In Text Questions:

1. What does a pure substance mean?

Sol. A pure substance is one, which contains only one type of atoms or molecules in a specific arrangement in any part of the sample taken. Example: water, diamond.

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

Homogeneous mixture	Heterogeneous mixture
Components are uniformly distributed throughout the mixture	All the components are completely mixed and can be identified with the naked eye or under a microscope.
No visible boundaries of separation	Visible boundaries of separation.
Has a uniform composition	Has a non uniform composition
Example: rainwater, vinegar etc	Example: seawater, pizza etc

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

Sol.

Property	Sol	Solution	Suspension
Nature	Heterogeneous	Homogeneous	Heterogeneous
Particle size	$10^{-7} – 10^{-5}$cm	Less than 1nm	More than 100nm
Stability	Quite stable	Very stable	unstable
Tyndall effect	yes	no	yes/no
Appearance	Generally clear	clear	opaque
Visibility	Visible with an ultra microscope	Not visible	Visible with naked eye
Diffusion	Diffuses very slowly	Diffuses rapidly	Do not diffuse
Settling	Get settled in centrifugation	Do not settle	Settle on their own
Example	Milk, blood, smoke	Salt and sugar in	Sand in water, dusty

		water	air

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

Sol. Mass of solute (NaCl) = 36 g

Mass of solvent (H_2O) = 100 g

Mass of solution (NaCl + H_2O) = 136 g

Concentration = Mass of solute

Mass of solution

Concentration = 36 *100

136

= 26.47%

Hence, the concentration of the solution is 26.47%

5. 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?

Sol. The mixture of miscible liquids whose boiling point difference is more than 25°C such as kerosene and petrol can be separated by a technique called simple distillation. The principle of separation is based on the volatility of the substances. The process of distillation is as follows:

(a) Take the mixture in a distillation flask.

(b) Fit it with a thermometer and heat the mixture.

(c) Petrol has a lower boiling point and evaporates first.

(d) As the vapors rise up and reach the condenser, the temperature is decreased and the vapor is condensed into liquid and is collected in a flask.

(e) The kerosene that has relatively higher boiling point remains in the flask in the liquid form.

(f) Hence, the liquids are separated.

6. Name the techniques used to separate the following:

(a) Butter from curd.

(b) Salt from seawater

(c) Camphor from salt

Sol. (a) The butter is separated from the curd based on its density through the process of centrifugation.

(b) Simple evaporation technique is used in the separation of salt from seawater. Commercially, this process is producing salt.

(c) Camphor does not undergo liquid phase during the phase change. Therefore, sublimation process is more suited for the separation of camphor from the other substance.

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

Sol. Crystallization is a technique of separation of solid from a liquid solution. It relates to precipitation but here, the precipitate obtained is in crystal form and has a very high purity. This technique is thus used in the purification of impure substances. Example: Salt from sea water after the evaporation.

8. Classify the following as physical or chemical change:

- 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 into hydrogen and oxygen gases.
- Dissolving common salt in water
- Making a fruit salad with raw fruits
- Burning of paper and wood

Sol.

Physical change	Chemical change
• Cutting the trees • Melting of butter in a pan • Boiling of water to form steam • Dissolving common salt in water • Making fruit salad with raw fruits	• Rusting of almirah • Passing of electric current through water, and water breaking into hydrogen and oxygen gases • Burning of paper and wood

9. Try segregating the things around you as pure substances and mixtures.

Sol. Pure substance: water, salt, iron, diamond

- Mixture: sand, salad, concrete, air, steel

<u>Exercises:</u>

1. Which separation technique will you use 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

Sol. (a)The process of Evaporation commercially does the sodium chloride separation from its solution in water.

(b) Ammonium chloride undergoes Sublimation. Hence, this technique is preferred.

(c) The metal scraps can be filtered manually.

(d) The delicate separation of different pigments from an extract of flower petal is done with the help of Chromatography.

(e) The butter from milk is separated with the principle of difference in its density. Hence the Centrifugation technique is used.

(f) Oil and water are two immiscible liquids with a difference in their densities. Separation using Separating funnel is an effective way.

(g) The leaves can be manually separated by simple Filtration.

