NCERT Solution For Class 9 Science Chapter 2 - Is Matter Around Us Pure

Exercise-2.1 (Page: 15)

1. What is meant by a substance?

   A substance is a particular kind or form of matter, having uniform characteristics, properties, and composition. For example— water, nitrogen, iron, etc.

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

Homogeneous mixture	Heterogeneous mixture
The mixture has a uniform proportion of its components in the entire sample.	The mixture has a non-uniform proportion of its components throughout the sample.
This mixture is also known as a solution. E.g., Air, Sugar solution.	This mixture is known as colloids. E.g., oil and water.
The mixture is visible under a microscope.	This can be seen through the naked eye.

Exercise-2.2 (Page: 18)

1. Differentiate between homogenous and heterogeneous mixtures with examples.

Homogeneous mixture	Heterogeneous mixture
This mixture is uniformly mixed with particles that are extremely small in size.	This mixture has unevenly distributed substances which are visible to the naked eye.
The substances in this mixture are pure.	The substances in this mixture are not pure.

The substances in the mixture exhibit similar physical properties.	The substances in this mixture have dissimilar physical properties.
Example: seawater, blood, saline solution, etc.	Example: rainwater, vinegar, etc.

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

Attributes	Sol	Solution	Suspension
Type of Mixture	Heterogeneous	Homogeneous	Heterogeneous
Size of particles	1nm- 100nm	Less than 1nm	More than 100nm
Tyndall effect	Exhibited as they scatter a beam of light	Not exhibited as they do not scatter a beam of light	Not exhibited as they do not scatter a beam of light
Appearance	Usually glassy and clear	Transparent	Cloudy and sometimes opaque
Visibility	Visible under an ultra-microscope	Not visible	Visible with the naked eye
Diffusion	Diffuses slowly	Diffuses instantly	Do not diffuse
Stability	Quite stable	Highly stable	unstable
Settling	Get settled only in centrifugation	Do not settle	Settle down if left undisturbed
Example	Blood, ink, mud, paint, etc.	The salt solution, Sugar solution	Sand in water, dusty air

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

   As we know, the mass of solute (NaCl) = 36 g

   Mass of solvent (H_2O) = 100 g

   Mass of solution (NaCl + H_2O) = 136 g

   And concentration = Mass of solute/Mass of solution x 100

   So, concentration = 36/136 x 100 = 26.47%

   Thus, the concentration of the solution is 26.47%

Exercise-2.3 (Page: 24)

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?

   Miscible liquids are separated using the technique of **fractional distillation,** which separates two liquids basing on the difference in their boiling points. The principle behind this technique is the **volatility of the liquids**. Let us understand how it works.

   - A mixture of kerosene and petrol is heated in a distillation flask to which a fractionating column is attached.
   - As the mixture gets heated, the vapours from the liquids arise as they reach their respective boiling points.
   - The vapours rise up the fractionating column, and as the tip of the fractionating column is cooler, the vapours condense and drop back into the distillation flask.
   - Petrol, being more volatile, distils first and kerosene, later.
   - Thus, the mixture gets separated using the fractional distillation technique.

2. Name the techniques used to separate the following:

(a) Butter from curd.

(b) Salt from seawater

(c) Camphor from salt

(a) Butter and curd can be separated using the process of **centrifugation—** a separation process based on the density of substances. In this process, the denser particles settle down while; the lighter particles move up.

(b) Salt and seawater can be separated using the **evaporation (simple distillation)** and **crystallization technique.**

(C) Sublimation is used to separate camphor from salt. In this process, the camphor, having a low boiling point, turns directly into gas, leaving behind the salt.

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

Crystallization is the process in which the atoms and molecules in a substance solidify into crystals. The crystals form in many ways, including **precipitation** and **freezing**.

Solid-liquid mixtures like salt solution and sugar solution can be separated, giving out pure solid crystals of salt and sugar in the respective solutions.

Exercise-2.4 (Page: 24)

1. Classify the following as physical or chemical 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 into hydrogen and oxygen gases.
- Dissolving common salt in water
- Making a fruit salad with raw fruits, and
- Burning of paper and wood

Physical change	Chemical change

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

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

Given below is a list of things classified into pure substances and mixtures:

Pure substance	Mixture
Water	Soil
Salt	Salad
Iron	Air
Diamond	Steel and alloys
Aluminum	Lemonade
Silver	Tea, coffee
Gold	Cold drinks
Sugar	Sugar solution
Salt	Salt solution

Exercise Main (Page 28)

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

(a) Sodium chloride from its solution in water.

- The process of evaporation helps in separating sodium chloride from its solution in water, as water will evaporate, leaving sodium chloride behind.

(b) Ammonium chloride from a mixture containing sodium chloride and ammonium chloride.

- Sublimation proves to be an effective method to separate Ammonium Chloride from a mixture containing sodium chloride and ammonium chloride as ammonium chloride is known to support the process of sublimation and will be collected as the sublime.

(c) Small pieces of metal in the engine oil of a car.

-This can be done using the method of filtration. Manual filtration is effective, too, in this case.

(d) Different pigments from an extract of flower petals.

- The process of chromatography helps in extracting various coloured components and pigments from the flower petals.

(e) Butter from curd.

- Centrifugation is a known process used to separate components with different densities. Therefore, the butter will get separated using this method.

(f) Oil from water.

- Being two immiscible liquids with varying densities, oil and water can be separated with the help of a separating funnel.

(g) Tea leaves from tea.

- This can be done using the method of filtration. Manual filtration using a sieve separates the two as tea leaves get collected on the sieve.

