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Is Matter Around us Pure

In the Chapter

- A mixture has more than one substance (element and/or compound) mixed in any proportion.
- Mixtures can be separated into pure substances by appropriate separation techniques.
- A solution is a homogeneous mixture of two or more substances. The major component of a solution is known as the solvent, and the minor, the solute.
- The concentration of a solution is the amount of solute present per unit volume or per unit mass of the solution/solvent.
- Materials which are insoluble in a solvent and have particles which are visible to naked eyes, form a suspension. A suspension is a heterogeneous mixture.
- Colloids are heterogeneous mixtures in which the particle size is too small to be seen with the naked eye, but is big enough to scatter light. Colloids are useful in industry and daily life. The particles are called the dispersed phase and the medium in which they are distributed is known as the dispersion medium.
- Pure substances can be elements or compounds. An element is a form of matter which cannot be broken down by chemical reactions into simpler substances. A compound is a substance composed of two or more different types of elements, chemically combined in a fixed proportion.
- Properties of a compound are different from its constituent elements, whereas a mixture shows the properties of its constituting elements or compounds.

Intext Exercises

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1. What is meant by a pure substance?

Ans. The substance which always have the same colour, taste or texture at a given temperature and pressure are pure substance.

2. List the points of differences between homogeneous and heterogeneous mixtures.

Ans. Homogeneous mixture

1. A homogeneous mixture has a uniform composition throughout its mass.
2. It has no visible boundaries of separation between the various constituents.

Heterogeneous mixture

1. A heterogeneous mixture does not have a uniform composition throughout tits mass.
2. It has visible boundaries of separation between the various constituents.

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1. Differentiate between homogeneous and heterogeneous mixtures with examples.

Ans. Homogeneous mixture

1. A mixture of salt in water (called salt solution) is a homogeneous mixture because all the parts of salt solution have the same salt-water composition and appear to be equally salty.
2. There is no visible boundary of separation between salt and water particles in a salt solution.

Heterogeneous mixture

1. A mixture of sand and iron filings is a heterogeneous mixture because different parts of this mixture will have different sand iron filings composition.
2. There is a visible boundary of separation between iron filings and sand particles.

2. How are solution and suspension different from each other?

Ans. True solution

1. It is a homogeneous mixture of two or more than two substance.
2. The molecules of the solute cannot be seen.
3. The size of molecule is less than 10–9 m.
4. The constituents cannot be separated by filtration.
5. Example : Aqueous solution of sugar.

Colloid

1. It has homogeneous looking, but heterogeneous mixture.
2. The particles of solute can be seen by microscope.
3. The size of particle is between 10–6 and 10–9 m.
4. Constituents can be separated only by ultrafiltration.
5. Milk.

Suspension

1. It is a heterogeneous mixture of a solid dispersed in a liquid or a gas.
2. The particles of the solid phase can be seen with naked eyes.
3. The size of particle is bigger than 10–6m.
4. The constituents can be separated by ordinary filtration.
5. Muddy water.

3. 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 solute (salt) =36h

Mass of solvent (water) - 100g

Mass of solution = Mass of solute + Mass of solvent

= 36 g + 100 g

= 136 g

Mass percentage of solution

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

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

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1. 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?

Ans. A mixture of kerosene and petrol can be separated by fractional distillation.

2. Name the technique to separate

Ans. (i) butter from curd

Butter from curd can be separated by the process of centrifugation.

(ii) salt from sea-water

Salt is separated from sea-water by the process of evaporation and crystallization.

(iii) camphor from salt

Camphor from salt can be separated by the process of sublimation.

3. What type of mixtures are separated by the technique of crystallisation?

Ans. Crystallisation is used to separation a mixture of solid containing impurities and a liquid. Crystallisation separates a pure solid in the form of its crystals from a solution.

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1. Classify the following as chemical or physical changes:

Ans. (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 the water breaking down into hydrogen and oxygen gases

Chemical Change.

(vi) dissolving common salt in water

Physical Change.

(vii) making a fruit salad with raw fruits

Physical Change, but if salt is added to the fruit salad then it will be a chemical change.

(viii) burning of paper and wood

Chemical Change.

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

Ans. Mixture : Soil, air, milk, stainless steel utensils, etc.

Pure substance : Distilled water, glucose, iron rod, mercury inside a thermometer, etc.

Exercise

1. 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) Fine mud particles suspended in water.