(h) The iron pins possess a magnetic quality which is the key character required for Magnetic separation.

(i) The wheat and husk vary in their mass thus with a little wind energy their moving distance varies. Winnowing/Sedimentation techniques are promoted in their separation.

(j) The mud particles being heavier settles at the bottom of the container when left undisturbed. The clear water is then separated by tilting it out. This process is known as Decantation/Sedimentation.

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

Sol. (a) Take a cup of milk in a vessel that acts as a solvent and heat it.

(b) Drop in the tealeaves or the powdered tealeaves into the milk as solute and continue heating.

(c) The tealeaves or the powdered tea leaves used is insoluble in the milk and is visible even after the heating.

(d) Now, to the boiling solution, add sugar and stir it.

(e) The sugar acts yet another solute, but in this case, it is soluble in the solvent.

(f) Due to continued stirring, the sugar completely becomes soluble in the tea solution and a saturation level is reached.

(g) After enough heating, filter the solution using a medium. When done, the insoluble tea leaves stays behind as residue and the soluble essence and sugar passes through the filter medium and is collected as the filtrate.

3. Pragya tested the solubility of three different substances at different temperatures and collected the data, which is 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 Kelvin and solubility				
	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 313K?

(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 down? 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:

Mass of potassium nitrate required to produce a saturated solution in 100 g of water at 313 K = 62g

Mass of potassium nitrate required to produce a saturated solution in 50 g of water = ?

Required amount =62∗50100=31

Hence 31 g of potassium nitrate is required.

(b) When the solution cools down, Pragya observes salt crystals of potassium chloride precipitating.

(c) Solubility of each salt at 293 K is as follows:

- Potassium nitrate —-> 21 g
- Sodium chloride —-> 36 g
- Potassium chloride —-> 35 g
- Ammonium chloride —-> 24 g

It is observed that the potassium chloride salt has the highest amount of solubility when compared to any other salt at 293 K.

(d) Effect of change of temperature in the solubility of salts:

It is observed from the given table that the solubility of the salt increases with the increase in temperature. This means that when a salt reaches its saturation point at a particular temperature, more salt can be dissolved yet by increasing the temperature of the solution.

4. Explain the following by giving examples:

(a)Saturated solution

(b)Pure substance

(c)Colloid

(d)suspension

Sol. (a) Saturated solution: At a given temperature, in a solution, if the solvent is no more soluble without increasing the temperature, then that state of solution is called the saturated solution.

(b) Pure substance: In a substance, if only one type of atoms or molecules or compounds is present with no contamination of other substance or any deviation of the arrangement, then the substance is known to be a pure substance.

(c) Colloid: A colloid, is a mixture in which one substance of microscopically dispersed insoluble particles is suspended throughout another substance. A colloid is a solution in which the size of solute particles are bigger than that of a true solution. These particles cannot be seen with naked eye, they are stable. Eg: ink, blood.

(d) Suspension: A suspension is a heterogeneous mixture containing solid particles that are sufficiently large for sedimentation. Usually, they must be larger than one micrometer. A suspension is a heterogeneous mixture in which the solute particles do not dissolve but get suspended throughout the bulk of the medium. Particles of suspension are visible to the naked eye. It is called a suspenion when particles are left floating around freely in a solvent.

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

Sol. Homogeneous: soda water, vinegar, filtered tea.

Heterogeneous: wood, air, soil.

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

Sol. Heat the given liquid to 100°C. If the liquid starts boiling, then it is confirmed that it is water. Else it is not water.

7. Which of the following materials fall into the category of pure substances?Ice, milk, iron, hydrochloric acid, calcium oxide, mercury, brick, wood, air.

Sol. The pure substances from the above-mentioned materials are ice, iron, hydrochloric acid, calcium oxide and mercury.

8. Identify the solutions among the following mixtures.

(a) Soil

(b) Seawater

(c) Air

(d) Coal

(e) Soda water

Sol. The solutions from the given mixtures are sea water, air and soda water.

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

(a) Salt solution

(b) Milk

(c) Copper sulphate solution

(d) Starch solution

Sol. From the above list, only milk and the starch solution shows 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.

Solution:

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