(h) Iron pins from sand.

- Magnetic force can be used to remove iron pins from the sand as irons possess strong magnetic qualities, and using a magnet will attract the pins from the sands towards itself, thus separating the two.

(i) Wheat grains from husk.

- Winnowing can be used to separate the two, as in this method, husk and wheat both possess different masses. When a small amount of wind energy is applied to them, these two components of different masses start separating from each other.

(j) Fine mud particles suspended in water.

- When you mix sand or fine mud particles in water, they tend to settle down on the waterbed if kept undisturbed since they are denser than water. The mud settles down in the bottom as the precipitate and can be separated using sedimentation. Sedimentation is based on the separation of mud particles from the water to acquire clear water by tilting it out as the mud particles settle down.

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

- To make tea, the very first step is to take some milk into a vessel to boil. The milk acts as a solvent in this case.

- The next step is to add tea leaves to it, which acts as a solute but is insoluble in milk.

- After applying continuous heat, add some sugar to the solution. Sugar here acts as a solute and is soluble in the solution and thus gets dissolved in it.

- Once you successfully stir it to remove the raw smell that the tea leaves emit and you think the tea is ready, stop applying it heat to it and filter it by using a strainer to remove the tea leaves from it.

- Since the tea leaves are insoluble, the strainer filters out the tea solution while holding back the tea leaves, which is the residue.

- This tea solution that is collected is known as the filtrate.

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 a 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 313K?

-To produce a saturated solution in 100g of water at 313k, 63 g of potassium nitrate is required. Therefore, to produce a saturated solution in 50g of water, The required amount of Potassium Nitrate is

1 gm = 62 g/ 100 g

50 gm = 62g /100g × 50 g

= 31 gm.

(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.

- The solubility of Potassium Chloride in the water decreases, when a saturated solution at 353K is cooled. As a result, the formation of crystals of Potassium Chloride would be noticed by Pragya, as it exceeds the solubility at a lower temperature.

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

- Solubility can be defined as the maximum amount of salt, which gets dissolved in 100 g of water to form a saturated solution at a given temperature. The table establishes that the maximum solubility of ammonium chloride is at 293K.
  The solubility of Potassium Nitrate is 32/100
  Sodium Chloride is 36/100
  Potassium Chloride is 35/100
  Ammonium Chloride is 37/100

(d) What is the effect of change of temperature on the solubility of a salt?

- We can see that a salt's solubility depends on the temperature, and therefore with a rise in the temperature, there is an increase in the salt's solubility as well. There is a tendency for dissolving more salt when the temperature of a solution containing salt increases as the salt reaches the

saturation point at a specific temperature. That of Potassium Nitrate increases by a considerable amount, and Ammonium Chloride sees a small difference, Potassium Chloride sees a marginal increase, whereas Sodium Chloride sees a negligible change.

4. Explain the following, giving examples.

(a) Saturated solution

- When a solution reaches a particular temperature beyond which a solvent can no longer be dissolved without applying further heat, it is called a saturated solution.

(b) Pure substance

- A pure substance is that which is made up of only similar molecules, atoms or compounds and thus has no other substance mixed in it in any form. A pure substance has the exact same colour texture and tastes throughout at any temperature and pressure applied and has a fixed melting and freezing point.
  Example – Sulphur, Diamond

(c) Colloid

- This is a homogeneous non-crystalline substance and is made up of particles that are sized between 1 to 100 nm. The particles in a colloid cannot be separated using a simple method of filtration or centrifugation.
  Ex- Blood, ink

(d) Suspension

- It is a heterogeneous mixture which comprises of suspended particles in the medium. These particles are solute, however not soluble, and unlike colloids are not microscopic but are quite large enough for the naked eye to see. These particles can be separated using sedimentation due to their large size.

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

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

- This is the classification of the above-mentioned mixtures

Homogeneous	Heterogeneous
Vinegar	Wood
Soda Water	Soil
Filtered Tea	Air

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

- To determine whether a colourless liquid such as water is pure or not, we can use the method of boiling. Water boils at 100 C. Therefore if we notice it carefully and see whether the water is boiling above 100 C or below the given temperature, we can conclude that the water is not pure.

7. Which of the following materials fall into the category of "pure substance"?

(a) Ice

(b) Milk

(c) Iron

(d) Hydrochloric acid

(e) Calcium oxide

(f) Mercury

(g) Brick

(h) Wood

(i) Air

- Out of the given options, the following can be categorized as pure substances: -
  Hydrochloric Acid
  Iron
  Mercury
  Ice

Calcium Oxide

8. Identify the solutions among the following mixtures.

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

- Following are the solutions from amongst the given options: -

Sea water

Air

Soda Water

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

(a) Salt solution
(b) Milk
(c) Starch solution
(d) Copper Sulphate Solution

- The Tyndall Effect is the effect that scatters the light when a light beam goes through a colloid. There are two substances that produce the Tyndall effect, i.e., Starch Solution and Milk.

10. Classify the following into elements, compounds, and mixtures.

(a) Sodium
(b) Soil
(c) Silver
(e) Calcium carbonate
(f) Tin
(g) Silicon

(h) Coal
(i) Air
(j) Soap
(k) Methane
(l) Carbon dioxide
(m) Blood
(n) Sugar Solution

- Following is the classification as required: -

Elements	Compounds	Mixture
Sodium	Calcium Carbonate	Soil
Silver	Carbon Dioxide	Sugar Solution
Tin	Methane	Coal
Silicon		Air
		Blood
		Soap