IS MATTER AROUND US PURE

NCERT Textbook Questions

Q.1. What is meant by a pure substance?

Ans. A pure substance is one which is made up of only one kind of particles. These particles may be atoms ormolecules. For example, sulphur is made up of only one kind of particles (called sulphur atoms), therefore, sulphur is a pure substance. Similarly, water is made up of only one kind of particles (called water molecules), therefore, water is also a pure substance. In fact, all the elements and compounds are pure substances because they contain only one kind of particles. A pure substance is homogeneous throughout its mass. A pure substance cannot be separated into other kinds of matter by any physical process. A pure substance has a fixed composition as well as a fixed melting point and boiling point.Q.2. List the points of differences between homogeneous and heterogeneous mixtures.Ans. The main points of difference between homogeneous mixtures and heterogeneous mixtures are as follows:

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Ans. The main points of difference between homogeneous mixtures and heterogeneous mixtures are as follows:

Homogeneous mixtures	Heterogeneous mixtures
(*i*) A homogeneous mixture has a uniform composition throughout its mass	(*i*) A heterogeneous mixture does not have a uniform composition throughout its mass.
(*ii*) A homogeneous mixture has no visible boundaries of separation between the various constituents	(*ii*) A heterogeneous mixture has visible boundaries of separation between the various constituents.
(*iii*) The constituents of a homogeneous mixture cannot be seen easily.	(*iii*) The constituents of a heterogeneous mixture can usually be seen easily.

Q.3. Differentiate between homogeneous and heterogeneous mixtures with examples.

Ans. (*a*) Those mixtures in which the substances are completely mixed together and are indistinguishable fromone another, are called homogeneous mixtures. A homogeneous mixture has a uniform composition throughout its mass. It has no visible boundaries of separation between the various constituents. A mixture of sugar in water (called sugar solution) is a homogeneous mixture because all the parts of sugar solution have the same sugar-water composition and appear to be equally sweet. There is no visible boundary of separation between sugar and water particles in a sugar solution. A mixture of two (or more) miscible liquids is also a homogeneous mixture. For example, a mixture of alcohol and water is a homogeneous mixture. All the homogeneous mixtures are called solutions.

(*b*) Those mixtures in which the substances remain separate and one substance is spread throughout the othersubstance as small particles, droplets or bubbles, are called heterogeneous mixtures. A heterogeneousmixture does not have a uniform composition throughout its mass. It has visible boundaries of separationbetween the various constituents. The mixture of sugar and sand is a heterogeneous mixture becausedifferent parts of this mixture will have different sugar-sand compositions. Some parts of this mixturewill have more of sugar particles whereas other parts will have more of sand particles. There is a visibleboundary of separation between sugar and sand particles. The suspensions of solids in liquids are alsoheterogeneous mixtures. For example, a suspension of chalk in water is a heterogeneous mixture. A mixturecontaining two (or more) immiscible liquids is also a heterogeneous mixture. For example, a mixture ofpetrol and water is a heterogeneous mixture.

Q.4. How are sol, solution and suspension different from each other?

Ans. Sol is a colloid in which tiny solid particles are dispersed in a liquid medium. So, in this question, the term 'sol' has been used to represent a colloid (or colloidal solution). The main points of difference between solutions, sols (or colloids) and suspensions are.

Solution (or True solution)	Solution (or Colloid)	Suspension
(*i*) A solution is a homogeneous mixture	(*i*) A sol (or colloid) appears to be homogeneous but actually it is heterogeneous	(*i*) A suspension is a heterogeneous mixture
(*ii*) The size of solute particles in a solution is extremely small. It is less than 1 nm in diameter.	(*ii*) The size of solute particles in a sol (or colloid) is bigger than that of true solutions but smaller than that in a suspension. It is between 1 nm and 100 nm in diameter.	(*ii*) The size of solute particles in a suspension is quite large. It is larger than 100 nm in diameter.
(*iii*) The particles of a solution cannot be seen even with a microscope	(*iii*) The particles of most of the sols (or colloids) cannot be seen even with a microscope. The particles of some of the sols (or colloids) can, however, be seen through a high power microscope	(*iii*) The particles of a suspension can be seen easily.

