle down when a suspension is left undisturbed. It is unstable in nature. It can be separated from the mixture by the process of filtration. When the particles settle down, the suspension breaks and it does not scatter light anymore.
- **Colloids :**

A colloid is a mixture where the particles uniformly spread throughout the solution. A colloidal solution is actually heterogeneous but appears to be homogeneous due to the relatively smaller size of particles. For eg : milk, cheese etc.

- **Properties of a colloid**
  1. A colloid is a heterogeneous mixture.
  2. The size of particles of a colloid is too small to be seen by naked eyes.
  3. Colloidals are big enough to scatter a beam of light passing through it and make the path visible.
  4. Colloidal solution is quite stable.
  5. They cannot be separated from the mixture by the process of filtration. But, centrifugation technique can be used to separate them.

Table 1.1 : Common examples of colloids

Dispersed phase	Dispersing Medium	Type	Example
Liquid	Gas	Aerosol	Fog, clouds, mist
Solid	Gas	Aerosol	Smoke, automobile exhaust
Gas	Liquid	Foam	Shaving cream
Liquid	Liquid	Emulsion	Milk, face cream
Solid	Liquid	Sol	Milk of magnesia, mud
Gas	Solid	Foam	Foam, rubber, sponge, pumice
Liquid	Solid	Gel	Jelly, cheese, butter
Solid	Solid	Solid Sol	Coloured gemstone, milky glass

➢ **Tyndall Effect :**
The scattering of light by colloidal particles in a colloidal solution is called as Tyndall Effect. For e.g. Solution of copper sulphate does not show tyndall effect while mixture of water and milk shows.

➢ Tyndall effect can also be observed when a ray of light passes through the canopy of a dense forest. In the forest, mist contains tiny droplets of water that acts as particles of colloid dispersed in air.

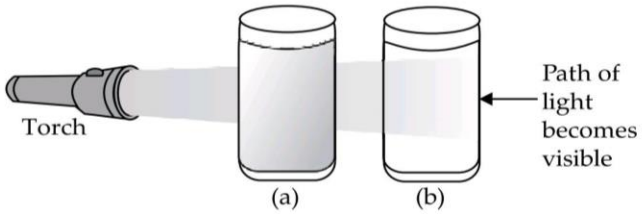


Fig. (a) Solution of copper sulphate does not show tyndall effect
(b) Mixture of water and milk shows Tyndall effect.

SELF ASSESSMENT – 1

I. OBJECTIVE TYPE QUESTIONS [1 mark each]

A. Multiple Choice Questions

R **Q. 1. A pure substance which is made up of only one kind of atom and cannot be broken into two or more simpler substances by physical or chemical means is referred to as**

(a) a compound **(b)** an element
(c) a molecule **(d)** a mixture

R **Q. 2. In tincture of iodine, _____ is the solute and _____ is solvent.**

(a) alcohol and iodine respectively
(b) iodine and alcohol respectively
(c) any component can be considered as solute or solvent
(d) tincture of iodine is not a solution

B. Passage Based Questions

U R **Q. 1. Read the given passage and answer the following questions.**

The teacher instructed three students A, B and C respectively to prepare a 50 % (mass by volume) solution of sodium hydroxide. 'A' dissolved 50 g of NaOH in 100 mL of water, 'B' dissolved 50 g of NaOH in 100 g of water while 'C' dissolved 50 g of NaOH in water to make 100 mL of solution.

(a) Which one of the following has made the desired solution?
(b) Define concentration of a solution.
(c) How will you prepare a 10% solution of sugar?
(d) The two components of a solution are _____ and _____.

A **C. Assertion and reason type questions.**

Directions : In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.

Q. 1. Assertion : A solution of table salt in a glass of water is homogeneous .
Reason : A solution having different composition throughout is homogeneous.

Q. 2. Assertion : A mixture of sugar and benzoic and can be separated by shaking with ether.
Reason : Sugar is insoluble in water.

D. Very short answer type questions.

AI R **Q. 1.** Define element.

R **Q. 2.** Write two main components of a solution.

R **Q. 3.** What are pure substances?

II. SHORT ANSWER TYPE QUESTIONS-I [2 marks each]

Q. 1. Classify sol, aerosol and gel, from the following list: Milk of magnesia, smoke, cheese, mist, mud and butter.

A **(CBSE Marking Scheme, 2020)**

Q. 2. Name the three categories in which elements can be normally divided. Give any one property of each element belonging to each category R **(Board Term-I, 2020)**

III. SHORT ANSWER TYPE QUESTIONS-II [3 marks each]

A **Q. 1.** Is air a mixture or a compound? State three reasons in support of your answer.

K **Q. 2.** Name the three categories in which elements can be normally divided. Give any one property of each element belonging to each category.

IV. LONG ANSWER TYPE QUESTIONS [5 marks each]

K **Q. 1.** Compare the solution, suspension and colloids in terms of
(i) Stability **(ii)** Filterability **(iii)** Tyndall effect

AI **Q. 2.(a)** List any three characteristics of colloid.

K **(b)** Name the two components of a colloid.
(c) Identify colloid from the following mixtures: Muddy water, Sugar in water, Ink, Blood, Soda water, Foam.

TOPIC-2
Separation Techniques, Physical and Chemical Changes

Revision Notes

➢ **Separating the Components of a Mixture**

The substances present in our nature are not chemically pure. Different methods of separation are employed to separate the components on from the mixture.

These are physical and chemical methods for separation. Heterogeneous mixtures can be separated by physical methods like handpicking, sieving and filtration. There are some special technique like fractional distillation, sublimation and use of separating funnel which are used for the separation of components of a mixture.

➢ **Some methods of separation are :**

1. **Evaporation :** The process of conversion of a substance from a liquid state to a gaseous state is called evaporation. The substance which evaporates is called a volatile substance.

❍ **Application :**

(a) This method is used to separate a volatile substance (solvent) from a non-volatile substance (solute) of a mixture.

(b) Common salt from sea water can be separated by this method as on heating the mixture the volatile component evaporates leaving behind the non-volatile component.

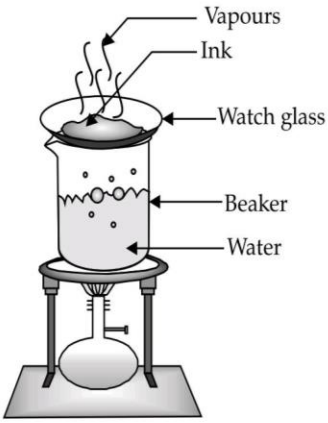


Fig. Evaporation

2. **Centrifugation :** This method is used for the solutions (or mixtures) having in which two components have difference in their densities.

Principle : In this separation technique, the denser particles reach at the bottom and the lighter particles come up at the top when rotated rapidly.

The device employed for this method is called as centrifuge. It can be rotated either manually or electrically.

❍ **Applications :** It is used in

(a) For blood and urine test in pathology/diagnostic laboratories.

(b) To separate butter from cream at dairies and homes.

3. **Separating Funnel :** This method is used to separate a mixture of two immiscible liquids.

Principle : This method depends upon the densities of two liquids (immiscible) involved in a solution.

❍ **Application :** It is used to

(a) Separate the mixture of oil and water.

(b) Separate lighter slag from molten iron during extraction of iron from its ore.

4. **Sublimation :** Some solids have the tendency to convert directly into the gaseous state without converting into liquid on heating, this process is called as sublimation : Eg. Camphor, ammonium chloride, napthalene, anthracene etc.

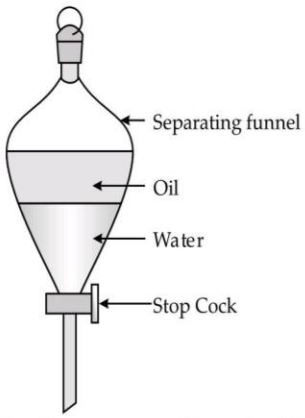


Fig. Separation of immiscible liquids

❍ **Application :**

(a) It is used to separate such mixtures that contain a sublimation volatile component from a non-sublimation impurity.

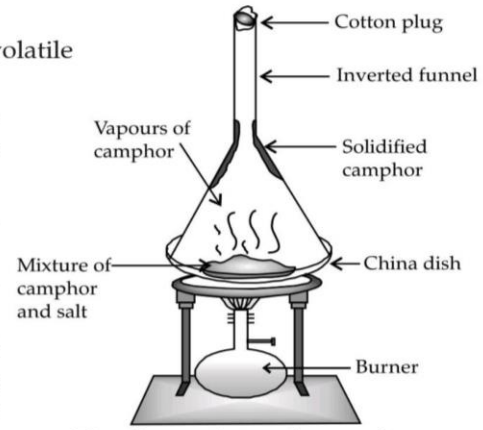


Fig. Separation of camphor and salt by sublimation

5. **Chromatography :** The term chromatography is derived from the greek word, **kroma** which means colour. This technique was first used for separation of colours.

It is a technique used for separation of those solutes that dissolve in the same solvent.

Several forms of chromatographic techniques have been invented. They are : Paper chromatography and Gaseous chromatography.

Principle : The ink that we use has water as the solvent and the dye is soluble in it. As the water rises on the filter paper it takes along with it the dye particles . Usually a dye is a mixture of two or more colours. The coloured component that is more soluble in water rises faster and in this way, the colours get separated.

❍ **Applications :**

It is used to–

(a) Separate colours in a dye.

(b) Drugs from blood.

(c) Pigments from natural colours.

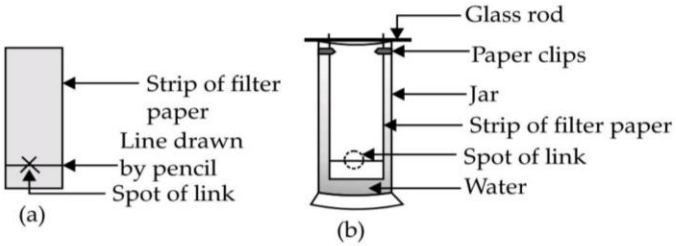


Fig. Separation of dyes in black ink using chromatography

6. **Distillation (Separation of two miscible liquids) :** Two liquids which are miscible into one another but having difference in their boiling points can be separated by the process of distillation. It can also be used to separate a solid dissolved in liquids. Distillation is used only if the liquids have a difference in boiling points of more than 25 K.

7. **Fractional Distillation:** This method is used to separate a mixture of two or more miscible liquids having the difference in boiling point to be less than 25 K.

This method is used by using a fractionating column – a tube packed with glass beads.

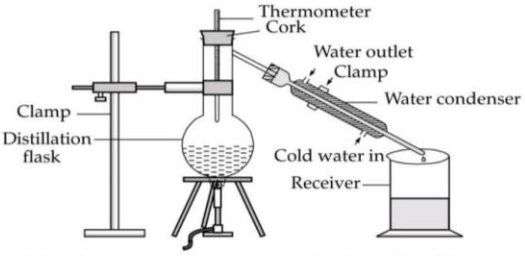


Fig. Separation of two miscible liquids by distillation

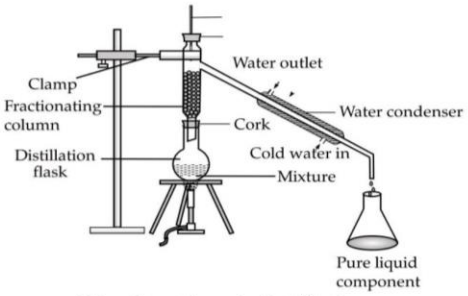


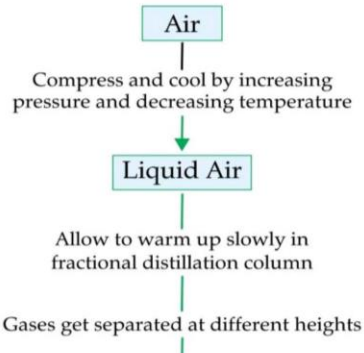
Fig. Fractional distillation

The beads provide surface for the vapours to cool and condense repeatedly.

Example : Separation of different gases in air.

Air is a homogeneous mixture and can be separated into its components by fractional distillation. The air is compressed by the pressure and is then cooled by decreasing the temperature to get liquid air.

This liquid air is allowed to warm up slowly in a fractional distillation column where gases get separated at different height depending upon its boiling points.



	Oxygen	Argon	Nitrogen
Boiling Point (°C)	–183	–186	–196
% Air by Volume	20.9	0.9	78.1

'Flow diagram explaining process of obtaining gases from air'

8. **Crystallisation (separation of pure substances from its impure form) :** Crystallisation is a process that separates the pure solid in its crystal form, from the saturated solution.

This method is employed to purify solids. For eg. the salt we obtain from sea water has many impurities in it. To remove these impurities the process of crystallisation is carried out.

The technique crystallisation is better than simple evaporation technique because some solids decompose or get charred like sugar on heating.

Some impurities may remain dissolved in the solution even after filtration. On evaporation these contaminate the solid.

Applications :

(a) Purification of salt from the impurities present in sea water.

(b) Separation of crystals of alum from impure samples.