Ans. (a) Evaporation
(b) Sublimation
(c) Filtration
(d) Chromatography
(e) Centrifugation
(f) Separating funnel
(g) Filtration
(h) Magnetic separation
(i) Winnowing
(j) Coagulation Decantation

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

Ans. Step 1 : Boil some water (solvent) in a pan.
Step 2 : Pour the boiling water into the pot and let it soak for a few minute. It will form a solution.
Step 3 : Pour the boiling water into the pot and let it soak for a few minutes. It will form a solution.
Step 4 : Put sugar (solute) into a cup.
Step 5 : Stir the solution in the tea pot.
Step 6 : Use a strainer and pour the solution into the cup. Put two teaspoons of milk. Remove the tainer and stir with a spoon. The tea is ready. The tea leaves (residue) will be left on the strainer while tea (filtrate) will pass through the solution. Sugar and milk are soluble solutes while tea leaves are insoluble solute.

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
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. The maximum amount of a solute which can be dissolved in 100 grams of a solvent is known as the solubility of that solute in that solvent (at a specified temperature and pressure).

(a) At 313 K, 100 g of water can dissolve a maximum of 62 g of potassium nitrate.
$\therefore$ At 313 K, 50 g of water will be able to dissolve a maximum of 11 g of potassium nitrate.

(b) Room temperature is taken as 20°C (approximately).

$$20°C = (20 + 273)\ K = 293\ K$$

At 353 K, 100 g of water can dissolve a maximum of 54 g of potassium chloride whereas at 293 K, 100 g of water can dissolve a maximum of 35 g of potassium chloride. The solubility of solids in liquids decreases with the decrease in temperature. Hence, powders of potassium chloride will start settling down.

(c) At 293 K,
Solubility of potassium nitrate = 32 g
Solubility of sodium chloride = 36 g
Solubility of potassium chloride = 35 g
Solubility of ammonium chloride= 24 g
At 293 K, sodium chloride has the maximum solubility.

(d) (i) The solubility of solids in liquids increases on increasing the temperature and decreases on decreasing the temperature.
(ii) The solubility of gases in liquids decreases on increasing the temperature and increases on decreasing the temperature.

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

Ans. (a) Saturated solution- At any particular temperature, a solution that has dissolved as much solute as it is capable of dissoving it, is said to be saturated solution.
For example, heat about 100 ml of water in a beaker to about 25°C and dissolve sodium chloride, in this water gradually, until no more sodium chloride goes into the solution. Maintain the solution at 25°C in a water bath.
The supernatent solution is the saturated solution of sodium chloride in water at 25°C.

(b) The substances which always have the same colour, taste or texture at a given temperature and pressure are pure substances. For example, distilled water.

(c) A heterogeneous mixture in which the size of the solute particles is between 1nm (10–9m) and 100 nm (l0–7im) is known as colloidal solution. For example, Milk, Gum, Jelly.

(d) A suspension is a heterogeneous mixture in which the solute particles do not dissolve but remain suspended throughout the bulk of the medium. For example, muddy water, saw dust-water mixture, chalk powder-water mixture, etc.

5. Classify each of the following as a homogeneous or heterogeneous mixture. soda water, wood, air, soil, vinegar, filtered tea.

Ans. Soda water– Homogeneous
Wood – Heterogeneous

Air – Heterogenous
Soil – Heterogeneous
Vinegar – Homogeneous
Filtered tea – Homogeneous

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

Ans. We can confirm that the colourless liquid given to us in pure water by checking its boiling point. Pure water will boil at 373K at normal atmospheric pressure (1 atm) but water containing some salt will boil over a range of temperature above 373K.

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. Iron, hydrochloric acid, calcium oxide and mercury are pure substances.

8. Identify the solutions among the following mixtures.

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

Ans. Sea water and soda water are solutions.

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

(a) Salt solution
(b) Milk
(c) Copper sulphate solution
(d) Starch solution.

Ans. Milk and strach solution will show "Tyndall Effect".

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. (a) Element (b)Mixture
(c) Mixture (d) Element
(e) Compound (f) Element
(g) Element (h) Element
(i) Mixture (j) Compound
(k) Compound (l) Compound
(m) Mixture

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. Rusting of iron, cooking of food, digestion of food and burning of a candle are chemical changes.

Additional Questions

1. How can we test for the purity of a substance? Explain by giving an example.

Ans. We can test for the purity of a substance by checking its boiling point or melting point.
A pure substance has a fixed boiling point or melting point at constant pressure.
For example, pure water boils at 373K at normal atmospheric pressure (1 atm) but water containing some salt will boil over a range of temperature above 373 K.

2. Why is mixture an impure substance ?

Ans. This is because it contains more than one kind of particles.

3. Write any five characteristics of a mixture ?

Ans. (i) A mixture has a variable composition. The components may be present in any proportion.
(ii) A mixture show the properties of the constituent substances.
(iii) A mixture can be separated by physical methods into its constituents.
(iv) No chemical reaction takes place during the formation of a mixture. (During mixture preparation no heat, light or electricity is absorbed or evolved.)
(v) A mixture does not have a fixed boiling point or melting point.

