NCERT Solution: (Is Matter Around Us Pure?)

Page – 15

1. What is meant by a substance?

A **substance** is a form of matter that has a **definite composition** and **distinct properties**. It is made up of **only one type of particle** (atoms or molecules) and cannot be separated into different components by **physical methods**.

🔻 Types of Substances:

- **Pure Substances**: Have a fixed composition (Example: Water, Oxygen).
- **Impure Substances (Mixtures)**: Contain two or more substances mixed together (Example: Air, Salt solution).

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2. Differences Between Homogeneous and Heterogeneous Mixtures

Feature	Homogeneous Mixture	Heterogeneous Mixture
Definition	A mixture with a **uniform composition** throughout.	A mixture with a **non-uniform composition**.
Appearance	Looks **same throughout**.	Different components can be **seen separately**.
Particle Distribution	Particles are **evenly spread**.	Particles are **not evenly spread**.
Separation	Difficult to separate components.	Components can be separated easily.
Examples	Air, Sugar dissolved in water, Alloys (Brass, Steel).	Sand in water, Oil and water, Pizza.

Page – 18

1. Differentiate between homogeneous and heterogeneous mixtures with examples.

Answer:

Feature	Homogeneous Mixture	Heterogeneous Mixture
Definition	A mixture with a **uniform composition** throughout.	A mixture with a **non-uniform composition**.
Appearance	Looks **same throughout**.	Different components can be **seen separately**.
Particle Distribution	Particles are **evenly spread**.	Particles are **not evenly spread**.

Separation	Difficult to separate components by physical methods.	Components can be separated easily by physical methods.
Tyndall Effect	Does not show the **Tyndall effect**.	May show **Tyndall effect** (if the particles are large enough).
Examples	Air, Saltwater, Sugar dissolved in water, Alloys (Brass, Steel).	Sand in water, Oil and water, Concrete, Pizza.

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

Answer:

Feature	Sol (Colloid)	Solution	Suspension
Definition	A **colloidal solution** where one substance is dispersed in another.	A **homogeneous mixture** of solute and solvent.	A **heterogeneous mixture** where solid particles do not dissolve in the liquid.
Particle Size	**1–100 nm**	**Less than 1 nm**	**More than 100 nm**
Tyndall Effect	Shows **Tyndall effect** (scatters light).	Does not show **Tyndall effect**.	Shows **Tyndall effect** but is less stable.
Settling of Particles	Particles do **not settle** on standing.	Particles do **not settle** on standing.	Particles **settle down** if left undisturbed.
Example	Milk, Blood, Fog, Ink.	Sugar solution, Saltwater, Soft drinks.	Sand in water, Muddy water, Chalk powder in water.

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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.

Answer:

We use the formula:

Concentration(%)=Mass of soluteMass of solution×100\text{Concentration} (\%) = \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100Concentration(%)=Mass of solutionMass of solute×100

🔻 **Given Data:**

- Mass of **solute** (Sodium Chloride, NaCl) = **36 g**
- Mass of **solvent** (Water) = **100 g**
- Mass of **solution** = **Mass of solute + Mass of solvent**

  =36g+100g=136g= 36 g + 100 g = 136 g=36g+100g=136g

🔻 **Applying the formula:**

Concentration(%)=36136×100\text{Concentration} (\%) = \frac{36}{136} \times 100Concentration(%)=13636×100 =26.47%= 26.47 \%=26.47%

🔻 **Final Answer:**

The concentration of the saturated solution is 26.47%.

Page – 19

1. Classify the following as chemical or physical changes:

Answer:

Process	Type of Change	Reason
Cutting of trees	**Physical Change**	No new substance is formed; only size and shape change.
Melting of butter in a pan	**Physical Change**	Only the state of butter changes (solid to liquid), no new substance is formed.
Rusting of almirah	**Chemical Change**	A new substance (iron oxide/rust) is formed, and it cannot be reversed.
Boiling of water to form steam	**Physical Change**	The state of water changes (liquid to gas), but no new substance is formed.
Passing of electric current through water, breaking it into hydrogen and oxygen gases	**Chemical Change**	Water is decomposed into new substances (hydrogen and oxygen gases).
Dissolving common salt in water	**Physical Change**	The salt dissolves, but no new substance is formed; the salt can be recovered.
Making a fruit salad with raw fruits	**Physical Change**	The fruits are mixed, but no new substance is formed.
Burning of paper and wood	**Chemical Change**	New substances like ash, carbon dioxide, and heat are produced; the process is irreversible.

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

Answer:

Things Around Us	Pure Substance or Mixture	Type
Water (H_2O)	**Pure Substance**	**Compound**
Gold (Au)	**Pure Substance**	**Element**
Air	**Mixture**	**Homogeneous** (contains oxygen, nitrogen, carbon dioxide, etc.)
Milk	**Mixture**	**Colloid** (Contains water, fats, proteins, etc.)
Sugar	**Pure Substance**	**Compound ($C_{12}H_{22}O_{11}$)**
Saltwater	**Mixture**	**Homogeneous** (Salt dissolved in water)
Sand and iron filings	**Mixture**	**Heterogeneous** (Components can be separated physically)
Steel (Iron + Carbon alloy)	**Mixture**	**Homogeneous (Alloy)**
Copper (Cu)	**Pure Substance**	**Element**
Vegetable soup	**Mixture**	**Heterogeneous** (Different components visible)