➢ **Purification of Drinking water**

Drinking water is supplied from water works in the cities. A number of dissolved and suspended impurities are to be removed to make the water fit for drinking purposes.

The various processes involved in purifying the impure water are :-

(a) Sedimentation – Settling down of impurities to remove suspended solids.

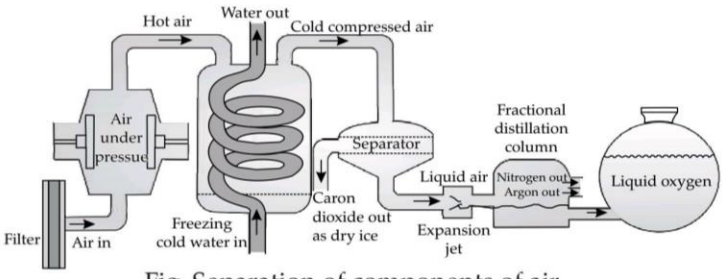


Fig. Separation of components of air

(b) Loading – Alum is used to settle down small particles like clay present in the water.

(c) Filtration – To remove the solids by passing through filtration tank unit containing three filtering layers:

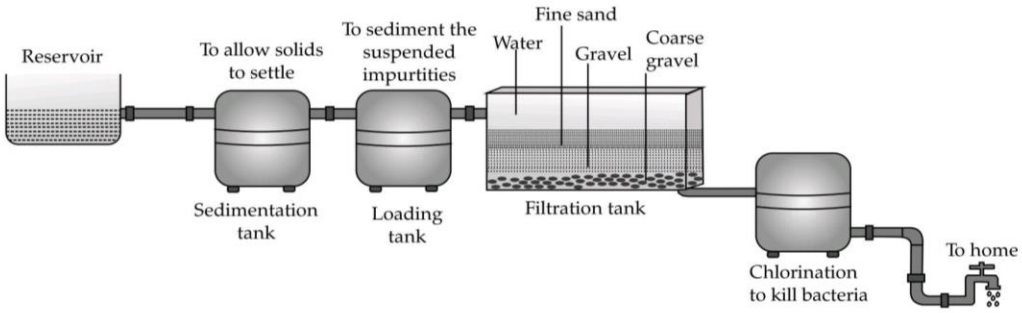


Fig. Water purification system

(1) Coarse gravel at the bottom

(2) Fine gravel in the centre

(3) Fine sand at the top.

Impure water is sent through these layers and then transferred into the chlorination tank.

(d) Chlorination – This method is done to kill bacteria. The pure water, then is supplied to homes for drinking purposes.

➢ **Physical Changes :** The properties such as colour, hardness, rigidity, fluidity, density, melting point, boiling point are the physical properties. The changes which occur without a change in the composition and no change in the chemical nature of the substance is called a physical change.

For eg. The inter-conversion state of matter (of water) from ice (solid) to water (liquid) and then gas (vapour) is the example of physical change.

➢ **Chemical changes :** In chemical changes, one substance reacts with another to undergo a change in chemical composition. This brings the change in the chemical composition or properties of matter and new substance is formed.

For eg. Burning a candle is chemical change.

SELF ASSESSMENT – 2

I. OBJECTIVE TYPE QUESTIONS [1 mark each]

A. Multiple Choice Questions

Ⓡ **Q. 1. Rusting of an article made up of iron is called :**

(a) Corrosion and it is a physical as well as chemical change.

(b) Dissolution and it is a physical change.

(c) Corrosion and it is a chemical change.

(d) Dissolution and it is a chemical change.

Ⓡ **Q. 2. When two liquids do not mix, they form two separate layers and are known as**

(a) Miscible liquids

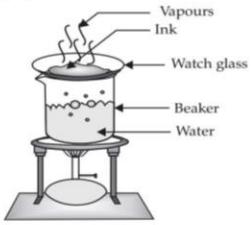
(b) Immiscible liquids

(c) Saturated liquids

(d) Super saturated liquids

B. Diagram Based Question

Ⓐ **Q. 1. Study the given diagram and answer the following questions.**



(a) Name and define the process shown in the diagram.
(b) Which type of substance can be separated by this method?
(c) What can we interpret about the nature of ink?
(d) Name the component which gets evaporated.

C. Assertion and Reason Type Questions

Directions : In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.

Ⓐ **Q. 1. Assertion :** True solution exhibits Tyndall effect.
Reason : Particles are very small in size.

Ⓐ **Q. 2. Assertion :** Impure benzoic acid can be purified by sublimation.
Reason : Benzoic acid sublimes on heating.

D. Very short answer type questions

Ⓡ **Q. 1.** Define evaporation.
Ⓤ **Q. 2.** Write the name of any two mixtures.
Ⓤ **Q. 3.** Define chromatography.

II. SHORT ANSWER TYPE QUESTIONS-I [2 marks each]

Q. 1. Write any two differences between physical and chemical changes. Give one example in which both physical and chemical changes take place. Ⓡ+Ⓤ **(Board Term-I, 2012, NCT 2014; DDE 2014) (NCERT Exemplar)**

Q. 2. (i) You are given a mixture of mustard oil and water. Name the process that can be used to obtain mustard oil from the above mixture.
(ii) Draw a well labelled diagram of the above process.
Ⓡ+Ⓐ **(Board Term-I, 2012, NCT-2014)**

III. SHORT ANSWER TYPE QUESTIONS-II [3 marks each]

Ⓐ **Q. 1.** Draw a flowchart showing the separation of components of air. Also, name the process.

AI Ⓚ **Q. 2. (a)** Name the compound formed on heating a mixture of iron filing and sulphur.

Ⓐ **(b)** If dilute HCl is added to above compound then name the gas evolved and write down its two properties.

IV. LONG ANSWER TYPE QUESTIONS [5 marks each]

Ⓚ **Q. 1. Write your observation when the following processes take place :**
(i) An aqueous solution of sugar is heated to dryness.
(ii) A saturated solution of potassium chloride prepared at 60°C is allowed to cool at room temperature.
(iii) A mixture of iron filings and sulphur powder is heated strongly.
(iv) A beam of light is passed through a colloidal solution.
(v) HCl is added to the mixture of iron and sulphur.

NCERT CORNER

Intext Questions

Q. 1. What is meant by a substance?
[NCERT Q. 1, Page 15]

Ans. A material that consists of a single type of particles is known as pure substance. All constituent particles of pure substance have the same chemical nature.

Q. 2. List the points of differences between homogeneous and heterogeneous mixtures.
[NCERT Q. 2. Page 15]

Ans. A homogeneous mixture is a mixture having a uniform composition throughout the mixture. **For**

example : Salt in water, sugar in water, copper sulphate in water.

A heterogeneous mixture is a mixture having a non-uniform composition throughout the mixture. **For example :** Sodium chloride and iron fillings, salt and sulphur, oil and water.

Q. 3. Differentiate between homogeneous and heterogeneous mixtures with examples.

[NCERT Q. 1, Page 18]

Ans.

Homogeneous mixture	Heterogeneous mixture
A mixture having a uniform composition throughout the mixture.	A mixture having a non-uniform composition throughout the mixture.
Examples : Mixtures of salt in water, sugar in water, copper sulphate in water, iodine in alcohol, alloy and air.	**Examples :** Composition of mixtures of sodium chloride and iron fillings, salt and sulphur, oil and water, chalk powder in water, wheat flour in water, milk and water.

Q. 4. How are sol, solution and suspension different from each other? **[NCERT Q. 2, Page 18]**

Ans.

Sol	Solution	Suspension
1. They are heterogenous in nature.	They are homogenous in nature.	They are heterogenous in nature.
2. They scatter a beam of light and hence show Tyndall effect.	They do not scatter a beam of light and do not show Tyndall effect.	They do not scatter beam of light and do not show Tyndall effect.
3. Particles cannot be seen with naked eyes.	Particles dissolves	Particles can be seen with naked eyes.
4. They are quite stable.	They are very stable.	They are unstable.
5. Example : Milk, blood, smoke	**Example :** salt in water sugar in water	**Example :** sand in water.

Q. 5. To make a saturated solution, 36 g of sodium chloride is dissolved in 100 g of water at 293 K. Find its concentration at this temperature.

[NCERT Q. 3, Page 18]

Ans. Mass of solute (sodium chloride) = 36 g (Given)

Mass of solvent (water) = 100 g (Given)

Then, mass of solution = Mass of solute + Mass of solvent

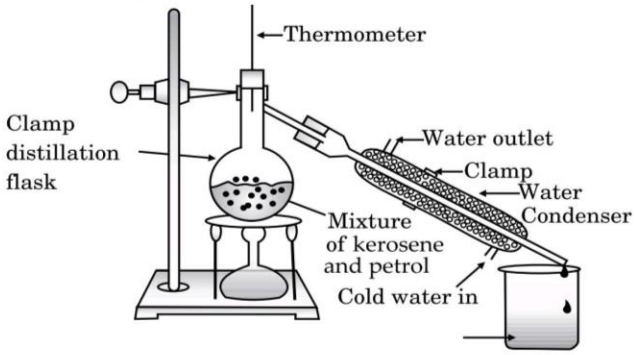
Concentration of solution =

$$\frac{\text{mass of solute}}{\text{mass of solution}} = (36 + 100)\text{g}$$

$$= \frac{36}{136} \times 100\% = 26.4\%$$

Q. 6. How will you separate a mixture containing kerosene and petrol (difference in their boiling points is more than 25°C), which are miscible with each other? **[NCERT Q. 1, Page 24-I]**

Ans. A mixture of two miscible liquids kerosene and petrol having a difference in their boiling points more than 25°C can be separated by the method of distillation.



In this method, the mixture of kerosene and petrol is taken in a distillation flask with a thermometer fitted in it. We also need a beaker, a water condenser and a bunsen burner. The apparatus is arranged as shown in the above figure. Then, the mixture is heated slowly. The thermometer should be watched simultaneously. Kerosene will vaporise and condense in the water condenser. The condensed kerosene is collected from the condenser outlet, whereas petrol is left behind in the distillation flask.

Q. 7. Name the technique to separate :

(i) Butter from curd

(ii) Salt from sea-water

(iii) Camphor from salt **[NCERT Q. 2, Page 24-I]**

Ans. **(i)** Butter can be separated from curd by centrifugation in which denser particles are forced to the bottom and the lighter particles stay at the top when spun rapidly.

(ii) Salt can be separated from sea-water by evaporation in which as the water evaporates less and less water molecules are present to keep the salt particles apart. The salt therefore recrystallizes and can be collected.

(iii) Camphor from salt can be separated by sublimation in which camphor sublimes directly converts to gas on heating leaving behind salt. Vapours of camphor solidifies and can be collected.

Q. 8. What type of mixtures is separated by the technique of crystallization ?

[NCERT Q. 3, Page 24-I]

Ans. Crystallisation is a process that separates a pure solid in the form of its crystals from a solution, for example, salt obtained from sea is separated from impurities; crystals of alum (Phitkari) are separated from impure samples.

Q. 9. Classify the following as chemical or physical changes :

(i) cutting of trees,
(ii) melting of butter in a pan,
(iii) rusting of almirah,
(iv) boiling of water to form steam,
(v) passing of electric current, through water and the water breaking down into hydrogen and oxygen gases,
(vi) dissolving common salt in water,
(vii) making a fruit salad with raw fruits, and
(viii) burning of paper and wood.

[NCERT Q. 1, Page 24]

Ans. The physical change is the inter conversion of states because these changes occurs without a change in composition and no change in the chemical nature of the substance. Chemical change brings change in the chemical properties of matter and new substances are formed. A chemical change is also called a chemical reaction.

(i) Cutting of trees → Physical change
(ii) Melting of butter in a pan → Physical change
(iii) Rusting of almirah → Chemical change
(iv) Boiling of water to form steam → Physical change
(v) Passing of electric current through water, and water breaking down into hydrogen and oxygen gas → Chemical change
(vi) Dissolving common salt in water → Physical change
(vii) Making a fruit salad with raw fruits → Physical change
(viii) Burning of paper and wood → Chemical change

Q. 10. Try segregating the things around you as pure substances or mixtures. **[NCERT Q. 2, Page 24]**

Ans. **Pure substance :** Water, salt and sugar, etc.

Mixture : Salt water, soil, wood, air, cold drink, rubber, sponge, fog, milk, butter, clothes and food.

Exercise Questions

Q. 1. Which separation techniques will apply for the separation of the following?

(a) Sodium chloride from its solution in water.
(b) Ammonium chloride from a mixture containing sodium chloride and ammonium chloride.
(c) Small pieces of metal in the engine oil of a car.
(d) Different pigments from an extract of flower petals.
(e) Butter from curd.
(f) Oil from water.
(g) Tea leaves from tea.
(h) Iron pins from sand.
(i) Wheat grains from husk.
(j) Fine mud particles suspended in water.

Ans. **(a)** Crystallization or evaporation.
(b) Sublimation.
(c) Centrifugation or sedimentation.
(d) Chromatography.
(e) Centrifugation.
(f) Separating funnel.
(g) Hand-picking.
(h) Magnetic separation.
(i) Winnowing.
(j) Centrifugation.