4. Why is air considered a mixture ?

Ans. (i) Air has a variable composition.
(ii) It shows the properties of its constituent gases.
(iii) It (liquid air) can be separated into its constituents by fractional distillation (physical process).
(iv) Air (liquid) does not have a fixed boiling point.

5. What are the two types of mixture?

Ans. Homogeneous mixture and heterogeneous mixture.

6. Give two examples of homogeneous mixture.

Ans. Sugar solution and salt solution.

7. Give two examples of heterogeneous mixture.

Ans. Mixture of salt and sand mixture of iron filings and sulphur.

8. What is a solution ?

Ans. A solution is a homogeneous mixture of two or more substances.

9. Which of the following is a true solution?
Vinegar in water, Aluminium paint, blood, muddy water.

Ans. Vinegar in water is a true solution.

10. Give an example of a solid solution.

Ans. Any alloy, for example, brass (a mixture of 70% copper and 30% zinc).

11. Give an example of a gas in liquid solution.

Ans. Aerated drinks like soda water, coke, etc. (a mixture of CO_2 and water).

12. Classify a solution depending upon the amount of solute present in it.

Ans. Depending upon the amount of solute present in a solution, it can be called a dilute, concentrated, saturated or super saturated solution.

13. What happens to the saturated solution of sugar when its temperature is raised by 5°C?

Ans. It becomes an unsaturated solution.

14. What is the effect of temperature on the solubility of solids in liquids ?

Ans. It increases on increasing the temperature and deceases on decreaing the temperature.

15. What is the effect of pressure on the solubility of gas in liquid?

Ans. It is directly proportional to the pressure.

16. What is meant by concentration of a solution?

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

17. When is a solution said to be saturated? How can you change a saturated solution to unsaturated without adding any more solvent to it?

Ans. (i) When the saturated solution is heated.

(ii) When a solution cannot dissolve any more solute, it is said to be a saturated solution at the given temperature.

18. Write the properties of a suspension.

Ans. (i) The particles of a suspension are bigger than 100nm (109–5 cm) in diameter. They can be seen by the naked eyes.

(ii) Suspension is a heterogeneous mixture.

(iii) The particles of a suspension scatter a beam of light passing through it and make its path visible.

(iv) The solute particles settle down when a suspension is left undisturbed, i.e., a suspension is unstable. The solute particles can be separated from the mixture by the process of filtration.

19. Why can't we see the particles of colloid with naked eyes?

Ans. Due to the small size (1 nm to 100 nm) of colloid particles we cannot see them with naked eyes.

20. Which one of the two solutions scatter light : sugar solution or soap solution?

Ans. Soap solution.

Multiple Choice Questions

1. After heating common salt and ammonium chloride for a few minutes, we can observe the following on the upper part of the inverted funnel :

(a) raddish brown deposit.
(b) water droplets
(c) a white solid deposit
(d) a yellow gas

Ans. (c) White deposit is of ammonium chloride which is also called sublimate.

2. Cloud is an example of

(a) liquid dispersed in a gas
(b) solid dispersed in a gas
(c) liquid dispersed in a solid

(d) solid dispersed in a solid.

Ans. (a) Cloud represents water drops suspended in air.

3. The cause of Brownian movement is

(a) impact of molecules of dispersion medium on colloidal particles.
(b) attractive forces between the particles of dispersed place and dispersion medium
(c) heat changes in liquid state.
(d) convection currents.

Ans. (a) impact of molecules of dispersion medium on colloidal particles.

4. The mixture will appear translucent in case of :

(a) $CuSO_4$ + water (b) alum + water
(c) sugar + water (d) starch + water

Ans. (d) It is a colloidal solution and is translucent.

5. When solutions of sodium sulphate and barium chloride are mixed, an insoluble solid settles at the bottom of the test tube. Its colour is

(a) blue (b) green
(c) white (d) yellow

Ans. (c) A white precipitate of barium sulphate is formed.

6. When a beam of light is passed through a colloidal solution, it gets:

(a) reflected (b) absorbed
(c) scattered (d) refracted

Ans. (c) The scattering of beam of light on passing through colloidal solution is known as Tyndall effect.

7. Which out of the following is a heterogeneous mixture?

(a) air (b) brass
(c) iodised table salt (d) steel.

Ans. (c) iodised table salt.

8. Size of colloidal particles in a solution is

(a) more than 100 nm
(b) less than 1 nm
(c) between 1 to 100 nm
(d) between 100 to 1000 nm

Ans. (d) between 100 to 1000 nm

9. Which of the following is not a compound?

(a) marble (b) washing soda
(c) quick lime (d) brass

Ans. (d) Brass is a homogeneous mixture of copper and zinc.

10. On heating a mixture of iron fillings and sulphur, it is observed that :

(a) the mixture sublimes
(b) a grey mass is formed.
(c) brown fumes are evolved
(d) no change occurs.

Ans. (b) The grey mass is of iron sulphide.