Textbook Question Answer:

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

Answer:

Mixture	Separation Technique	Principle Used
(a) Sodium chloride from its solution in water	**Evaporation**	Sodium chloride is left behind after water evaporates.
(b) Ammonium chloride from a mixture containing sodium chloride and ammonium chloride	**Sublimation**	Ammonium chloride changes directly into gas on heating, leaving sodium chloride behind.
(c) Small pieces of metal in the engine oil of a car	**Filtration (Using a filter or magnet)**	Metal pieces can be removed by filtration or using a magnet.
(d) Different pigments from an extract of flower petals	**Chromatography**	Different pigments move at different speeds on filter paper.
(e) Butter from curd	**Centrifugation**	Spinning separates butter from the liquid.
(f) Oil from water	**Separating funnel**	Oil and water form distinct layers due to density differences.
(g) Tea leaves from tea	**Filtration**	Tea leaves are separated using a sieve or filter paper.
(h) Iron pins from sand	**Magnetic separation**	Iron is attracted to a magnet, but sand is not.
(i) Wheat grains from husk	**Winnowing**	Lighter husk is blown away by wind, heavier grains stay behind.
(j) Fine mud particles suspended in water	**Sedimentation & Decantation**	Mud settles at the bottom, and clean water is poured off.

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

Answer:

From the given solubility table:

- **Solubility of potassium nitrate (KNO_3) at 313 K = 62 g per 100 g of water**
- For **50 g of water**, the required mass is:

62100×50=31 g\frac{62}{100} \times 50 = 31 \text{ g}10062×50=31 g

Final Answer: 31 g of potassium nitrate is needed.

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3. 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.

Answer:

As the temperature decreases, the solubility of potassium chloride **reduces**. Some of the dissolved **potassium chloride will crystallize out** of the solution. This is because at lower temperatures, less potassium chloride can remain dissolved in water.

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

Answer:

Salt	Solubility at 293 K (g per 100 g of water)
Potassium nitrate (KNO_3)	32 g
Sodium chloride (NaCl)	36 g
Potassium chloride (KCl)	35 g
Ammonium chloride (NH_4Cl)	37 g

🔺 **Highest Solubility: Ammonium chloride (NH_4Cl)** at **37 g per 100 g of water**.

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5. What is the effect of change in temperature on the solubility of a salt?

Answer:

- **Increase in temperature** → **Increases solubility** of most salts.
- **Decrease in temperature** → **Decreases solubility**, causing excess salt to crystallize.

Example: **Potassium nitrate (KNO_3)** dissolves more at **higher** temperatures.

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6. Explain the following giving examples:

(a) Saturated solution

A solution in which **no more solute can dissolve** at a given temperature.
Example: Adding excess sugar to tea until no more dissolves.

(b) Pure substance

A substance that contains **only one type of particle** and has a fixed composition.
Example: Oxygen (O_2), Water (H_2O).

(c) Colloid

A **heterogeneous mixture** where particles are too small to settle but can scatter light (**Tyndall effect**).
Example: Milk, Fog.

(d) Suspension

A **heterogeneous mixture** where solid particles are **large enough** to settle.
Example: Muddy water.

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

Answer:

Substance	Type of Mixture
Soda water	Homogeneous
Wood	Heterogeneous
Air	Homogeneous
Soil	Heterogeneous
Vinegar	Homogeneous
Filtered tea	Homogeneous

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

Answer:

To confirm the liquid is **pure water**, we can:

1. **Check its boiling point** → Pure water boils at **100°C**.
2. **Check its freezing point** → Pure water freezes at **0°C**.
3. **Evaporate the liquid** → If no residue is left, it is pure.

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9. Write the steps for making tea using the words: solution, solvent, solute, dissolve, soluble, insoluble, filtrate, and residue.

Answer:

1. Take **water** as the **solvent** and heat it.
2. Add **tea leaves** (an **insoluble** substance).
3. Add **sugar**, which is **soluble** and will **dissolve** completely.
4. Add **milk** to form a **solution**.
5. Boil for some time and then filter it.
6. The **filtrate** (tea) is collected in a cup, and the **residue** (tea leaves) is left behind.

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10. Which of the following materials are pure substances?

Answer:

Material	Pure Substance (Yes/No)
Ice	✓ Yes
Milk	✗ No (It's a mixture)
Iron	✓ Yes
Hydrochloric acid (HCl)	✓ Yes
Calcium oxide (CaO)	✓ Yes
Mercury (Hg)	✓ Yes
Brick	✗ No (It's a mixture)
Wood	✗ No (It's a mixture)
Air	✗ No (It's a mixture)

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11. Identify the solutions among the following mixtures:

Answer:

Mixture	Solution (Yes/No)
Soil	✗ No
Sea water	✓ Yes
Air	✓ Yes
Coal	✗ No
Soda water	✓ Yes

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

Answer:

Substance	Tyndall Effect (Yes/No)
Salt solution	✗ No
Milk	✓ Yes
Copper sulphate solution	✗ No
Starch solution	✓ Yes

13. Which of the following are chemical changes?

Process	Type of Change
Growth of a plant	✓ Chemical Change
Rusting of iron	✓ Chemical Change
Mixing iron filings and sand	✗ Physical Change
Cooking of food	✓ Chemical Change
Digestion of food	✓ Chemical Change
Freezing of water	✗ Physical Change
Burning of a candle	✓ Chemical Change