Q. 2. Write the steps you would use for making tea. Use the words—solution, solvent, solute, dissolve, soluble, insoluble, filtrate and residue.

Ans. **(i)** Take the solvent, water, in a kettle. Heat it. When the solvent boils, add the solute, milk. Milk and water forms a solution.

(ii) Then pour some tea leaves over a sieve. Pour slowly hot solution of milk over tea leaves. Colour of tea leaves goes into solution as filtrate. The remaining tea leaves being insoluble remains as residue.

(iii) Add requisite sugar which dissolves and the tea is ready.

Q. 3. Pragya tested the solubility of three different substances at different temperatures and collected the data as given below (results are given in the following table, as grams of substance dissolved in 100 grams of water to form a saturated solution).

Substance Dissolved	Temperature in K				
	283	293	313	333	353
	Solubility				
Potassium nitrate	21	32	62	106	167
Sodium chloride	36	36	36	37	37
Potassium chloride	35	35	40	46	54
Ammonium chloride	24	37	41	55	66

(a) What mass of potassium nitrate would be needed to produce a saturated solution of potassium nitrate in 50 grams of water at 313 K?

(b) Pragya makes a saturated solution of potassium chloride in water at 353 K and leaves the solution to cool at room temperature. What would she observe as the solution cools? Explain.

(c) Find the solubility of each salt at 293 K. Which salt has the highest solubility at this temperature?

(d) What is the effect of change of temperature on the solubility of a salt?

Ans. **(a)** At 313 K, Potassium nitrate for saturated solution of 100 grams of water = 62 g
Potassium nitrate for saturated solution of 50 grams of water = 31 g

(b) Some amount of dissolved potassium chloride will reappear as undissolved solid '(crystallisation)' as solubility of solute decreases with the decrease in temperature.

(c) **Solubility of each salt at 393 K are as follows :**

1. Potassium nitrate 32

2. Sodium chloride 36

3. Potassium chloride 35

4. Ammonium chloride 37

Ammonium chloride salt has the highest solubility at this temperature.

(d) Solubility of salt increases with the increase in temperature.

Q. 4. Explain the following giving examples.

(a) Saturated solution,

(b) Pure substance,

(c) Colloid,

(d) Suspension.

Ans. **(a) Saturated solution :** A solution in which no more of the solid (solute) can be dissolved at a given temperature is called a saturated solution. Suppose 50 g of a solute is the maximum amount that can be dissolved in 100 g water at 298 K. Then 150 g of solution so obtained is the saturated solution at 298 K.

(b) **Pure substance :** A pure substance consists of a single type of matter or particles and cannot be separated into other kind of matter by any physical process. Pure substances always have the same colour, taste and texture at a given temperature and pressure. For example, pure water is always colourless, odourless and tasteless and boils at 373 K at normal atmospheric pressure.

(c) **Colloid :** Colloids are heterogeneous mixtures, the particle size is too small to be seen with a naked eye, but it is big enough to scatter light. The particles are called the dispersed phase and the medium in which they are distributed is called the dispersion medium. Colloids are useful in industry and daily life. A colloid has the following characteristics :

- It is a heterogeneous mixture.
- The size of particles of a colloid lies between 1 nm –100 nm and cannot be seen by naked eyes.
- The particles of colloid can scatter a beam of light passing through it and make the path visible.
- The particles of colloid cannot be separated from the mixture by filtration. The process of separation of colloidal particles is known as 'centrifugation'.
- They do not settle down when left undisturbed. In other words, colloids are quite stable, *e.g.* smoke, milk, fog, cloud etc.

(d) **Suspension :** A 'suspension' is a heterogeneous mixture in which the solute particles do not dissolve but remain suspended throughout the bulk of the medium. A suspension has the following characteristics :

- It is a heterogeneous mixture.
- The size of particles of a suspension is greater than 100 nm and is visible to naked eyes.
- The particles of suspension can scatter a beam of light passing through it.
- The particles of a suspension settle down when left undisturbed.
- The particles of a suspension can be separated from its mixture by filtration. Eg. sand water.

Q. 5. Classify each of the following as a homogeneous or heterogeneous mixtures :

Soda water, wood, air, soil, vinegar and filtrated tea.

Ans. **Homogeneous mixture :** Soda water, air, vinegar, a filtrated tea.

Heterogeneous mixture : Wood, soil.

Q. 6. How would you confirm that a colourless liquid given to you is pure water?

Ans. As we know every liquid has a specific boiling point at 1 atm (atmospheric pressure). If the given colourless liquid boils exactly at 373 K at 1 atm, then it is pure water. If the boiling point is different, then the water is contaminated.

Q. 7. Which of the following materials fall in the category of a 'pure substance'?

(a) Ice **(b) Milk**
(c) Iron **(d) Hydrochloric acid**
(e) Calcium oxide **(f) Mercury**
(g) Brick **(h) Wood**
(i) Air

Ans. Ice, Iron, Hydrochloric acid, Calcium oxide and Mercury are pure substances.

Q. 8. Identify the solutions among the following mixtures.

(a) Soil **(b) Sea water**
(c) Air **(d) Coal**
(e) Soda water

Ans. **Among the given mixtures following are the solutions :**

(b) Sea water, **(c)** Air and **(e)** Soda water.

Q. 9. Which of the following will show "Tyndall effect"?

(a) Salt solution

(b) Milk

(c) Copper sulphate solution

(d) Starch solution.

Ans. Milk and starch solution show Tyndall effect because they are colloidal solution. Salt solution and copper sulphate solution are true solution. Their particle size is too small to scatter light. So they do not show Tyndall effect.

Q. 10. Classify the following into elements, compounds and mixtures :

(a) Sodium	**(b) Soil**
(c) Sugar solution	**(d) Silver**
(e) Calcium carbonate	**(f) Tin**
(g) Silicon	**(h) Coal**
(i) Air	**(j) Soap**
(k) Methane	**(l) Carbon dioxide**
(m) Blood	

Ans. **Elements :** Sodium, silver, tin, silicon.

Compounds : Calcium carbonate, methane, carbon dioxide.

Mixtures : Soil, sugar solution, coal, air, soap, blood.

Q. 11. Which of the following are chemical changes?

(a) Growth of a plant
(b) Rusting of iron
(c) Mixing of iron filings and sand
(d) Cooking of food
(e) Digestion of food
(f) Freezing of water
(g) Burning of a candle.

Ans. **(a)** Growth of a plant, **(b)** rusting of iron, **(d)** cooking of food, **(e)** digestion of food and **(g)** burning of a candle, show chemical changes.

NCERT Exemplar

Multiple Choice Questions

Q. 1. Which of the following statements are true for pure substances?

(i) Pure substances contain only one kind of particles
(ii) Pure substances may be compounds or mixtures
(iii) Pure substances have the same composition throughout
(iv) Pure substances can be exemplified by all elements other than nickel

(a) (i) and (ii)
(b) (i) and (iii)
(c) (iii) and (iv)
(d) (ii) and (iii)

Ans. **Correct option :** (b)

Explanation : Pure substances have same chemical composition and are made up of same kind of elements.

Q. 2. Rusting of an article made up of iron is called :

(a) corrosion and it is a physical as well as chemical change
(b) dissolution and it is a physical change
(c) corrosion and it is a chemical change
(d) dissolution and it is a chemical change

Ans. **Correct option :** (c)

Explanation : Rusting of an article is a corrosion and it is a chemical change. In the presence of water or air moisture the redox reaction of iron and oxygen occurs which forms iron oxide, usually red oxide called as rust.

Q. 3. A mixture of sulphur and carbon disulphide is :

(a) heterogeneous and shows Tyndall effect
(b) homogeneous and shows Tyndall effect
(c) heterogeneous and does not show Tyndall effect
(d) homogeneous and does not show Tyndall effect

Ans. **Correct option :** (a)

Explanation : A mixture of sulphur and carbon disulphide is a heterogeneous colloid and shows Tyndall effect. In a colloidal solution, the particles are big enough to scatter light. The scattering of light by colloidal particles is known as Tyndall effect. Colloids are actually heterogeneous in nature though they appear to be homogeneous.

Q. 4. Tincture of iodine has antiseptic properties. This solution is made by dissolving :

(a) iodine in potassium iodide
(b) iodine in vaseline
(c) iodine in water
(d) iodine in alcohol

Ans. **Correct option :** (d)

Explanation : Iodine is nonpolar and water is polar. Polar substances dissolve with polar substances and nonpolar with nonpolar. In this case Ethanol is both polar and nonpolar, water doesn't have similar molecular attraction to ethanol and there is negligible molecular interaction, so the iodine hardly dissolves in water.

Q. 5. Which of the following are homogeneous in nature?

(i) ice (ii) wood (iii)soil (iv) air
(a) (i) and (iii)
(b) (ii) and (iv)
(c) (i) and (iv)
(d) (iii) and (iv)

Ans. **Correct option :** (c)

Explanation : Homogeneous nature means substances that has uniform composition throughout, and out of given four substances, ice and air are same throughout whereas wood and soil are mixture.

Q. 6. Which of the following are physical changes?

(i) Melting of iron metal
(ii) Rusting of iron
(iii) Bending of an iron rod
(iv) Drawing a wire of iron metal

(a) (i), (ii) and (iii)
(b) (i), (ii) and (iv)
(c) (i), (iii) and (iv)
(d) (ii), (iii) and (iv)

Ans. Correct option : (c)

Explanation : (i) Melting of iron metal, (iii) Bending of an iron rod and (iv) Drawing a wire of iron metal are physical changes, because in these three processes, iron changes its form, not the chemical composition. In rusting of iron, its chemical composition is changed.

Q. 7. Which of the following are chemical changes?

(i) Decaying of wood
(ii) Burning of wood
(iii) Sawing of wood
(iv) Hammering of a nail into a piece of wood
(a) (i) and (ii)
(b) (ii) and (iii)
(c) (iii) and (iv)
(d) (i) and (iv)

Ans. Correct option : (a)

Explanation : (i) Decaying of wood and (ii) Burning of wood are chemical changes, because in these processes, the chemical composition of wood is changed and new substances are formed, which cannot be converted back into their original form. In (iii) Sawing of wood and (iv) Hammering of a nail into a piece of wood, chemical composition of wood is not changed and they are physical changes.

Q. 8. Two substances, A and B were made to react to form a third substance, A_2B according to the following reaction :

$$2\,A + B \rightarrow A_2B.$$

Which of the following statements concerning this reaction are incorrect?

(i) The product A_2B shows the properties of substances A and B
(ii) The product will always have a fixed composition
(iii) The product so formed cannot be classified as a compound
(iv) The product so formed is an element
(a) (i), (ii) and (iii),
(b) (ii), (iii) and (iv)
(c) (i), (iii) and (iv)
(d) (ii), (iii) and (iv)

Ans. Correct option : (c)

Explanation : A_2B is a compound made up of two elements A and B in a fixed ratio. The properties of a compound (*e.g.*, A_2B) are completely different from those of its constituent elements (*e.g.*, A and B). The composition of a compound is fixed.

Q. 9. Two chemical species X and Y combine together to form a product P which contains both X and Y

$$X + Y \rightarrow P$$

X and Y cannot be broken down into simpler substances by simple chemical reactions. Which of the following concerning the species X, Y and P are correct?

(i) P is a compound
(ii) X and Y are compounds
(iii) X and Y are elements
(iv) P has a fixed composition
(a) (i), (ii) and (iii)
(b) (i), (ii) and (iv)
(c) (ii), (iii) and (iv)
(d) (i), (iii) and (iv)

Ans. Correct option : (d)

Explanation : In this reaction, X and Y cannot be broken down into simpler substances by chemical reactions; thus, X and Y are elements. A compound is a substance made up of two or more elements chemically combined in a fixed proportion by mass; therefore, P is a compound, having a fixed composition.

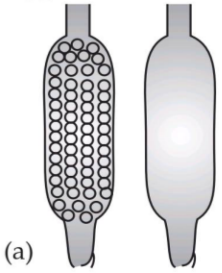
Short Answer Type Questions

Q.10. Suggest separation technique(s) one would need to employ to separate the following mixtures.

(a) Mercury and water
(b) Potassium chloride and ammonium chloride
(c) Common salt, water and sand
(d) Kerosene oil, water and salt

Ans. (a) Separating funnel
(b) Sublimation method
(c) Decantation, Evaporation
(d) Decantation by using separating funnel and evaporation.

Q. 11. Which of the tubes in the given Figures (a) and (b) will be more effective as a condenser in the distillation apparatus?



Ans. Out of the tubes in the given figures, tube (a) will be more effective as a condenser in the distillation apparatus because beads present will provide more surface area for cooling of the vapours passing through it.

Q. 12. Salt can be recovered from its solution by evaporation. Suggest some other technique for the same?

Ans. Apart from evaporation, crystallisation is another technique through which salt can be separated from its solution. Crystallisation is better than evaporation because it removes soluble impurities also.

