

Chapter – 2 Is Matter Around Us Pure?**Class 9 Science NCERT Textbook – Page No. 15****Q1. What is meant by pure substance?****Answer:**

A pure substance is made up of single atom or molecule. Pure substances are not separated into different matters by any physical or chemical processes.

Examples of Pure substances are: Hydrogen, Oxygen, Carbon, Silver, Gold, Sulphur, Mercury, Silicon etc.

Q2. List the points of differences between homogeneous and heterogeneous mixtures.**Answer:**

S/No.	Homogeneous mixtures	Heterogeneous mixtures
1.	It has uniform composition.	It does not have a uniform composition.
2.	It has no visible boundaries of separation between various different constituents.	It has visible boundaries of separation between various different constituents.
3.	The various constituents are invisible in a homogeneous mixture.	The various constituents are visible in a heterogeneous mixture.

Class 9 Science NCERT Textbook – Page No. 18**Q1. Differentiate between homogeneous and heterogeneous mixture with examples.****Answer:****Homogeneous mixture -**

- In this mixture substances are mixed together and are indistinguishable from each other are called as homogeneous mixtures.
- Homogeneous mixture has a uniform composition.
- There are no boundaries which shows the separation of various different constituents.
- Example: - A sugar and water mixture is a homogeneous mixture, as sugar gets completely dissolved in the water.

- e) A mixture of two or more miscible liquids is also a homogeneous mixture, such as a mixture of alcohol and water.

Heterogeneous mixture –

- a) In this mixture substances are not mixed completely and remain separate as small particles are called heterogeneous mixture.
- b) Heterogeneous mixture will not have a uniform composition.
- c) There is a boundary which will show the separation of various different constituents in it.
- d) Example: - A sugar and sand mixture are a heterogeneous mixture, because there are different sugar-sand compositions.
- e) The suspension of solid and liquid are also a heterogeneous mixture.
- f) Example: - Chalk in water is a suspension and a heterogeneous mixture.
- g) A mixture of two or more immiscible liquids is a heterogeneous mixture such as a mixture of petrol and water.

Q2. How are sol, solution and suspension different from each other?

Answer:

The main distinguishable points between sol, solution and suspension are:

S/No.	Sol	Solution	Suspension
1.	A sol is a colloid, which appears to be homogeneous, but it is a heterogeneous.	A solution is a homogeneous mixture.	A suspension is a heterogeneous mixture.
2.	The size of solute is in the range 1nm to 100 nm in a diameter.	The size of solute is less than 1nm in a diameter.	The size of solute in a suspension is greater than 100 nm in a diameter.
3.	The particles of a sol can pass through a filter paper, so it cannot be separated by the filtration process.	The particles of a solution can pass through a filter paper. So, a solution cannot be separated by the filtration process.	The particles of a suspension do not pass through a filter paper, so a suspension is separated by a filtration.
4.	The sol is quite stable.	The solution is very stable.	The suspension is unstable.
5.	A sol scatters a beam of light when passed through it.	A true solution does not scatter light.	A suspension scatters a beam of light when passed through it.

Q3. 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.

Answer:

Given: Mass of sodium chloride = 36 g

Mass of Water (solvent) = 100 g

Temperature = 293 K

Formula used:

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

As,

$$\begin{aligned}\text{Mass of solution} &= \text{Mass of solute} + \text{Mass of solvent} \\ &= 36 \text{ g} + 100 \text{ g} \\ &= 136 \text{ g}\end{aligned}$$

On substituting the mass of solute and mass of solution in formula we get:

$$\begin{aligned}\text{Concentration of solution} &= \frac{36}{136} \times 100 \\ &= \frac{3600}{136}\end{aligned}$$

$$\text{Concentration of solution} = 26.47\% \text{ (in mass)}$$

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Q1. How will you separate a mixture containing kerosene and petrol (difference in their boiling point is more than 25°C), which are miscible with each other?

Answer:

Distillation process is used to separate the two miscible liquids if their boiling point difference is 25°C.

