EXERCISE – 2.1 PAGE: 15

1. What is meant by a substance?

Solution:

It is a pure single form of matter. A substance has definite properties and compositions. Example – Iron

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

Solution:

Homogeneous mixture	Heterogeneous mixture
Particles are uniformly distributed throughout the mixture	All the particles are completely mixed and can be distinguished with the bare eyes or under a microscope.
Has a uniform composition	Irregular composition
No apparent boundaries of division	Noticeable boundaries of division.

EXERCISE – 2.2 PAGE: 18

1. Differentiate between homogenous and heterogeneous mixtures with examples.

Solution:

The following are the differences between heterogeneous and homogenous mixtures.

Heterogeneous mixture	**Homogeneous mixture**
All the particles are completely mixed and can be distinguished with the bare eyes or under a microscope.	Particles are uniformly distributed throughout the mixture
Irregular composition	Has a uniform composition
Noticeable boundaries of division.	No apparent boundaries of division
Example: seawater, blood, etc.	Example: rainwater, vinegar, etc.

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

Solution:

Attributes	**Sol**	**Solution**	**Suspension**
Type of Mixture	Heterogeneous	Homogeneous	Heterogeneous
Size of particles	10^{-7} – 10^{-5} cm	Less than 1nm	More than 100nm
Tyndall effect	Exhibited	Not exhibited	May or may not be exhibited
Appearance	Usually glassy and clear	Unclouded and clear	Cloudy and opaque

Visibility	Visible with an ultramicroscope	Not visible	Visible with naked eye
Diffusion	Diffuses very slowly	Diffuses rapidly	Do not diffuse
Stability	Pretty stable	Highly stable	unstable
Settling	Get settled in centrifugation	Do not settle	Settle on their own
Example	Milk, blood, smoke	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.

Solution:

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 x 100

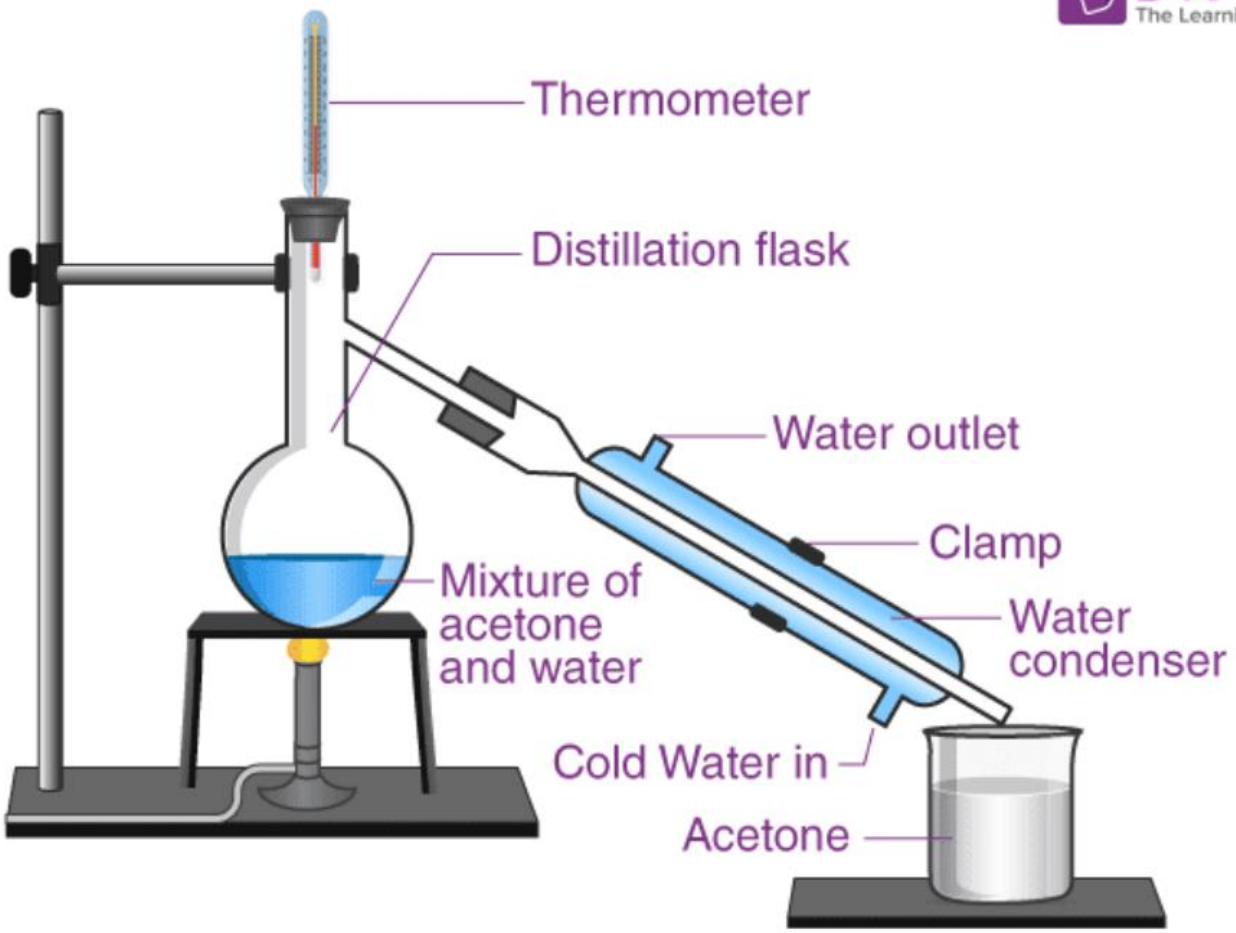
Concentration = 36/136 x 100 = 26.47%

Hence, 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?