Q. 13. The 'sea-water' can be classified as a homogeneous as well as heterogeneous mixture. Comment.

Ans. **(i)** Sea water is a mixture of many salts, water and many other impurities. Apart from these, many gases are also dissolved in sea water. As we know homogeneous mixture has uniform composition throughout and heterogeneous mixture does not have uniform composition.

(ii) In sea water because of salt, sand shell made of calcium carbonate, microbes and some other bigger size of impurities, sea water is classified as heterogeneous mixture.

(iii) And because of mixture of several gases in sea water it is also classified as homogeneous mixture.

Q. 14. While diluting a solution of salt in water, a student by mistake added acetone (boiling point 56°C). What technique can be employed to get back the acetone? Justify your choice.

Ans. Acetone can be obtained back by simple distillation method of the mixture because the boiling point of acetone is 56°C and boiling point of water is 100°C, and for distillation the minimum difference in temperature should be 25°C. Thus, by the process of distillation acetone can be separated.

Q. 15. What would you observe when

(a) a saturated solution of potassium chloride prepared at 60°C is allowed to cool to room temperature.

(b) an aqueous sugar solution is heated to dryness.

(c) a mixture of iron filings and sulphur powder is heated strongly.

Ans. **(a)** A saturated solution of potassium chloride prepared at 60°C is allowed to cool to room temperature then potassium chloride will settle down at the bottom of flask at room temperature because saturation decreases with decrease in temperature. Thus, solid potassium chloride will separate out.

(b) When an aqueous sugar solution is heated to dryness, initially the water will evaporate and sugar is left in the container but overheating may char or burn the sugar.

(c) When a mixture of iron filings and sulphur powder are heated strongly, iron sulphide (ferrous sulphide) will be formed.

Q. 16. Explain why particles of a colloidal solution do not settle down when left undisturbed, while in the case of a suspension they do.

Ans. Particles of a colloidal solution do not settle down when left undisturbed, while in the case of a suspension they do. This is because :

(i) In colloidal solution, particles are small and not heavy. Thus, they move in a zig-zag motion, called as Brownian movement.

(ii) This Brownian movement counters the force of gravity acting on colloidal particles and helps in providing stability to colloidal sols by not allowing them to settle down.

(iii) Also, colloidal particles are not charged and repel each other, thus they do not settle down whereas molecular interaction in a suspension is not strong enough to keep the particles suspended and they are heavy and charged thus, they settle down.

Q. 17. Smoke and fog both are aerosols. In what way are they different?

Ans. Smoke and fog both are aerosols and their dispersion medium is also same, that is, air. But they differ in dispersed phase. In smoke solid carbon particles, mixture of gases, incomplete combustion of fuels like coal are present in air, thus smoke is caused by pollution whereas fog is natural phenomenon contains tiny particles of water in air.

Q. 18. Classify the following as physical or chemical properties.

(a) The composition of a sample of steel is : 98% iron, 1.5% carbon and 0.5% other elements.

(b) Zinc dissolves in hydrochloric acid with the evolution of hydrogen gas.

(c) Metallic sodium is soft enough to be cut with a knife.

(d) Most metal oxides form alkalis on interacting with water.

Ans. **(a)** The composition of a sample of steel is : 98% iron, 1.5% carbon and 0.5% other elements; physical property because steel is the alloy and considered as mixture of more than one element.

(b) Zinc dissolves in hydrochloric acid with the evolution of hydrogen gas; chemical property because it shows the reaction of zinc with hydrochloric acid.

(c) Metallic sodium is soft enough to be cut with a knife; physical property since, it shows the softness of sodium.

(d) Most metal oxides form alkalis on interacting with water; chemical property because it shows the reaction of metal oxides with water.

Q. 19. The teacher instructed three students 'A', 'B' and 'C' respectively to prepare a 50% (mass by volume) solution of sodium hydroxide (NaOH). 'A' dissolved 50 g of NaOH in 100 mL of water, 'B' dissolved 50 g of NaOH in 100 g of water while 'C' dissolved 50 g of NaOH in water to make 100 mL of solution. Which one of them has made the desired solution and why?

Ans. Concentration is the relative percentage of solute compared to the total volume of the solution and it is calculated by dividing mass by volume.

Student A dissolved 50 g of NaOH in 100 mL of water, the total volume of solution became about 150 mL, thus concentration of NaOH would be less than 50%.

Student B dissolved 50 g of NaOH has been dissolved in 100 g of water, therefore, total volume of the solution would become 150 mL, consequently concentration of NaOH would again less than 50%.

Student C dissolved 50 g of NaOH in water and then volume of the solution made to 100 mL, thus concentration of NaOH would become 50%.

Therefore, C made the solution of NaOH having concentration equal to 50%. 'C' has made the desired solution.

$$\text{Mass by volume \%} = \frac{\text{Mass of solute}}{\text{Volume of solution}}$$

$$= \frac{50}{100} \times 100$$

$$= 50\%$$

Q. 20. Name the process associated with the following :

(a) Dry ice is kept at room temperature and at one atmospheric pressure.

(b) A drop of ink placed on the surface of water contained in a glass spreads throughout the water.

(c) A potassium permanganate crystal is in a beaker and water is poured into the beaker with stirring.

(d) A acetone bottle is left open and the bottle becomes empty.

(e) Milk is churned to separate cream from it.

(f) Settling of sand when a mixture of sand and water is left undisturbed for some time.

(g) Fine beam of light entering through a small hole in a dark room, illuminates the particles in its paths.

Ans. **(a)** Dry ice is kept at room temperature and at 1 atm (atmospheric pressure) : Sublimation.

(b) A drop of ink placed on the surface of water contained in a glass spreads throughout the water : Diffusion.

(c) A potassium permanganate crystal is in a beaker and water is poured into the beaker with stirring : Dissolution.

(d) An acetone bottle is left open and the bottle becomes empty : Evaporation, diffusion.

(e) Milk is churned to separate cream from it : Centrifugation.

(f) Settling of sand when a mixture of sand and water is left undisturbed for some time : Sedimentation.

(g) Fine beam of light entering through a small hole in a dark room, illuminates the particles in its paths : Scattering of light (Tyndall effect).

Q. 21. You are given two samples of water labelled as 'A' and 'B'. Sample 'A' boils at 100°C and sample 'B' boils at 102°C. Which sample of water will not freeze at 0°C? Comment.

Ans. Sample 'B' will not freeze at 0°C because it is not pure water. At 1 atm, the boiling point of pure water is 100°C and the freezing point of pure water is 0°C. Since impurities in water raise its boiling point, thus water in sample B is impure. Hence, it will not freeze at 0°C because of impurities.

Q. 22. What are the favourable qualities given to gold when it is alloyed with copper silver for the purpose of making ornaments?

Ans. Pure gold is very soft, malleable and very dense metal as compared to gold alloyed with silver or copper. Thus, for providing strength and hardness to gold, it is alloyed.

Q. 23. An element is sonorous and highly ductile. Under which category would you classify this element? What other characteristics do you expect the element to possess?

Ans. An element which is sonorous and highly ductile is a metal. Other characteristics expected to be possessed by the element are lustre, malleability, heat and electrical conductivity.

Q. 24. Give an example each for the mixture having the following characteristics. Suggest a suitable method to separate the components of these mixtures.

(a) A volatile and a non-volatile component.

(b) Two volatile components with appreciable difference in boiling points.

(c) Two immiscible liquids.

(d) One of the components changes directly from solid to gaseous state.

(e) Two or more coloured constituents soluble in some solvent.

Ans. **(a)** A volatile and a non-volatile component : Evaporation or distillation.

(b) Two volatile components with appreciable difference in boiling points : Distillation.

(c) Two immiscible liquids : Separation by using separating funnel.

(d) One of the components changes directly from solid to gaseous state : Sublimation.

(e) Two or more coloured constituents soluble in some solvent : Chromatography.

Q. 25. Fill in the blanks.

(a) A colloid is a _____ mixture and its components can be separated by the technique known as _____

(b) Ice, water and water vapour look different and display different _____ properties but they are _____ the same.

(c) A mixture of chloroform and water taken in a separating funnel is mixed and left undisturbed for some time. The upper layer in the separating funnel will be of _____ and the lower layer will be that of _____ .

(d) **A mixture of two or more miscible liquids, for which the difference in the boiling points is less than 25 K can be separated by the process called _____ .**

(e) **When light is passed through water containing a few drops of milk, it shows a bluish tinge. This is due to the _____ of light by milk and the phenomenon is called _____ . This indicates that milk is a _____ solution.**

Ans. **(a)** heterogeneous, centrifugation

(b) physical, chemically

(c) water, chloroform

(d) fractional distillation

(e) scattering, Tyndall effect, colloidal

Q. 26. Sucrose (sugar) crystals obtained from sugarcane and beetroot are mixed together. Will it be a pure substance or a mixture? Give reasons for the same.

Ans. When sugarcane and beet root are mixed together then sucrose (sugar) crystals are obtained which is a pure substance because chemical composition of sugar crystals is same irrespective of its source.

Q. 27. Give some examples of Tyndall effect observed in your surroundings?

Ans. Tyndall effect can be seen when light passes through a heterogeneous mixture.

Example :

(i) When sunlight passes through the canopy of a dense forest.

(ii) When fine beam of light enters a room from a small hole.

Q. 28. Can we separate alcohol dissolved in water by using a separating funnel? If yes, then describe the procedure. If not, explain.

Ans. Mixture of alcohol and water cannot be separated by using separating funnel because they are miscible liquids and can be separated by the process of distillation.

Q. 29. On heating calcium carbonate gets converted into calcium oxide and carbon dioxide.

(a) Is this a physical or a chemical change?

(b) Can you prepare one acidic and one basic solution by using the products formed in the above process? If so, write the chemical equation involved.

Ans. (a) Chemical change

(b) Acidic and basic solutions can be prepared by dissolving the products of the above process in water.

$CaO + H_2O \rightarrow Ca(OH)_2$ (basic solution)

$CO_2 + H_2O \rightarrow H_2CO_3$ (acidic solution)

Q. 30. Non-metals are usually poor conductors of heat and electricity. They are non-lustrous, non-sonorous, non-malleable and are coloured.

(a) Name a lustrous non-metal.

(b) Name a non-metal which exists as a liquid at room temperature.

(c) The allotropic form of a non-metal is a good conductor of electricity. Name the allotrope.

(d) Name a non-metal which is known to form the largest number of compounds.

(e) Name a non-metal other than carbon which shows allotropy.

(f) Name a non-metal which is required for combustion.

Ans. **(a)** Iodine

(b) Bromine

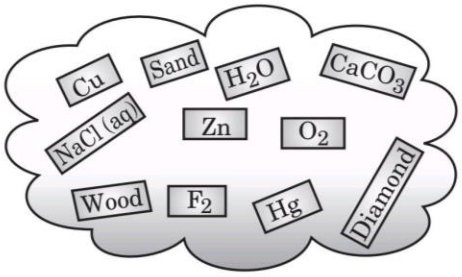
(c) Graphite

(d) Carbon

(e) Sulphur, phosphorus

(f) Oxygen

Q. 31. Classify the substances given in the Figure into elements and compounds.



Ans. **Elements :** Cu, Zn, F_2, O_2, Diamond (carbon), Hg

Compounds : $CaCO_3$, H_2O, NaCl, Sand, Wood.

Q. 32. Which of the following are not compounds?

(a) Chlorine gas **(b) Potassium chloride**

(c) Iron **(d) Iron sulphide**

(e) Aluminium **(f) Iodine**

(g) Carbon **(h) Carbon monoxide**

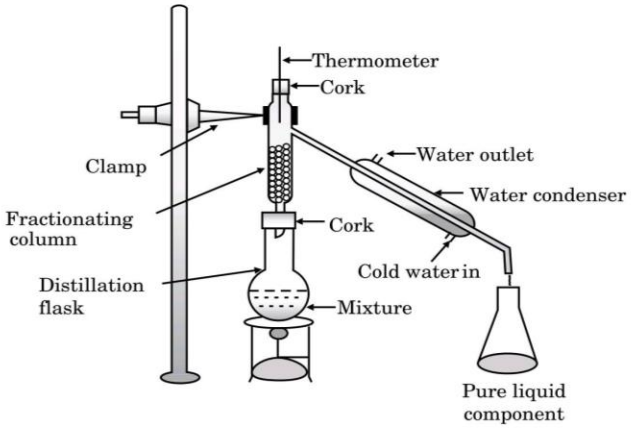
(i) Sulphur powder

Ans. Chlorine gas, iron, aluminium, iodine, carbon, and sulphur powder are not compounds.

Long Answer Questions

Q. 33. Fractional distillation is suitable for separation of miscible liquids with a boiling point difference of about 25 K or less. What part of fractional distillation apparatus makes it efficient and possess an advantage over a simple distillation process. Explain using a diagram.

Ans. The fractionating column packed with glass beads provides a surface for the vapours to collide and lose energy so that they can be quickly condensed and distilled. Also length of the column would increase the efficiency.



Q. 34. (a) Under which category of mixtures will you classify alloys and why?

(b) A solution is always a liquid. Comment.