Steps in separation of mixture of kerosene and petrol are:

1. Take the mixture of kerosene and petrol in a flask.
2. Fit a thermometer and a water condenser to the flask.
3. Heat the distillation flask using a burner.
4. The petrol will vaporize on burning and will be condensed in the water condenser, since petrol has less boiling point as compared to kerosene.
5. Kerosene which has higher boiling point is collected in distillation container.

Q2. Name the techniques to separate:

- a) Butter from curd.
- b) Salt from sea-water.
- c) Camphor from salt.

Answer:

- a) Centrifugation.
- b) Evaporation.
- c) Sublimation.

Q3. What type of mixtures are separated by the techniques of crystallization?

Answer:

Those mixtures in which impurities are either less soluble in solvent or more soluble than solids, are separated by the process of crystallization.

Example: - Impurities present in copper sulphate, common salt and alum etc. are separated by the process of crystallization.

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Q1. Classify the following as Chemical or physical changes:

- a) Cutting of trees.
- b) Melting of butter in a pan.
- c) Rusting of almirahs.
- d) Boiling of water to form steam.
- e) Passing of electric current through water and the water breaking down into hydrogen and oxygen gases.
- f) Dissolving the common salt in water.
- g) Making a fruit salad with raw fruits, and
- h) Burning of paper and wood.

Answer:

Chemical changes	Physical changes
Cutting of trees.	Melting of butter in a pan.
Rusting of Iron.	Boiling of water to steam.
Passing of electric current through water and water breaks into hydrogen and oxygen gases.	Dissolving common salt in water.
Burning of paper and wood.	Making a fruit salad with raw fruits.

Q2. Try segregating the things around you as pure substances or mixtures.

Answer:

Things that we use in our day-to-day life are segregated as pure substances or mixtures:

Pure substances	Mixtures
Naphthalene balls	Milk
Sodium chloride	Air
Distilled water	Salt solution
Steam	Vinegar
Alcohol	Wood
Baking soda	Steel

Class 9 Science NCERT Textbook Exercise – Page No. 28, 29 and 30

Q1. Which separation techniques will you apply for the separation of the following?

- Sodium chloride from its solution in water.
- Ammonium chloride from a mixture containing sodium chloride and ammonium chloride.
- Small pieces of metal in the engine oil of a car.
- Different pigments from an extract of flower petals.
- Butter from curd.
- Oil from water.
- Tea leaves from tea.
- Iron pins from sand.
- Wheat grains from husk.
- Fine mud particles suspended in water.

Answer:

S/No.	Different solutions/mixtures	Separation Techniques
1.	Sodium chloride from its solution in water.	Evaporation
2.	Ammonium chloride from a mixture containing sodium chloride and ammonium chloride.	Sublimation
3.	Small pieces of metal in the engine oil of a car.	Filtration
4.	Different pigments from an extract of flower petals.	Chromatography
5.	Butter from curd.	Centrifugation
6.	Oil from water.	Separating Funnel
7.	Tea leaves from tea.	Filtration
8.	Iron pins from sand.	Using a magnet

9.	Wheat grains from husk.	Winnowing
10.	Fine mud particles suspended in water.	Centrifugation

Q2. Write the steps you would use for making tea. Use the words solution, solvent, solute, dissolve, soluble, insoluble, filtrate and residue.

Answer:

Steps for making tea are: -

1. Take 100 *ml* of solvent water in a kettle.
2. Add 1 tea-spoon of solute sugar which is soluble in water to form the sugar solution.
3. Now add half a teaspoon of tea leaves which is insoluble in water.
4. Boil the mixture for 4 to 5 minutes, so that the solvent and solute get dissolve.
5. Add half cup of milk and boil again for 2 to 3 minutes.
6. Filter the tea with the help of a sieve, the insoluble tea leaves will be left as residue.
7. The tea is collected in the cup as filtrate.

Q3. Pragya tested the solubility of three different substances at different temperatures and collected the data as given below (resulted 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?

