Exercise 1

Question 1:

What is meant by a pure substance?

Solution 1:

A pure substance is the one that consists of a single type of particles, i.e., all constituent particles of the substance have the same chemical nature. Pure substances can be classified as elements or compounds.

Question 2:

List the points of differences between homogeneous and heterogeneous mixtures.

Solution 2:

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

Exercise 2

Question 1:

Differentiate between homogeneous and heterogeneous mixtures with examples.

Solution 1:

A homogeneous mixture is a mixture having a uniform composition throughout the mixture. For example, mixtures of salt in water, sugar in water, copper sulphate in water, iodine in alcohol, alloy, and air have uniform compositions throughout the mixtures.
On the other hand, a heterogeneous mixture is a mixture having a non-uniform composition throughout the mixture. For example, 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 are not uniform throughout the mixtures.

Question 2:

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

Solution 2:

Sol is a heterogeneous mixture. In this mixture, the solute particles are so small that they cannot be seen with the naked eye. Also, they seem to be spread uniformly throughout the mixture. The Tyndall effect is observed in this mixture. For example: milk of magnesia, mud Solution is a homogeneous mixture. In this mixture, the solute particles dissolve and spread uniformly throughout the mixture. The Tyndall effect is not observed in this mixture. For example: salt in water, sugar in water, iodine in alcohol, alloy Suspensions are heterogeneous

mixtures. In this mixture, the solute particles are visible to the naked eye, and remain suspended throughout the bulk of the medium.
The Tyndall effect is observed in this mixture. For example: chalk powder and water, wheat flour and water

Question 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.

Solution 3:
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
= (36 + 100) g
= 136 g
Therefore, concentration (mass by mass percentage) of the solution

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

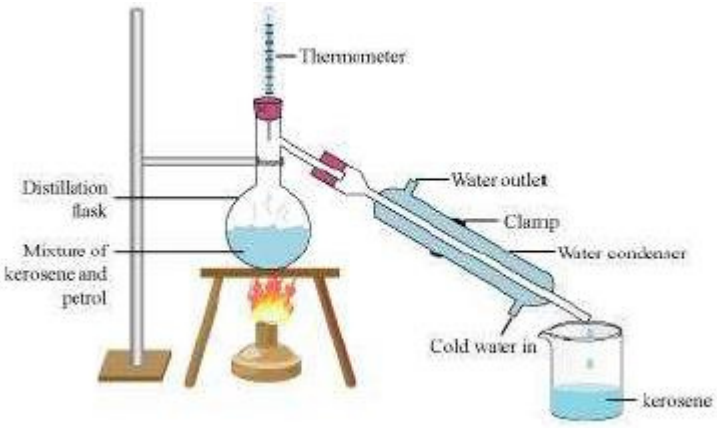
$$\frac{36}{136} \times 100\%$$

$$26.47\%$$

Exercise 3

Question 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?

Solution 1:
A mixture of two miscible liquids having a difference in their boiling points more than 25°C can be separated by the method of distillation. Thus, kerosene and petrol can be separated by 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 vaporize and condense in the water condenser. The condensed kerosene is collected from the condenser outlet, whereas petrol is left behind in the distillation flask.

Question 2:

Name the technique to separate
(i) butter from curd
(ii) salt from sea-water
(iii) camphor from salt

Solution 2:

(i) Butter can be separated from curd by centrifugation.
(ii) Salt can be separated from sea-water by evaporation.
(iii) Camphor can be separated from salt by sublimation.

Question 3:

What type of mixtures is separated by the technique of crystallization?

Solution 3:

By the technique of crystallization, pure solids are separated from impurities. For example, salt obtained from sea is separated from impurities; crystals of alum (Phitkari) are separated from impure samples.

Exercise 4

Question 1:

Classify the following as chemical or physical changes:
• Cutting of trees
• Melting of butter in a pan
• Rusting of almirah
• Boiling of water to form steam
• Passing of electric current through water, and water breaking down into hydrogen and oxygen gas
• Dissolving common salt in water
• Making a fruit salad with raw fruits
• Burning of paper and wood

Solution 1:

• Cutting of trees → Physical change
• Melting of butter in a pan → Physical change
• Rusting of almirah → Chemical change

• Boiling of water to form steam → Physical change
• Passing of electric current through water, and water breaking down into hydrogen and oxygen gas → Chemical change
• Dissolving common salt in water → Physical change
• Making a fruit salad with raw fruits → Physical change
• Burning of paper and wood → Chemical change

Question 2:

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

Solution 2:

Pure substance: Water, salt, sugar
Mixture: Salt water, soil, wood, air, cold drink, rubber, sponge, fog, milk, butter, clothes, food

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NCERT Exercise

Question 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.