(c) Can a solution be heterogeneous?

Ans. **(a)** We will classify the alloys in homogeneous mixture because alloys have uniform composition throughout. Alloys are homogeneous mixtures of metals and cannot be separated into their components by physical methods. But it shows the properties of its constituents and can have variable composition, thus considered as a mixture.

(b) "A solution is always a liquid", this statement is not correct as solid solutions and gas solution is also possible, example of solid solution is brass and air is the example of gaseous solution.

(c) No a solution cannot be heterogeneous, it is a homogeneous mixture of two or more substances.

Q. 35. Iron filings and sulphur were mixed together and divided into two parts, 'A' and 'B'. Part 'A' was heated strongly while Part 'B' was not heated. Dilute hydrochloric acid was added to both the parts and evolution of gas was seen in both the cases. How will you identify the gases evolved?

Ans. **Part A :**

H_2S gas formed has a vulgar smell and on passing through lead acetate solution, it turns the solution black.

When the mixture of iron filings and sulphur is strongly heated it forms ferrous sulphide. When dilute HCl added to it , it forms ferrous chloride and hydrogen sulphide gas is released.

$$Fe\,(s) + S\,(s) \xrightarrow{\text{Heat}} FeS\,(s)$$

$$FeS + 2HCl\,(aq) \rightarrow FeCl_2 + H_2S$$

Part B :

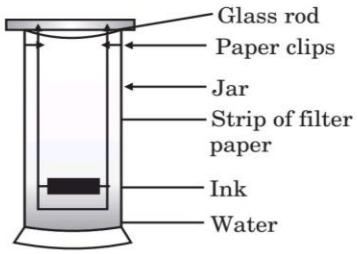
$$Fe\,(s) + S\,(s) \rightarrow \text{Mixture of iron filings and sulphur}$$

When dilute HCl is added to it

$$Fe\,(s) + S\,(s) + 2HCl\,(aq) \quad FeCl_2 + H_2\,(g)$$

Sulphur remains unreacted. Ferrous chloride is formed and hydrogen gas is released. Hydrogen gas burns with a pop sound.

Q. 36. A child wanted to separate the mixture of dyes constituting a sample of ink. He marked a line by the ink on the filter paper and placed the filter paper in a glass containing water as shown in Figure below. The filter paper was removed when the water moved near the top of the filter paper.



(i) What would you expect to see, if the ink contains three different coloured components?

(ii) Name the technique used by the child.

(iii) Suggest one more application of this technique.

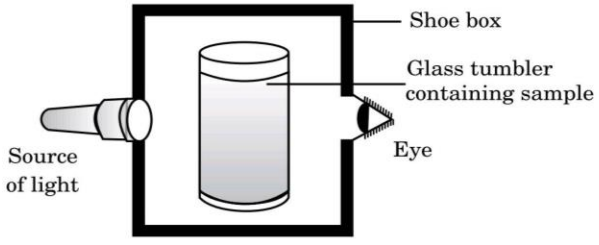
Ans. **(i)** If the ink contains three different components, then the colour component which is more soluble in water dissolves first, rises faster and produces a colour band (spot) on the paper at a higher position. The less soluble colour components dissolve a little later, rise slower and form coloured bands at lower heights. In this way, three different bands will be observed.

(ii) Technique used by the child is chromatography which is the process of separation of the individual components of a mixture based on their relative affinities towards stationary and mobile phases.

(iii) One more application is to separate the pigments present in chlorophyll.

Q. 37. A group of students took an old shoe box and covered it with a black paper from all sides. They fixed a source of light (a torch) at one end of the box by making a hole in it and made another hole on the other side to view the light. They placed a milk sample contained in a beaker/tumbler in the box as shown in the Figure. They were amazed to see that milk taken in the tumbler was illuminated. They tried the same activity by taking a salt solution but found that light simply passed through it?

(a) Explain why the milk sample was illuminated. Name the phenomenon involved.



Fig

(b) Same results were not observed with a salt solution. Explain.

(c) Can you suggest two more solutions which would show the same effect as shown by the milk solution?

Ans. **(a)** The milk sample was illuminated because milk is a colloid. If a beam of light is put on a milk sample contained in a beaker the path of light beam is illuminated and becomes visible when seen from the other side. This is because as the light falls on the colloidal particles, they start scattering. This scattered light enters our eyes and the path of light beam can be seen. The scattering of light by colloidal particles is known as Tyndall effect.

(b) Salt solution is a true solution and would not scatter light. If a beam of light is put on a salt solution kept in a beaker in a dark room, the path of light beam is not visible inside the solution when seen from the other side. Because salt particles cannot scatter lights falling on them as they are very small.

(c) Detergent solution, sulphur solution

Q. 38. Classify each of the following, as a physical or a chemical change. Give reasons.

(a) Drying of a shirt in the sun.

(b) Rising of hot air over a radiator.

(c) Burning of kerosene in a lantern.

(d) Change in the colour of black tea on adding lemon juice to it.

(e) Churning of milk cream to get butter.

Ans. **Physical changes :** (a), (b), (e)

Chemical changes : (c), (d)

Q. 39. During an experiment the students were asked to prepare a 10% (Mass/Mass) solution of sugar in water. Ramesh dissolved 10 g of sugar in 100 g of water while Sarika prepared it by dissolving 10 g of sugar in water to make 100 g of the solution.

(a) Are the two solutions of the same concentration

(b) Compare the mass % of the two solutions.

Ans. **(a)** No.

$$\text{Mass\%} = \frac{\text{Mass of solute}}{\text{Mass of solute} + \text{Mass of solvent}} \times 100$$

(b) Solution made by Ramesh :

$$\text{Mass\%} = \frac{10}{10+100} \times 100$$
$$= 9.09\%$$

Solution made by Sarika :

$$\text{Mass\%} = \frac{10}{100} \times 100$$
$$= 10\%$$

[4]

The solution prepared by Sarika has a higher mass % than that prepared by Ramesh.

Q. 40. You are provided with a mixture containing sand, iron filings, ammonium chloride and sodium chloride. Describe the procedures you would use to separate these constituents from the mixture?

Ans. To separate the constituents of sand, iron filings, ammonium chloride and sodium from the mixture, we need to follow the given steps of the procedure :

Step-1 Magnet attract the iron filings, so to separate iron filings we can use a magnet.

Step-2 Then from the remaining mixture, to separate ammonium chloride, sublimation process is used as ammonium chloride sublimes easily.

Step-3 Then to the remaining mixture, add water, stirr and filter, to separate sand.

Step-4 The filtrate can be evaporated to get back sodium chloride.

Q. 41. Arun has prepared 0.01% (by mass) solution of sodium chloride in water. Which of the following correctly represents the composition of the solutions?

(a) 1.00 g of NaCl + 100 g of water

(b) 0.11 g of NaCl + 100 g of water

(c) 0.01 g of NaCl + 99.99 g of water

(d) 0.10 g of NaCl + 99.90 g of water

Ans. **Correct option : (c)**

Explanation :

$$\text{Mass\%} = \frac{\text{Mass of solute} \times 100}{(\text{Mass of solute} + \text{Mass of solvent})}$$
$$= \frac{0.01}{0.01+99.99} \times 100$$
$$= \frac{0.01}{100} \times 100$$
$$= 0.01\%$$

Q. 42. Calculate the mass of sodium sulphate required to prepare its 20% (mass percent) solution in 100 g of water?

Ans. Let the mass of sodium sulphate required be = x g

The mass of solution would be = $(x + 100)$ g

x g of solute in $(x + 100)$ g of solution

$$20\% = \frac{x}{x+100} \times 100$$
$$20x + 2000 = 100x$$
$$80x = 2000$$
$$x = \frac{2000}{80}$$
$$= 25 \text{ g}$$

BOARD CORNER

Short Answer Questions

Q. 1. (a) Name the separation technique used for the separation of different fragments from the floral petals.

(b) Classify each of the following as element, compound and mixture:

Gold, air, sodium, calcium carbonate

(KVS-2018, Agra Region)

Ans. (a) Chromatography

(b) Element - Sodium, Gold

Compound - Calcium carbonate

Mixture - Air

Commonly Made Error

- Many students are not able to classify the substances into elements, compounds and mixture.

Answering Tip

- Classify the following substances vigilantly.

Q. 2. Give an example each of the having following characteristics. Also suggest a suitable method to separate the component of these mixtures.

(KVS-2018 Jammu Region)

(i) A volatile and a non-volatile component

(ii) Two volatile components with appreciable difference in boiling point.

(iii) Two immiscible liquids.

Ans. (i) Mixture of acetone and water. Simple distillation can be used to separate mixture of volatile and now-volatile components.

(ii) Mixture of kerosene and petrol. Simple distillation can be used to separate two volatile components with appreciable difference in boiling points.

(iii) Mixture of mustard oil and water. Separating funnel can be used to separate a mixture of immiscible liquids.

Commonly Made Error

- Children are often confused in distillation and fractional distillation.

Answering Tip

- Learn the various types of separation techniques with proper examples.

Q. 3. Can you separate mixture of common salt and sugar by sublimation? Explain

(KVS-2018 Jammu Region)

Ans. No, because common salt and sugar are not sublimates. Sublimates are substances which on heating directly changes into vapour without changing into liquid.

We can separate sublimating substances (like napthalene/camphor/ammonium chloride) from the mixture through the process of sublimation.

Commonly Made Error

- Students often get confused with the terms sublimation and evaporation.

Answering Tip

- Always remember that the sublimation process does not involve liquid phase, it is a direct conversion from solid to gas phase

SOLVED EXAMPLES - FOUNDATIONS

1. How will you separate a mixture of common salt, sulphur powder and sand?

Sol. First shake the mixture with carbon disulphide, sulphur powder dissolves leaving behind common salt and sand. The mixture is filtered. Evaporation of carbon disulphide from the filtrate gives sulphur powder. The residue left on the filter paper consists of common salt and sand. Shake this mixture well with water when common salt dissolves leaving behind sand. The mixture is filtered. Evaporation of water from the filtrate gives common salt.

2. Comment upon the following :

(i) Smoke and fog are aerosols.

(ii) An emulsifying agent stabilizes a colloidal sol of a solid in a liquid.

(iii) Amalgamated zinc is a compound.

Sol. (i) A colloidal solution in which gas is the dispersion medium is called the aerosol.

Since smoke is a colloidal sol of solid carbon particles is air and fog is a colloidal sol of moisture (water droplets) in air, therefore, both are aerosols.

(ii) Colloidal sols of solid in liquid or liquid in solid are quite stable. Therefore, they do not need any emulsifying agent. However, liquid in liquid type colloidal sols called emulsions are usually unstable. Therefore, to stabilize them usually emulsifying agents are added.

For example, milk in which liquid fat is dispersed in water is stabilized by the protein lactalbumin present in it.

(iii) Amalgamated zinc is obtained by vigorously shaking zinc granules with a solution of mercuric chloride. As a result, the surface of zinc granules is coated with mercury. In other words, amalgamated zinc is not a compound but is a heterogeneous mixture of zinc and mercury.

3. Classify the following as pure substances or mixtures. Separate the pure substances into elements, compounds and divide the mixtures into homogeneous and heterogeneous:
(i) Air (ii) Milk (iii) Graphite (iv) Gasoline (v) Diamond (vi) Tap water (vii) Distilled water (viii) Oxygen (ix) Brass (x) 22 Carat gold (xi) Steel (xii) Iron (xiii) Sodium chloride (xiv) Iodized table salt.

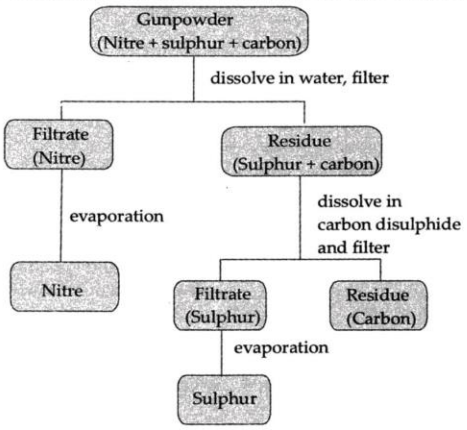
Sol.
(i) Air : Mixture (Homogeneous)
(ii) Milk : Mixture (Homogeneous)
(iii) Graphite : Pure substance (Element)
(iv) Gasoline : Mixture (Homogeneous)
(v) Diamond : Pure substance (Element)
(vi) Tap water : Mixture (Homogeneous)
(vii) Distilled water : Pure substance (Compound)
(viii) Oxygen : Pure substance (Element)
(ix) Brass : Mixture (Homogeneous)
(x) 22 Carat gold : Mixture (Homogeneous)
(xi) Steel : Mixture (Homogeneous)
(xii) Iron : Pure substance (Element)
(xiii) Sodium chloride : Pure substance (Compound)
(xiv) Iodized table salt : Mixture (Homogeneous)

4. How will you separate the components of gun powder?

Sol. Gunpowder is a mixture of nitre (potassium nitrate), sulphur and powdered charcoal.