Answer:

a) Thus:

- Mass of potassium nitrate present in 100 *grams* of water in a saturated solution at 313 *K* is = 62 *grams*.
- The mass of potassium nitrate in 50 *grams* of water in the saturated solution at 313 *K* is:

$$= \frac{62 \text{ grams}}{100 \text{ grams}} \times 50 \text{ grams}$$

Mass of potassium nitrate = 31 grams

- Therefore, the mass of potassium nitrate in 50 *grams* of water in the saturated solution at 313 *K* is **31 grams**.

b) If a saturated solution of potassium chloride is left to cool down at room temperature then:

- The solubility of potassium chloride in water decrease as potassium chloride will lose heat at 353 *K*.
- The crystal of potassium chloride is observed, for the amount of potassium chloride which surpasses its solubility at lower temperature.

c) Finding the solubility of salts at 293 *K* –

i. Solubility of potassium nitrate: -

$$= \frac{32 \text{ grams}}{100 \text{ grams}} \text{ of water.}$$

ii. Solubility of sodium chloride: -

$$= \frac{36 \text{ grams}}{100 \text{ grams}} \text{ of water.}$$

iii. Solubility of potassium chloride: -

$$= \frac{35 \text{ grams}}{100 \text{ grams}} \text{ of water.}$$

iv. Sodium of ammonium chloride: -

$$= \frac{37 \text{ grams}}{100 \text{ grams}} \text{ of water.}$$

- From the above calculations it is observed that ammonium chloride salt has the highest amount of solubility at 293 K temperature.

d) The solubility of a salt depends on the temperature, if the temperature increases then the solubility of the salt increases.

For example, the data given in the above table shows that there is very high solubility of potassium nitrate salt as the temperature increases, but there is negligible increase in the ammonium chloride salt as the temperature increases. Also, there is a very small increase or almost the solubility remains the same in sodium chloride.

Q4. Explain the following giving examples.

- a) Saturated solution.
- b) Pure substance.
- c) Colloid
- d) Suspension.

Answer:

a) Saturated Solution: -

- A solution in which no more solute can be dissolved at a particular temperature, is called a saturated solution.
- A saturated solution which has maximum amount of solute dissolved in it, at a particular temperature.
- Saturated solution contains greater amount of solute than an unsaturated solution.

For example: -

1. Potassium nitrate of 32 grams can be dissolved in 100 grams of water at a temperature of 20°C.

So, we can say that, a saturated solution of potassium nitrate at 20°C contains *32 grams of potassium nitrate* dissolved in *100 grams of water*.

2. Sodium chloride of *36 grams* (common salt) is dissolved in *100 grams of water* at a temperature of 20°C .

So, a saturated solution of sodium chloride at 20°C consists of *36 grams* of sodium chloride dissolved in *100 grams of water*.

b) Pure Substance: -

- A pure substance is made up of one kind of atoms or molecules.
- A pure substance is homogeneous in nature.
- It cannot be separated by any physical process.
- A pure substance has a fixed composition and a fixed melting point and boiling point.
- All the elements and compounds are pure substances.

For example: -

1. All the elements like hydrogen, oxygen, nitrogen, chlorine, iodine, carbon, Sulphur, iron, copper, silver, gold, mercury and silicon are pure substances.
2. All the compounds like water, carbon dioxide, sodium chloride, calcium oxide, sodium hydroxide, hydrochloric acid, sulphuric acid, nitric acid, potassium permanganate, camphor are pure substance.

c) Colloid: -

- A colloid is a solution in which the size of solute particles is in between the true solutions and the suspensions.
- The size of solute particles in colloid is larger than true solution but smaller than suspension.
- Colloids appears to be homogeneous but they are heterogeneous when observed through high power microscope.