Solution (or True solution)	Solution (or Colloid)	Suspension
(*iv*) The particles of a solution pass through a filter paper. So, a solution cannot be separated by filtration	(*iv*) The particles of a sol (or colloid) can pass through a filter paper, so a sol (or colloid) cannot be separated by filtration	(*iv*) The particles of a suspension do not pass through a filter paper, so a suspension can be separated by filtration.
(*v*) The solutions are very stable. The particles of solute present in a solution do not separate out on keeping	(*v*) The sols (or colloids) are quite stable. The particles of a sol (or colloid) usually do not separate out on keeping	(*v*) The suspensions are unstable. The particles of a suspension settle down after some time.
(*vi*) A true solution does not scatter light (because its particles are very, very small)	(*vi*) A sol (or colloid) scatters a beam of light passing through it (because its particles are fairly large).	(*vi*) A suspension scatters a beam of light passing through it (because its particles are quite large).

Q.5. 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. Concentration of solution $= \dfrac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$

Here, Mass of solute (sodium chloride) = 36 g

And, Mass of solvent (water) = 100 g

So, Mass of solution = Mass of solute + Mass of solvent

= 36 + 100

= 136 g

Now, putting these values of 'mass of solute' and 'mass of solution' in the above formula, we get:

$$\text{Concentration of solution} = \frac{36}{136} \times 100$$

$$= \frac{3600}{136}$$

= 26.47 per cent (by mass)

Q.6. 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. If the difference in the boiling points of two miscible liquids is 25°C (or more), their mixture can be separated by the process of simple distillation. In this case, the difference in the boiling points of two miscible liquids, kerosene and petrol, is 25°C, therefore, a mixture containing kerosene and petrol can be separated by the process of simple distillation. This can be done as follows: The mixture of kerosene and petrol is taken in a distillation flask fitted with a thermometer and a water condenser. On heating the distillation flask with a burner, the petrol having lower boiling point distils over first and collected in a suitable container. Kerosene having higher boiling point distils over later and collected in another container (Caution: Petrol is highly inflammable. It catches fire easily).

Q.7. Name the technique to separate:

(*i*) butter from curd.

(*ii*) salt from sea-water.

(*iii*) camphor from salt.

Ans. (*i*) Centrifugation

(*ii*) Evaporation

(*iii*) Sublimation

Q.8. What type of mixtures are separated by the technique of crystallisation?

Ans. The mixtures containing solids in which the impurities may be either 'less soluble' in the solvent or 'more soluble' in the solvent than the solids, are separated by the technique of crystallisation. For example, the impurities present in impure copper sulphate, common salt and alum, etc., can be separated by the technique of crystallisation to obtain the respective pure substances.

Q.9. Classify the following as chemical or physical changes:

(*i*) cutting of trees

(*ii*) melting of butter in a pan

(*iii*) rusting of almirahs

(*iv*) boiling of water to form steam

(*v*) passing of electric current through water and the water breaking down into hydrogen and oxygen gases

(*vi*) dissolving common salt in water

(*vii*) making a fruit salad with raw fruits, and

(*viii*) burning of paper and wood

Ans.

Chemical changes	*Physical changes*
(*i*) cutting of trees	(*ii*) melting of butter in a pan
(*iii*) rusting of almirahs	(*iv*) boiling of water to form steam

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(*vi*) dissolving common salt in water

(*vii*) making a fruit salad with raw fruits

(*viii*) burning of paper and wood

Q.10. Try segregating the things around you as pure substances or mixtures.

Ans. Some of the things around us are: Tap water, Milk, Napthalene balls, Sodium chloride, Air, Gold ornaments, Ice-cream, Steel, Distilled water, Diamond, Steam, Kerosene oil, Alum, Salt solution, Brass, Alcohol, Vinegar,Graphite, Wood and Baking soda. We can segregate (or separate) these things as pure substances or mixtures as shown below:

Pure substances	*Mixtures*
Naphthalene balls	Tap water
Sodium chloride	Milk
Distilled water	Air
Diamond	Gold ornaments
Steam	Ice-cream
Alum	Steel
Alcohol	Kerosene oil
Graphite	Salt solution
Baking soda	Brass
	Vinegar
	Wood

NCERT Exercises

Q.1. Which separation technique 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 (by using a magnet)

(*i*) Winnowing (*j*) Loading (by using alum)

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

Ans. Take a few cups of water in a pan and heat it on a gas burner. To the hot water, add some tea leaves and boil. The water acts as a solvent and extracts soluble substances from tea leaves giving a dark brown mixture. Then add sugar and milk. Sugar is a solute which dissolves in hot water to form a solution. After boiling for some more time, the mixture is filtered through a tea-strainer. The prepared tea passes through the fine holes of the tea-strainer and collects as a filtrate in the cup placed below. The used tea-leaves, being insoluble, collect as a residue in the tea-strainer.