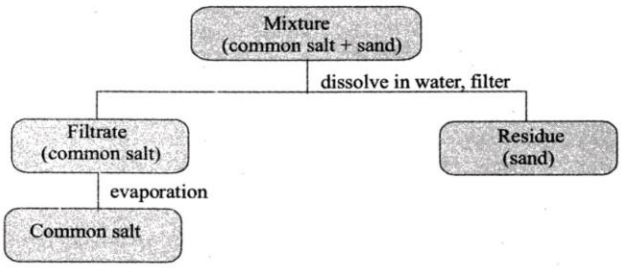
The mixture is thoroughly shaken with water when nitre goes into solution leaving behind sulphur and charcoal undisclosed. The solution is filtered out. The filtrate contains aqueous solution of nitre. On slow evaporation, the filtrate gives crystals of nitre. Undisclosed residue containing sulphur and charcoal is treated with carbon disulphide solution.

Sulphur dissolves in the solution but charcoal does not. On filtration, charcoal is obtained as a residue. The filtrate, which contains sulphur, on evaporation gives sulphur as the residue.



5. How will you separate the components of a mixture of common salt and sand?

Sol. The mixture is treated with water. Common salt dissolves in water, but sand remains undissolved. The solution is filtered. The filtrate is an aqueous solution of common salt The solution on evaporation gives common salt as the residue.



6. Calculate the concentration of a solution in volume per cent made when 56 g of water is mixed with 0.17 L of ethanol.

Sol. Volume of water

$$=\frac{\text{mass}}{\text{density}}=\frac{5\text{g}}{1.0\text{gcm}^{-3}}=56\text{cm}^3=56\text{mL}$$

Volume of ethanol = 0.17 L = 0.17 x 1000 mL = 170 mL

$\therefore$ volume of solution = (56+170) mL= 226 mL

$\therefore$ concentration percent by

$$\text{volume}=\frac{56}{226}\times 100=24.78\%$$

7. How will you separate iron filings, ammonium chloride and sand from their mixture?

Sol. The mixture containing iron filings, ammonium chloride and sand is separated as follows:

(i) Iron filings are attracted by a magnet so they are removed by the method of magnetic separation. When a magnet is moved in this mixture, iron filings cling to the magnet and get separated. We are then left with ammonium chloride and sand.

(ii) Ammonium chloride sublimes on heating whereas sand does not sublime. So, ammonium chloride is separated from sand by the process of sublimation. When the mixture containing ammonium chloride and sand is heated, then ammonium chloride forms vapours easily.

These vapours on cooling give pure ammonium chloride.

8. You are given a mixture of sand, water and mustard oil. How will you separate the components of this mixture?

Sol. This mixture contains three components: sand, water and mustard oil. Now, sand is a solid which is insoluble in water as well as mustard oil. Water and mustard oil are immiscible liquids.

(i) The mixture of sand, water and mustard oil is filtered. Sand is left on the filter paper as residue. Water and mustard oil collects as filtrate.

(ii) The filtrate containing water and mustard oil is put in a separating funnel. Water forms the lower layer and mustard oil forms the upper layer in separating funnel. The lower layer of water is run out first by opening the stop-cock of the separating funnel.

Mustard oil remains behind in the separating funnel and can be removed separately.

9. If 110 g of salt is present in 550 g of solution, calculate the concentration of solution.

Sol. Here, mass of solute (salt) = 110 g

And, mass of solution = 550 g

Now, we know that:

Concentration of solution

$$=\frac{\text{Mass of solute}}{\text{Mass of solution}}\times 100=\frac{110}{550}\times 100=\frac{100}{5}=20$$

Percent (or 20%) Thus, the concentration of this salt solution is 20 percent (or it is a 20% salt solution).

10. A solution contains 50 mL of alcohol mixed with 150 mL of water. Calculate the concentration of this solution.

Sol. This solution contains a liquid solute (alcohol) mixed with a liquid solvent (water), so we have to calculate the concentration of this solution in terms of volume percentage of solute (alcohol). Now, we know that:

Concentration of solution

$$=\frac{\text{volume of solute}}{\text{Volume of solution}}\times 100$$

Here, Volume of solute (alcohol) = 50 mL

And, Volume of solvent (water) = 150 mL

So, Volume of solution = Volume of solute + Volume of solvent = 50 + 150 = 200 mL

Now, putting the values of 'volume of solute' and 'volume of solution' in the above formula we get:

Concentration of solution

$$=\frac{50}{200}\times 100=\frac{50}{2}=25\%$$

11. Can physical and chemical changes occur together? Illustrate your answer.

Sol. In some cases, physical and chemical changes occur together. One such example is burning of candle. The solid wax present in the candle first changes into liquid state and then into the vapour state. Both these changes are physical changes. The wax vapours then combine with oxygen of the air to form a mixture of carbon dioxide and water. This involves a chemical change. The un burnt wax vapours again change first to the liquid state and finally to the solid state. This inter conversion of states is a physical change. Thus, burning of candle involves both physical and chemical changes.

12. How can a saturated solution be made unsaturated?

Sol. A saturated solution can be made unsaturated in the following two ways:

(i) By increasing the temperature of the solution. When a saturated solution is heated, solubility of the solute increases and hence the solution becomes unsaturated.

(ii) By adding more of the solvent or by diluting.

13. Mercuric oxide is a red powder (HgO). When heated in a dry test tube, it gives out liquid mercury and colourless oxygen gas as :
Mercuric oxide → Mercury + Oxygen
What conclusion will you draw regarding these three substances: mercuric oxide, mercury and oxygen?

Sol. Mercuric oxide: It is a compound because it splits up into simpler substances mercury and oxygen.

Mercury: It is an element because it cannot be further decomposed into simpler substances.

Oxygen: It is also an element because it cannot be further decomposed into simpler substances.

14. Hydrogen is a combustible gas and oxygen is a supporter of combustion. Water contains both hydrogen and oxygen but it is used to existinguish fire. Explain.

Sol. Hydrogen and oxygen are elements and have their characteristic properties. But water is a compound of hydrogen and oxygen combined together in a fixed ratio of 1:8 by mass. The properties of a compound are entirely different from those of its constituent atoms from which it is formed. Therefore, water has different properties than hydrogen and oxygen.

15. Name the following:
(a) An element which is liquid at room temperature and metallic in nature.
(b) An element attracted by magnet.
(c) A non-metal which is gaseous at room temperature.
(d) Two gases present in air.
(e) Components of alloy brass.

Sol. (a) Mercury
(b) Iron
(c) Hydrogen
(d) Oxygen and nitrogen
(e) Copper and zinc

16. Identify the dispersed phase and dispersion medium in the following colloidal solutions.
(i) milk, (ii) latex, (iii) sponge, (iv) sprays.

Sol. (i) Dispersed phase → fat, proteins dispersion medium → water
(ii) Dispersed phase → rubber particles; dispersion medium → water
(iii) Dispersed phase → air; dispersion medium → rubber (material of the sponge)
(iv) Dispersed phase → liquid perfume; dispersion medium → gas (Freon)

NCERT SECTION

1. What is meant by a pure substance?

Ans. A pure substance is one which is made up of only one kind of atom or molecules. e.g. water is made up of only one kind of particles. So water is a pure substance.

2. List the points of difference between homogeneous and heterogeneous mixture.

Ans.

Homogeneous mixture	Heterogeneous mixture
1. A mixture in which different constituents are mixed uniformly.	1. A mixture in which different constituents are not mixed uniformly.
2. They cannot have physically distinct parts.	2. They have physically distinct parts.
3. The constituents cannot be easily seen.	3. The constituents can be easily seen.
4. The constituents cannot be easily separated.	4. The constituents can be easily separated.
5. **Example :** Sugar solution, soda, water, soft drinks, vinegar, air etc.	5. **Example :** Sugar and sand mixture, milk, ink, paint, wood, blood etc.

3. Differentiate between homogeneous and heterogeneous mixtures with examples.

Ans.

Homogeneous mixture	Heterogeneous mixture
1. A mixture in which different constituents are mixed uniformly.	1. A mixture in which different constituents are not mixed uniformly.
2. They cannot have physically distinct parts.	2. They have physically distinct parts.
3. The constituents cannot be easily seen.	3. The constituents can be easily seen.
4. The constituents cannot be easily separated.	4. The constituents can be easily separated.
5. **Example :** Sugar solution, soda, water, soft drinks, vinegar, air etc.	5. **Example :** Sugar and sand mixture, milk, ink, paint, wood, blood etc.

4. How are sol, solution and suspension differ from each other?

Ans.

Property	Sol	Solution	Suspension
1. Nature	Heterogeneous	Homogeneous	Heterogeneous
2. Particle size (diameter)	Between 10^{-7} to 10^{-5} cm (10^{-9} to 10^{-7} m or 1 nm to 100 nm)	Less than 1 nm (less than 10^{-9} to 10^{-7}m)	More than 100 nm
3. Appearance	Generally clear	Clear	Opaque
4. Visibility	Visible with ultra microscope	Not visible	Visible with naked eye
5. Diffusion	Diffuses very slowly	Diffuses rapidly	Does not diffuse
6. Tyndall effect	Show	Do not show	May show
7. Settling of particles	Settle only on centrifugation	Do not settle	Settle of their own
8. Brownian movement	Shows	May or may not show	May show

5. To make a saturated solution 36 g of sodium chloride is dissolved in 100 g of water at 293 K. Find its concentration at this temperature.

Ans. Mass of sodium chloride = 36 g

Mass of solution = 36 + 100 = 136 g

Conc entration of solution

$$= \frac{mass\ of\ solute}{mass\ of\ solution} \times 100 = \frac{36}{136} \times 100 = 26.47\%\ (w/w)$$

6. How will you separate a mixture containing kerosene and petrol, (difference in their building points is more than 25°C), which are miscible with each other?

Ans. The mixture of two miscible liquids such as kerosene and petrol whose boiling points differ by more than 25°C can be easily separated by the technique of simple distillation.

The separation is based upon the principle that the boiling point of more volatile (low building liquid of the mixture. The vapour almost exclusively consists of the more volatile liquid Likewise at the boiling of the less volatile (high boiling) liquid/ vapours almost entirely consists of the less volatile liquid since the more volatile liquid has already distilled over.

7. Name the technique to separate

(i) butter from curd

(ii) salt from sea water

(iii) camphor from salt

Ans. (i) Butter from curd can be separated by the technique of centrifugation.

(ii) Salt from sea water can be separated by the technique of crystallization or by the evaporation.

(iii) Camphor is sublimable but salt is not. So, camphor can be separated from salt sublimation technique.

8. What type of mixtures are separated by the technique of crystallization?

Ans. Homogeneous mixtures such as common salt solution and copper sulphate solution separated by technique of crystallization.

9. Classify the following as chemical or physical changes.

(1) cutting of trees

(2) melting of butter in a pan

(3) rusting of almirah

(4) boiling of water to form steam

(5) passing of electric current through water and the water breaking down into hydrogen and oxygen

(6) dissolving common salt in water

(7) making a fruit salad with raw fruits

(8) burning of paper and wood

Ans. (1) Cutting of trees is a chemical change since all chemical reactions stop and we cannot get back the original tree from the wooden peaces.

(2) Melting of butter in a pan is a physical change since there is no change in the chemical composition of butter, only the physical state changes from solid to liquid.

(3) Rusting of almirah is a chemical change since during rusting, a new chemical compound called hydrated iron oxide (rust) is formed.

(4) Boiling of water to form steam is a physical change because during this change only changer of state occurs from liquid water to steam (gaseous) without any change in its chemical composition.

(5) Passing of electric energy through water to form hydrogen and oxygen is a chemical change since the properties of hydrogen (combustible gas) and oxygen (supporter of combustion) are altogether different from those of water which is neither combustible nor a supporters of combustion but it actually extinguishes fire.

(6) Dissolution of common salt in water is a physical change since salt can be easily recovered by evaporating water.

(7) Making a fruit salad with raw fruits is a physical change since there is no change in the chemical properties of the fruits but only the physical appearance has changed.

(8) Burning of paper is a chemical change since carbon dioxide, water vapours, smoke and ash which are the products of combustion cannot be converted back into paper or wood by any physical method.

10. Try segregating the things around you as pure substances or mixtures.

Ans. Pure substances: Distilled water, diamond, graphite, raw rubber.

Mixtures: Curd, ice-cream, kerosene oil, cooking oil, steel, vulcanized rubber, solder wire (alloy of lead and tin).

11. Which separation techniques will you apply for the separation of the following?

(a) Sodium chloride from its solution in water.

(b) Ammonium chloride from a mixture containing sodium chloride and ammonium chloride.

(c) Small pieces of metal in the engine oil of a car.

(d) Different pigments from an extract of flower petals.

(e) Butter from curd.

(f) Oil from water.

(g) Tea leaves from tea.

(h) Iron pins from sand.
(i) Wheat grains from husk.
(j) Find mud particles suspended in water.