For example: -

1. Soap solution.
2. Starch solution.

3. Milk.
4. Ink.
5. Blood.
6. Solutions of synthetic detergents.

d) Suspension: -

- A suspension is a heterogeneous mixture in which the small particles of a solid are in a liquid without dissolving in it.
- The size of solute particles in a suspension is larger than 1000 nm .
- The particles of a suspension do not pass through a filter paper and can be separated by filtration.
- A suspension scatters a beam of light passing through it and it is known as Tyndal effect.

For example: -

- Chalk-water mixture is a suspension of chalk particles in water.
- Muddy water is a suspension of soil particles in water.
- Milk of magnesia is a suspension of magnesium hydroxide in water.

Q5. Classify each of the following as a homogeneous or heterogeneous mixture.

Soda water, wood, air, soil, vinegar, filtered tea.

Answer:

A homogeneous mixture is a mixture in which the substances are mixed together uniformly. A homogeneous mixture has a uniform composition.

A heterogeneous mixture is a mixture in which the substances remain separated and one substance is spread as small particles, droplets or bubbles. A heterogeneous mixture does not have a uniform composition.

The classification of homogeneous and heterogeneous mixture are as follows: -

1. Soda water is a **Homogeneous**.
2. Wood is a **Heterogeneous**.
3. Air is a **Homogeneous**.
4. Soil is a **Heterogeneous**.
5. Vinegar is a **Homogeneous**.
6. Filtered tea is a **Homogeneous**.

Q6. How would you confirm that a colorless liquid given to you is pure water?

Answer:

- Liquids has a specific boiling point. As pure water has a boiling point of 100°C at 1 atmospheric pressure.
- If the given colorless liquid boils at above or below the boiling point of 100°C , then the given liquid is impure water. A pure water boils at sharp 100°C .
- Hence with the help of boiling point, we conclude whether a given colorless liquid is a pure or impure water.

Q7. 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.

Answer:

Pure substance: - A substance which is made up of one kind of particles and cannot be separated by physical processes.

The list of pure substance are: -

- a) Ice is made up of water (H_2O)
- b) Iron is made up from Iron ore.
- c) Hydrochloric acid is made up of elements such as hydrogen and chlorine.
- d) Calcium oxide is made up of quicklime (CaO).
- e) Mercury is made up of vapors of mercuric sulphide ore.

List of Impure substances: -

- a) Milk is a colloid and acts as a heterogeneous mixture so it is not a pure substance.
- b) Brick and Air are made up of more than one substance so they are not pure substance.

Q8. Identify the solutions among the following mixtures.

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

Answer:

- a) Soil is a **Heterogeneous mixture**.
- b) Sea water is a **Homogeneous mixture**.
- c) Air is a **Homogeneous mixture**.
- d) Coal is a **Heterogeneous mixture**.
- e) Soda water is a **Homogeneous water**.

Q9. Which of the following will show “Tyndall effect”?

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

Answer:

Tyndall effect is scattering of light by the colloid particles.

The colloids show Tyndall effect because their particles are large enough to scatter the beam of light passing through them.

Milk and **Starch solution** are colloids, so they show Tyndall effect.

Salt solution and Copper sulphate solution does not show Tyndall effect as their particle size is less than 1 nm in diameter, so they do not scatter beam of light passing through it.

Q10. 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.**

Answer:

Element: - An element is a substance which cannot split up into two or more simpler substances by any chemical methods.

Compounds: - A compound is a substance which is made up of two or more elements chemically combined in a fixed proportion by mass.

Mixtures: - A mixture is a substance which consists of two or more elements or compounds not chemically combined together.

Elements	Compounds	Mixtures
Sodium	Calcium carbonate	Soil
Silver	Soap	Sugar solution
Tin	Methane	Coal
Silicon	Carbon dioxide	Air
		Blood

Q11. 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 candle.**

Answer:

Chemical changes: -

- The changes in which new substances are formed, are called chemical changes.
- In this, the substances involved change their identity, they get converted into new substances.
- Chemical changes are irreversible.

The chemical changes occur in: -

1. Growth of a plant.
2. Rusting of iron.
3. Cooking of food.
4. Digestion of food.

5. Burning of candle.

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