Q.3. Pragya tested the the solubility of four 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	Solubility				
	283 K	293 K	313 K	333 K	353 K
1. Potassium nitrate	21	32	62	106	167
2. Sodium chloride	36	36	36	37	37
3. Potassium chloride	35	35	40	46	54
4. 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 in temperature on the solubility of a salt?

Ans. (*a*) The solubility of potassium nitrate at 313 K is 62 grams (see the given table). This means that 62 grams of potassium nitrate is needed to make a saturated solution of potassium nitrate in 100 grams of water at 313 K. So, to make a saturated solution in 50 grams of water we will need half of 62 grams of potassium nitrate, which is $\frac{62}{2} = 31$ grams of potassium nitrate.

(*b*) When a saturated solution of potassium chloride at 353 K is left to cool, then solid potassium chloride (or crystals of potassium chloride) will gradually separate out from the solution (because the solubility decreases on cooling).

(*c*) The solubility of various salts at 293 K is: Potassium nitrate 32 g; Sodium chloride 36 g; Potassium chloride 35 g; and Ammonium chloride 37 g. Ammonium chloride has the highest solubility (of 37 g) at this temperature of 293 K.

(*d*) The given data shows that the solubility of a salt increases on increasing the temperature.

Q.4. Explain the following giving examples:

(*a*) saturated solution (*b*) pure substance

(*c*) colloid (*d*) suspension

Ans. (*a*) Saturated solution. A solution in which no more solute can be dissolved at that temperature, is called a saturated solution. For example, if in an aqueous salt solution, no more salt can be dissolved at that temperature, then that salt solution will be a saturated solution. Thus, a saturated solution contains the maximum amount of solute which can be dissolved in it at that temperature. For example, a maximum of 36 grams of sodium chloride (common salt) can be dissolved in 100 grams of water at 20°C, so a saturated solution of sodium chloride at 20°C contains 36 grams of sodium chloride dissolved in 100 grams of water.

(*b*) Pure substance. A pure substance is one which is made up of only one kind of particles. These particles may be atoms or molecules. All the elements and compounds are pure substances. Thus all the elements like hydrogen, oxygen, chlorine, bromine, iodine, etc are pure substances. Similarly, all the compounds such as water, carbon dioxide and sodium chloride, etc are pure substances.

(*c*) Colloid. A colloid is a kind of solution in which the size of solute particles is intermediate between those in true solutions and those in suspensions. The size of solute particles in a colloid is bigger than that of a true solution but smaller than those of a suspension.

Though colloids appear to be homogeneous to us but actually they are found to be heterogeneous when observed through a high power microscope. So, a colloid is not a true solution. Some of the examples of colloids (or colloidal solutions) are: Soap solution, Starch solution, Milk, Ink, Blood, Jelly and Solutions of synthetic detergents. Colloids are also known as colloidal solutions.

(*d*) Suspension. A suspension is a heterogeneous mixture in which the small particles of a solid are spread throughout a liquid without dissolving in it. Some common examples of suspensions are: Chalk-water mixture, Muddy water, Milk of Magnesia, Sand particles suspended in water, and Flour in water. Chalkwater mixture is a suspension of fine chalk particles in water; muddy water is a suspension of soil particles in water; and milk of Magnesia is a suspension of magnesium hydroxide in water. Please note that solid particles and water remain separate in a suspension. The particles do not dissolve in water.

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

Ans.

Homogeneous mixtures	*Heterogeneous mixtures*
soda water	wood
air	soil
vinegar	
filtered tea	

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

Ans. Pure water has a fixed boiling point of 100°C under standard atmospheric pressure. This fact can be used to confirm that a colourless liquid given to us is water as follows: We take the colourless liquid in a distillation flask fitted with a thermometer. Let us heat the flask with a gas burner till the liquid starts boiling. If all the colourless liquid distils over (or boils off) at the same temperature of 100°C, without leaving behind any residue in the distillation flask, it will be pure water.

Q.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. Pure substances are: Ice, Iron, Calcium oxide and Mercury.

(**Note**. Hydrochloric acid is a mixture of hydrogen chloride gas and water, so it is not a pure substance).

Q.8. Identify the solutions among the following mixtures:

(*a*) Soil (*b*) Sea-water (*c*) Air

(*d*) Coal (*e*) Soda water

Ans. Sea-water, Air and Soda-water.

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

(*a*) Salt solution (*b*) Milk

(*c*) Copper sulphate solution (*d*) Starch solution

Ans. Milk and Starch solution (Because they are colloids).

Q.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. We can classify the given materials into elements, compounds and mixtures as follows:

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

Q.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. Chemical changes: Growth of a plant; Rusting of iron; Cooking of food; Digestion of food; and Burning of a candle.