Ans. (a) **Evaporation:** Water will evaporate leaving behind sodium chloride.
(b) **Sublimation:** Ammonium chloride will be collected as sublime.
(c) **Filtration:** Pieces of metal can be separated by filtration.
(d) **Chromatography:** Pigments (coloured components) from the extract of flower plants can be separated by chromatography.
(e) **Centrifugation:** Butter will get separated upon centrifugation.
(f) Separating funnel: Oil and water can be separated by the use of separating funnel.
(g) **Filtration:** Upon filtration through a sieve, tea leaves will be collected on the sieve.
(h) **Magnetic separation:** A magnet will attract iron pins and not sand particles.
(i) **Sieving:** Wheat grains from husk can be separated with the help of sieves.
(j) **Sedimentation:** As a result of sedimentation, mud particles will settle as precipitate. It can be separated later on by filtration.

12. Write the steps you would use for making tea. Use the words solution, solvent, solute, dissolve, soluble, insoluble, filtrate and residue.

Ans. Take 100 mL of water which acts as solvent. Boil water on a gas stove. Add one teaspoon of sugar which acts as solute. Sugar is soluble in water, so gets dissolved in water and forms a solution. Now add about half a teaspoon of tea leaves which are insoluble in water. Boil the contents for 4 to 5 minutes and add a half cup of milk and allow to boil again for 2-3 minutes. Filter the tea with the help of a sieve. Tea leaves will be left as residue while tea will be obtained as filtrate.

13. Pragya tested the solubility of three different substances at different temperatures and collected the data as given below (results are given in the following table, as grams of substance dissolved in 100 grams of water to form a saturated solution).

Substance Dissolved	Temperature in K				
	283	293	313	333	353
Potassium nitrate	21	32	62	106	167
Sodium chloride	36	36	36	37	37
Potassium chloride	35	35	40	46	54
Ammonium chloride	24	37	41	55	66

(a) What mass of potassium nitrate would be needed to produce a saturated solution of potassium nitrate in 50 grams of water at 313 K?
(b) Pragya makes a saturated solution of potassium chloride in water at 353 K and leaves the solution to cool at room temperature. What would she observe as the solution cools? Explain.
(c) Find the solubility of each salt at 293 K. Which salt has the highest solubility at this temperature?
(d) What is the effect of change of temperature on the solubility of a salt?

Ans. (a) Solubility of potassium nitrate at $313\,K = \frac{62}{100}$
100 g of water contains potassium nitrate = 62 g
∴ 50 g of water contains potassium nitrate $= \frac{62}{100} \times 50 = 31\,g$
Thus, 31 g potassium nitrate would be needed to produce a saturated solution of potassium nitrate in 50 g of water at 313 K.
(b) When a saturated solution of potassium chloride at 353 K is cooled/ the solubility potassium chloride in water decreased. As a result the amount of potassium chloride which exceeds its solubility at lower temperature separates out as crystals.
(c) The maximum amount of the salt which is dissolved in 100 g of water to form a saturate solution at the given temperature/ is known as solubility.
Solubility of potassium nitrate at $293\,K = \frac{32}{100}$
Solubility of sodium chloride at $293\,K = \frac{36}{100}$
Solubility of potassium chloride at $293\,K = \frac{35}{100}$
Solubility of ammonium chloride at $293\,K = \frac{37}{100}$
From the above data it is clear that ammonium chloride has the highest solubility at 293
(d) In general the solubility of a salt increases with temperature. The increase is however

different for different salts. For example the solubility of potassium nitrate increase appreciably that of ammonium chloride increases slightly that of potassium chloride increases marginally while that of sodium chloride almost remains constant.

14. Explain the following giving examples.
(a) saturated solution
(b) pure substance
(c) colloid
(d) suspension

Ans. (a) **Saturated solution:** A solution in which no more solute can be dissolved in a given amount of solvent at a particular temperature is called saturated solution. For example, if we dissolve 40 g sodium chloride in 100 g of water at 293 K/ it will form a saturated solution because the solubility of sodium chloride at 293 K is 36 g per 100 g of water.
(b) **Pure substance:** A substance made up of only one kind of atoms or molecules is called a pure substance. A pure substance has the same colour taste and texture at a given temperature and pressure. A pure substance also has a fixed melting and boiling point at a constant pressure. For example hydrogen gas sodium chloride water etc.
(c) **Colloid:** A substance is said to be a colloid if its particles size lies between 1 to 100 nm.
A colloidal solution is a heterogeneous and consists of two phases, i.e., dispersed phase (colloidal particles) and dispersion medium in which colloidal particles are suspended.
For example colloidal solution of sulphur or starch milk etc.
(d) **Suspension:** It is a heterogeneous mixture in which the particles of the solute do not dissolve but remain suspended throughout the bulk of the solvent. The size of the suspension particles is more than 10^{-7} m. For example, chalk powder in water is a suspension.

15. Classify each of the following as a homogeneous or heterogeneous mixtures.
Soda water, wood air soil vinegar filtered tea

Ans. Homogeneous mixtures: Soda water/ vinegar and filtered tea.
Heterogeneous mixtures: Wood and soil.
Air is a homogeneous mixture of different gases. However, if some dust or other particles are also present, then air becomes heterogeneous mixture.

16. How would you confirm that a colourless liquid given to you is pure water?

Ans. The boiling point and freezing point of the given liquid comes out to be 100°C or 373 K and 0°C or 273 K respectively under one atmospheric pressure, it confirms that the given liquid is pure water.

17. Which of the following materials fall in the category of a "pure substance"?
(a) ice, (b) milk, (c) iron, (d) hydrochloric acid, (e) calcium oxide, (f) mercury, (g) brick, (h) wood, (i) air

Ans. Ice, iron, calcium oxide and mercury are pure substances since they contain particles of only one kind of matter. In contrast, milk, hydrochloric acid (hydrogen chloride gas dissolved in water), brick and air cannot be called pure substances because they consists of particles of more than one kind of matter.

18. Identify the solutions among the following mixtures.
(a) Soil, (b) sea water, (c) air, (d) coal, (e) soda water

Ans. A solution is a homogeneous mixture of two or more substance. In the light of this, the solution among the following are (b) sea water, (c) air and (e) soda water.

19. Which of the following will show Tyndall effect?
(a) Salt solution
(b) Milk
(c) Copper sulphate solution
(d) Starch solution

Ans. (b) milk and (d) starch solution show Tyndall effect because they are colloidal solution.
Whereas (a) salt solution and (c) copper sulphate solution are true solution. Their particle size is too small to scatter light. So they do not show Tyndall effect.

20. Classify the following into elements, compounds and mixtures.
(a) Sodium, (b) soil, (c) sugar solution, (d) silver, (e) calcium carbonate,(f) tin, (g) silicon, (h) coal, (i) air, (j) soap, (k) methane, (1) carbon dioxide, (m) blood

Ans. **Elements:** The elements are regarded as the building blocks of the universe. So (a) sodium, (d) silver, (f) tin and (g) silicon are elements.
Compounds: It is a pure substance made up of two or more elements chemically combined in a fixed proportion by mass. So, (e) calcium carbonate, (k) methane and (1) carbon dioxide are compounds.
Mixtures: It is a substance containing two or more substance (elements or compound) in any proportion. So (b) soil, (c) sugar solution, (h) coal, (i) air, (j) soap and (m) blood are mixtures.

EXERCISE

Multiple Choice Questions

1 Which of the following would be described as impure?
(a) Crystallized salt (b) Salt solution
(c) Rock salt (d) All of the above.

2 If the component of the substance can be separated by a chemical change only then it is
(a) element (b) compound
(c) mixture (d) none of these.

3. Water is a compound because
(a) it exists as a solid, liquid or gas
(b) it cannot be split up
(c) it contains two different elements joined by chemical bonds
(d) it has 3 elements.

4. Mixtures always have
(a) definite composition
(b) invariable composition
(c) variable composition
(d) none of the above.

5. The zig-zag movement of dispersed phase particle in a colloidal system is known as
(a) Brownian motion
(b) transitional motion
(c) circular motion
(d) linear motion.

6. Iodized common salt is
(a) homogeneous mixture
(b) heterogeneous mixture
(c) pure substance
(d) oxidized substance.

7. The concentration of a solution indicates
(a) the quantity of the solute present in solution
(b) the quantity of the impurities present in a solution
(c) the quantity of the solvent present in a solution
(d) the total quantity of solution.

8. In sweetened tea, the sugar is
(a) solvent (b) solute
(c) solution (d) none of these

9. A solution that has dissolved as much solute as it is capable of dissolving at a given temperature is
(a) only solution
(b) unsaturated solution
(c) saturated solution
(d) concentrated solution.

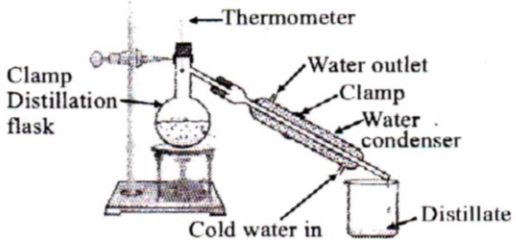
10. Pigments of natural colors can be separated
(a) By chromatography (b) centrifugation
(c) filtration (d) sublimation.

11. The fine particles of an insoluble substance uniformly dispersed throughout a gas or liquid is called
(a) suspension (b) precipitate
(c) colloidal solution (d) impurity.

12. What kind of solution is gel?
(a) Colloid (b) Mixture
(c) Emulsion (d) Suspension.

13. What will happen when a solute is added to a saturated solution?
(a) The solution will freeze
(b) The solution will become less concentrated
(c) A precipitate will form
(d) Concentration will increase.

14. While using the given apparatus, what must be kept in mind?



(a) The mixture in the distillation flask must contain a solid.
(b) The temperature difference between the boiling point of components of the mixture must be less then $25^{\circ} C$.
(c) The temperature difference between the boiling points of components of the mixture must be more than $25^{\circ} C$.
(d) All of these.

15. A small amount of the sample of a soil was mixed with water in beaker. After stirring for some time, the beaker was allowed to stand. The mud was found to settle down. The liquid above the mud was carefully filtered. The filtrate will be
(a) a true solution
(b) a colloidal solution
(c) can be a true solution or a colloidal solution
(d) a suspension.

16. Which of the following upon shaking with water will not form a true solution?
(a) Alum (b) Common salt
(c) Albumin (d) Sucrose. .

17. Water was taken in four beakers labeled as to IV. To these beakers the following substances were added.
Beaker (I) Common salt
Beaker (II) Alum

Beaker (III) Potassium nitrate
Beaker (IV) A few drops of barium chloride and a few drops of dilute H_2SO_4.
After sometime, the contents of the beakers were filtered. The contents of which beaker will leave residue on the filter paper.
(a) Beaker (I) (b) Beaker (II)
(c) Beaker (III) (d) Beaker (IV).

18. A student mixed a small amount of iron filings and sulphur powder in a dish. He could not affect the separation by simple hand picking. Which liquid will you suggest to effect the separation?
(a) Carbon disulphide (b) Cold water
(c) Boiling water (d) Kerosene.

19. Which of the following will show Tyndall effect?
(a) Starch solution
(b) Sodium chloride solution
(c) Copper sulphate solution
(d) Sugar solution

20. An emulsion is a colloidal solution formed by mixing
(a) two miscible liquids
(b) any two liquids
(c) any two gases
(d) two immiscible liquids.

21. The size of colloidal solution is in the range of
(a) $1-100\,nm$ (b) $100-1000\,nm$
(c) $10^{-5}\,m-10^{-7}\,m$ (d) $10^{7}-10^{9}\,m$

22. Brass contains
(a) gold and copper (b) copper and zinc
(c) zinc and silver (d) copper and silver.

23. Which of the following is NOT a colloid?
(a) Sugar syrup (b) Fog
(c) Milk (d) Cheese

24. A liquid non-metal, amongst the following is
(a) bromine (b) mercury
(c) phosphorus (d) both (a) and (b)

25. Which of the following is a homogeneous mixture?
(a) Solution of sugar in water
(b) Chalk powder in water
(c) Kerosene oil in water
(d) None of these

26. A mixture of common salt, sulphur, and iron filings is shaken with carbon disulphide and filtered through a filter paper. The filtrate is evaporated to dryness in a china dish. What will be left in the dish after evaporation?
(a) Sand (b) Sulphur
(c) Iron filings (d) Common salt

27. A mixture of sulphur and iron filings is heated strongly to obtain a residue. Which of the following is not a characteristic property of the residue?
(a) It can be separated into sulphur and iron filings by physical methods
(b) Its composition does not change from one part to another.
(c) Its properties are entirely different from those of sulphur and iron filings.
(d) Its appearance is different from those of sulphur and iron filings.

28. Solutions with low concentrations of solutes are
(a) concentrated (b) dilute
(c) solvents (d) none of these.

29. Which of these is a mixture?
(a) Solution (b) Alloy
(c) Amalgam (d) All of these

30. Which of the following is always true when a substance undergoes a physical change?
(a) It changes colour
(b) A new substance is formed
(c) It boils
(d) Its composition remains the same

31. Which of the following statement is correct?
(a) A pure substance must contain only one type of atom.
(b) A mixture containing two compounds must be heterogeneous.
(c) A heterogeneous mixture must contain at least three elements.
(d) A homogeneous mixture must be uniform.