Solution 1:

(a) Sodium chloride from its solution in water → Evaporation
(b) Ammonium chloride from a mixture containing sodium chloride and ammonium chloride → Sublimation
(c) Small pieces of metal in the engine oil of a car → Centrifugation or filtration or decantation
(d) Different pigments from an extract of flower petals → Chromatography
(e) Butter from curd → Centrifugation
(f) Oil from water → Using separating funnel
(g) Tea leaves from tea → Filtration
(h) Iron pins from sand → Magnetic separation
(i) Wheat grains from husk → Winnowing
(j) Fine mud particles suspended in water → Centrifugation

Question 2:

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

Solution 2:

First, water is taken as a solvent in a saucer pan. This water (solvent) is allowed to boil. During heating, milk and tea leaves are added to the solvent as solutes. They form a solution. Then, the solution is poured through a strainer. The insoluble part of the solution remains on the strainer as residue. Sugar is added tothe filtrate, which dissolves in the filtrate. The resulting solution is the required tea.

Question 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?

Solution 3:

(a) Mass of potassium nitrate needed to produce its saturated solution in 100 g of water at 313 K = 62 g
Mass of potassium nitrate needed to produce its saturated solution in
50 g of water at 313

$$K = \frac{62}{100} \times 50g = 31g$$

(b) Crystals of potassium chloride are formed. This happens as solubility of solid decreases with decreasing the temperature.

(c) Solubility of each salt at 293 K Potassium nitrate 32 g per 100 g water Sodium chloride 36 g per 100 g water Potassium chloride 35 g per 100 g water Ammonium chloride 37 g per 100 g water.

Note: Solubility of a solid is that amount in gram which can be dissolved in 100 g of water (solvent) to make saturated solution at a particular temperature.

Ammonium chloride has the maximum solubility (37 g per 100 g of water) at 293 K.

(d) Solubility of a (solid) salt decreases with decrease in temperature while it increases with rise in temperature.

Question 4:

Explain the following giving examples:
(a) Saturated solution
(b) Pure substance
(c) Colloid
(d) Suspension

Solution 4:

(a) Saturated solution
A saturated solution is a solution in which the maximum amount of solute has been dissolved at a given temperature. The solution cannot dissolve beyond that amount of solute at that temperature. Any more solute added will settle down at the bottom of the container as a precipitate.
Suppose 500 g of a solvent can dissolve a maximum of 150 g of a particular solute at 40°C. Then, the solution obtained by dissolving 150 g of that solute in 500 g of that solvent at 300 K is said to be a saturated solution at 300 K.
(b) Pure substance
A pure substance is a substance consisting of a single type of particles i.e., all constituent particles of the substance have the same chemical properties. For example, salt, sugar, water are pure substances.
(c) Colloid
A colloid is a heterogeneous mixture. The size of the solutes in this mixture is so small that they cannot be seen individually with naked eyes, and seems to be distributed uniformly throughout the mixture. The solute particles do not settle down when the mixture is left undisturbed. This means that colloids are quite stable.
Colloids cannot be separated by the process of filtration. They can be separated by centrifugation. Colloids show the Tyndall effect. For example, milk, butter, foam, fog, smoke, clouds.
(d) Suspension
Suspensions are heterogeneous mixtures. The solute particles in this mixture remain suspended throughout the bulk of the medium. The particles can be seen with naked eyes.

Suspension shows the Tyndall effect. The solute particles settle down when the mixture is left undisturbed. This means that suspensions are unstable. Suspensions can be separated by the method of filtration. For example, mixtures of chalk powder and water, wheat flour and water.

Question 5:

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

Solution 5:

Homogeneous mixtures: Soda water, air, vinegar
Heterogeneous mixtures: Wood, soil, filtered tea

Question 6:

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

Solution 6:

Every liquid has a characteristic boiling point. Pure water has a boiling point of 100°C (373 K) at 1 atmospheric pressure. If the given colourless liquid boils at even slightly above or below 100°C, then the given liquid is not pure water. It must boil at sharp 100°C. Thus, by observing the boiling point, we can confirm whether a given colourless liquid is pure water or not.

Question 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

Solution 7:

The following materials fall in the category of a "pure substance":
(a) Ice
(c) Iron
(d) Hydrochloric acid
(e) Calcium oxide
(f) Mercury

Question 8:

Identify the solutions among the following mixtures:
(a) Soil
(b) Sea water
(c) Air
(d) Coal
(e) Soda water

Solution 8:

The following mixtures are solutions:
(b) Sea water
(c) Air
(e) Soda water

Question 9:

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

Solution 9:

Milk and starch solution will show the "Tyndall effect".

Question 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

Solution 10:

Elements
(a) Sodium

(d) Silver
(f) Tin
(g) Silicon

Compounds

(e) Calcium carbonate
(k) Methane
(t) Carbon dioxide

Mixtures

(b) Soil
(c) Sugar solution
(h) Coal
(i) Air
(j) Soap
(m) Blood

Question 11:

Which of the following are chemical changes?

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

Solution 11:

The following changes are chemical changes:

(a) Growth of a plant
(b) Rusting of iron
(d) Cooking of food
(e) Digestion of food
(g) Burning of candle