32. Which of the following is not an example of a physical change?
(a) Dissolving sugar in water
(b) Casting iron in moulds
(c) Setting of cement
(d) Magnetization of iron

33. Distillation involves all the following processes except
(a) change of state (b) boiling
(c) condensation (d) evaporation

34. Separation of petroleum into its components is done by
(a) chromatography (b) sublimation
(c) distillation
(d) fractional distillation

35. Simple distillation can be best used to separate
(a) a mixture of benzene (boiling point $80^{\circ}C$)
(b) and toluene (boiling point $110^{\circ}C$)
(c) a mixture of ether (boiling point $35^{\circ}C$) and toluene (boiling point $110^{\circ}C$)a mixture of

ethanol (boiling point $78^{\circ}C$)and water (boiling point $100^{\circ}C$)
(d) none of these.

36. Which method cannot be used for purification of liquids?
(a) Chromatography
(b) Distillation
(c) Sublimation
(d) Fractional distillation

37. A mixture contains four solid compounds A, B, C, D. On heating C changes to vapor state. C can be separated from rest of the solids by
(a) crystallization (b) sublimation
(c) distillation (d) filtration

38. A liquid is found to scatter a beam of light but leaves no residue when passed through the filter paper. The liquid is
(a) a suspension (b) a true solution
(c) a colloidal sol (d) oil

39. Identify the false statement.
(a) colloids are homogeneous
(b) colloids show Tyndall effect
(c) colloids show Brownian movement
(d) The size of colloidal particles ranges between 1 - 100 nm.

40. Which is not an example of macromolecular colloids?
(a) Nylon (b) Plastics
(c) Rubber (d) Soaps

41. Which of the following is not a colloid?
(a) Foam (b) Cloud
(c) Roohafza syrup (d) Egg

42. Smoke is an example of
(a) gas dispersed in liquid
(b) gas dispersed in solid
(c) solid dispersed in gas
(d) solid dispersed in solid

43. Micelles are
(a) emulsion cum gel (b) associated colloids
(c) true solution (d) suspensions

44. Which one of the following is correct matched?
(a) Emulsion - curd (b) Foam - mist
(c) Aerosol – smoke (d) Solid sol - cake

45. For a colloidal solution, dispersion medium dispersed phase is liquid - liquid. This is example of
(a) emulsion (b) aerosol
(c) gel (d) sol

46. Suspensions are
(a) visible to naked eye
(b) invisible through microscope
(c) not visible by any means
(d) invisible under electron microscope.

47. Butter is a colloid formed when
(a) fat is dispersed in fat
(b) fat is dispersed in water
(c) water is dispersed in fat
(d) proteins dispersed in water

48. Which one is an example of Micelle system?
(a) Soap + water (b) Rubber + benzene
(c) Protein + water (d) Rubber + water

49. The cause of Brownian movement is
(a) heat change in liquid state
(b) convection current
(c) impact of molecules of dispersion medium on colloidal particles
(d) attractive forces between the particles

50. The number of phases in colloidal system are
(a) one (b) two
(c) three (d) four

51. If we heat iodine , then it is a
(a) physical change (b) chemical change
(c) no change (d) color change

52. Color of rust is
(a) blue (b) green
(c) reddish brown (d) white

53. Which of the following is not a chemical Change
(a) electrolysis of water
(b) boiling of water
(c) digestion of food
(d) burning of magnesium

54. Which of the following is a compound?
(a) Steel (b) Water
(c) Brass (d) Iodine

55. Tincture of iodine is a solution of iodine in
(a) water (b) acetone
(c) benzene (d) ethyl alcohol

56. Which gas present in air has the highest boiling point?
(a) Oxygen (b) Nitrogen
(c) Argon (d) Hydrogen

57. Which method is used to separate drugs from blood?
(a) Fractional distillation
(b) Crystallization
(c) Chromatography
(d) Distillation

58. Which of the following involves both physical and chemical change?
(a) Burning of a candle (b) Rusting of iron
(c) Cooking of food (d) Boiling of water

59. The particles of a true solution are
(a) > 1 nm in diameter
(b) < 1 nm in diameter
(c) = 1 nm in diameter
(d) > or = 1 nm in diameter

60. Which of the following is the smallest part of a compound whose properties are the same as those of a compound?
(a) Atom (b) Molecule
(c) Mixture (c) Unit cell

61. What is the name of the insoluble substance which settles to the bottom of its container?
(a) Solute (b) Solvent
(c) Sediment (d) Slag

62. We can separate a pure solid from its solution by
(a) crystallization (b) simple distillation
(c) sedimentation (d) both (a) and (b)

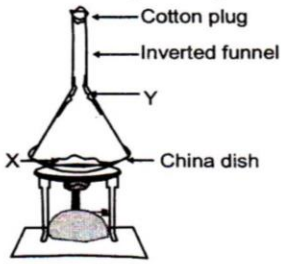
63. Boron, silicon, germanium are
(a) metals (b) non-metals
(c) metalloids (d) impurities

64. Which of the following statements is correct about non-metals?
(a) They have lustre.
(b) They make a ringing sound when hit.
(c) They are poor conductors of heat and electricity.
(d) They have shine.

65. In modern surgery, metal pins are used for holding the broken bones together. This pin is made of
(a) copper (b) stainless steel
(c) aluminum (d) none of these

66. Soda water is a solution of carbon dioxide in water. What is this solution composed of?
(a) Liquid solute in a gaseous solvent
(b) Gaseous solute in a liquid solvent
(c) Liquid solute in a liquid solvent
(d) Gas in suspended form in liquid

67. Identify X and Y in the given figure.



(a) $X =$ Mixture of naphthalene and anthracene $Y =$ Solid naphthalene
(b) $X =$ Mixture of $NaCl$ and water $Y =$ Solid $NaCl$
(c) $X =$ Mixture of $NaCl$ and anthracene $Y =$ Solid anthracene
(d) $X =$ Mixture of sugar and $NaCl$ $Y =$ Solid sugar

68. Which of the following is not true for a compound?
(a) It is heterogeneous in nature.
(b) A compound contains different elements in a fixed ratio.
(c) Properties of a compound are entirely different from those of the elements present in it.
(d) Constituents of a compound cannot be separated by simple physical methods.

69. Two substances A and B when brought together form a substance C with the evolution of heat. The properties of C are entirely different from those of A and B. The substance C is
(a) a compound (b) an element
(c) a mixture (d) none of the above

70. Purity of a solid substance can be checked by its characteristic
(a) boiling point (b) melting point
(c) solubility in water
(d) solubility in a alcohol

71. Which of the following pairs does not contain both elements?
(a) Carbon, silicon (b) Helium, nitrogen
(c) Bronze, zinc (d) Copper, silver.

72. Solvent used in crystallization should
(a) not dissolve the impurities
(b) not react chemically with substance
(c) do not crystallize on cooling
(d) all of the above

73. Principle of chromatography is
(a) rate of absorption (b) rate of adsorption
(c) rate of diffusion (d) none of these.

74. Solvent used in chromatography is
(a) alcohol (b) water
(c) both (a) and (b) (d) ether

75. In chromatography different constituents of a mixture get adsorbed differently on same adsorbent because
(a) they have difference in pressure
(b) they have different rates of movement
(c) both (a) and (b)
(d) none of these

76. The gas which is added to water to kill germs is
(a) CO_2 (b) Cl_2
(c) O_2 (d) H_2

77. To supply drinking water in a city the water from a river is pumped by the pumping static into a large reservoir called
(a) sedimentation tank (b) loading tank
(c) filtration tank (d) chlorination tank

78. Which of the following is a non-aqueous solvent?
(a) Water (b) Chloroform
(c) Both (a) and (b) (c) None of the above

79. Super saturated solution contains

(a) amount of solute more than saturation level
(b) amount of solute less then saturation level
(c) amount of solute equal to saturation level
(d) no solute at all.

80. Identify the aqueous solution
(a) sugar dissolved in water
(b) sugar dissolved in alcohol
(c) iodine dissolved in ether
(d) sulphur dissolved in carbon disulphide

81. A 15% alcohol solution means
(a) 15 mL alcohol and 85 mL water
(b) 15 mL alcohol and 100 mL water
(c) 15 mL water and 85 mL alcohol
(d) 15 mL alcohol and 50 mL water

82. The solution which has two components is known as
(a) binary solution (b) true solution
(c) quaternary solution (d) aqueous solution

FILL IN THE BLANKS

1. In general, on decrease of temperature.....solution is converted into super saturated solution and on increase of temperature a saturated solution is converted in to.....

2. Heating of coal is considered as.....change.

3. Digestion of food is..... change.

4. Gases can be separated from air by.....method

5. 10% by mass of a solution means..... g of solute is present in 50 g of solution.

6. In an unsaturated solution more solute can be dissolved without increasing the amount of the

7. Oil and water do not mix easily. They are said to be..... .

8. Milk is an emulsion in which the dispersed phase is..... and the dispersion medium is..... .

9. Fog is a colloid consisting of..... in air.

10. Soap solution is a colloidal solution in which the dispersed phase is.....while the dispersion medium is..... .

11. The reaction between an aqueous solution of sodium chloride and silver nitrate is a..... change.

12. Milk is a..... solution while vinegar is a..... solution.

13. There is a difference in properties of a solution, colloid and suspension due to difference in

14. When a liquid is dispersed in other liquid, the colloid is termed as..... .

15. The zig - zag motion of colloidal particles is known as..... .

16. The colloidal dispersion of liquids in solid media are called .....

17. The sky looks blue due to..... effect.

18. Mixing of iron filings and sand is a.....change.

19. The properties of a compound differ from those of it's ..... .

20. Migration of colloidal particles under the influence of an electric field is known as.....

TRUE OR FALSE

1. Solution of copper sulphate will show Tyndall effect.

2. Immiscible liquids separate out in layers depending on the densities.

3. During burning of a candle, both physical and chemical changes take place.

4. Constituents of a mixture can be separated by physical methods.

5. Mixture of salt and ammonium chloride can be separated by crystallization process.

6. The colored components present in a dye can be separated by a process known as chromatography.

7. The particles of a colloid can pass through a filter paper.

8. Colloidal state is an intermediate state between suspension and true solution.

9. Mixtures are always combination of the same compounds that are in different states.

10. "Element" word was first used by Robert Boyle in 1661.

11. A true solution is a heterogeneous mixture.

12. Two or more miscible liquids can be separated by distillation.

13. Graphite is a good conductor of electricity.

14. Mixture of sand and sulphur can be separated by dissolving the mixture in water and filtering it.

15. Making of wine from grapes is a chemical change.

16. Drying of paint on a door is a physical change.

ANSWER – KEY

1. C	**2.** B	**3.** C	**4.** C	**5.** A	**6.** A	**7.** A
8. B	**9.** C	**10.** A	**11.** C	**12.** A	**13.** C	**14.** C
15. B	**16.** C	**17.** D	**18.** A	**19.** A	**20.** D	**21.** A
22. B	**23.** A	**24.** A	**25.** A	**26.** B	**27.** A	**28.** B
29. D	**30.** D	**31.** D	**32.** C	**33.** D	**34.** D	**35.** B
36. C	**37.** B	**38.** C	**39.** A	**40.** D	**41.** C	**42.** C
43. B	**44.** C	**45.** A	**46.** A	**47.** C	**48.** A	**49.** C
50. B	**51.** A	**52.** C	**53.** B	**54.** B	**55.** D	**56.** A
57. C	**58.** A	**59.** B	**60.** B	**61.** C	**62.** A	**63.** C
64. C	**65.** B	**66.** B	**67.** C	**68.** A	**69.** A	**70.** B
71. C	**72.** D	**73.** B	**74.** C	**75.** B	**76.** B	**77.** A
78. B	**79.** A	**80.** A	**81.** A	**82.** A		

Fill in the Blanks

1. Saturated , unsaturated	**2.** Chemical
3. Chemical	**4.** Fractional distillation
5. 5	**6.** Solvent
7. Immisciblec	**8.** Fat (milk protein) , water
9. Water droplets	**10.** Solid (soap) , liquid (water)
11. Chemical	**12.** Colloidal, true.
13. Particle size.	**14.** Emulsion
15. Brownian movement	**16.** Gel
17. Tyndall	**18.** Physical
19. Constituents	**20.** Electrophoresis.

True or False

1. False. It is a true solution.
2. True
3. True
4. True
5. False. Mixture is salt and ammonium chloride can be separated by sublimation.
6. True
7. True
8. True
9. False. Any substance can be mixed with another substance to make a mixture.
10. True
11. False. A true solution is a homogeneous mixture.
12. True
13. True
14. False. Sulphur and sand are insoluble in water. Sulphur dissolves in carbon disulphide (CS_2).
15. True
16. False. It is a chemical change.
17. False. There is no similarity between physical properties of an element and its compounds.
18. True
19. True
20. True