Solution:



According to the question, kerosene and petrol are miscible, and their boiling points differ by more than 25 degrees Celsius, which is a significant difference, therefore they can be separated using a simple distillation procedure.

Distillation can separate kerosene and petrol since their boiling points differ by more than 25 degrees Celsius. The kerosene and petrol combination will be poured into a hot distillation flask. Because petrol has a lower boiling point, it will evaporate and create vapours first as the temperature of the mixture rises. A condenser condenses the vapours of gasoline and collects them through the condenser output. In the distillation flask, kerosene with a higher boiling point will be left behind.

Because their vapours will develop within the same temperature range if the difference in boiling points of two liquids is not great, a simple distillation procedure cannot be utilised to separate them. Fractional distillation separates these liquids by passing the vapours through a fractionating column before condensation.

2. Name the techniques used to separate the following:

(a) Butter from curd.

(b) Salt from seawater

(c) Camphor from salt

Solution:

a) A process known as centrifugation is used to separate butter from curd. The process is governed on the principle of density.

b) We can use the simple evaporation technique to separate salt from seawater. Distillation causes water to evaporate leaving solid salt behind, hence the production of salt.

c) Sublimation can be used to separate camphor from salt as during the phase change, camphor does not undergo a liquid phase.

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

Solution:

The technique of crystallization is used to separate solids from a liquid solution. It is linked to precipitation, but in this technique, the precipitate is achieved in a crystal form which exhibits extremely high levels of purity. The principle of crystallization can be applied to purify impure substances.

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**

Solution:

The following is the classification into physical and chemical change

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.

Solution:

Listed below are the classifications based on pure substances and mixtures:

Pure substance	Mixture
Water	Soil
Salt	Salad

Iron	Air
Diamond	Steel

EXERCISE PAGE: 28

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:

(a) In water, sodium chloride in its solution can be separated through the process of Evaporation.

(b) The technique of sublimation is apt as Ammonium chloride supports Sublimation.

(c) Tiny chunks of metal pieces in engine oil of car can be manually filtered.

(d) Chromatography can be used for the fine segregation of various pigments from an extract of flower petals.

(e) The technique of centrifugation can be applied to separate butter from curd. It is based on the concept of difference in density.

(f) To separate oil from water which are two immiscible liquids which vary in their densities, separating funnel can be an effective method.

(g) Tea leaves can be manually separated from tea using simple filtration methods.

(h) Iron pins can be separated from sand either manually or with the use of magnets as the pins exhibit strong magnetic quality which can be a key characteristic hence taken into consideration.

(i) The differentiating property between husk and wheat is that there is a difference in their mass. If treated with a small amount of wind energy, a remarkable variation in the moving distance is noticed. Hence to separate them, the sedimentation/winnowing procedure can be applied.

(j) Due to the property of water, sand or fine mud particles tends to sink in the bottom as it is denser provided they are undisturbed. Through the process of sedimentation/decantation water can be separated from fine mud particles as the technique is established on obtaining clear water by tilting it out.

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

Solution:

(a) Into a vessel, add a cup of milk which is the solvent, supply it with heat.

(b) Add tea powder or tea leaves to the boiling milk, which acts as a solute. Continue to heat

(c) The solute i.e., the tea powder remains insoluble in the milk which can be observed while it is still boiling.

(d) At this stage, add some sugar to the boiling solution while stirring

(e) Sugar is a solute but is soluble in the solvent

(f) Continuous stirring causes the sugar to completely dissolve in the tea solution hence reaching saturation.

(g) Once the raw smell of tea leaves is vanished and tea solution is boiled enough, take the solution off the heat, filter or strain it to separate tea powder and the tea solution. The insoluble tea powder remains as a residue while the solute (sugar) and the solvent (essenced milk solution) strain through the filter medium which is collected 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?

(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:

(a) Given:

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

To find:

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

Required amount = 62 x 50/100 = 31

Hence 31 g of potassium nitrate is required.

(b) The solubility of potassium chloride in water is decreased when a saturated solution of potassium chloride loses heat at 353 K. Consequently, Pragya would observe crystals of potassium chloride which would have surpassed it solubility at low temperatures.

(c) As per the given data, that is

Solubility of potassium nitrate at 293K = 32 g

Solubility of sodium chloride at 293K = 36 g

Solubility of potassium chloride at 293K = 35 g

Solubility of ammonium chloride at 293K = 37g

We can observe from this data that ammonium chloride has the highest solubility at 293K.

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

The table clearly depicts that the solubility of the salt is dependent upon the temperature and increases with an increase in temperature. With this, we can infer that when a salt arrives at its saturation point at a specific temperature, there is a propensity to dissolve more salt through an increase in the temperature of the solution.

4. Explain the following giving examples.

(a) Saturated solution

(b) Pure substance

(c) Colloid

(d) suspension

Solution:

(a) Saturated solution: It is that state in a solution at a specific temperature when a solvent is no more soluble without an increase in the temperature. Example: Excess carbon leaves off as bubbles from a carbonated water solution saturated with carbon.

(b) Pure substance: A substance is said to be pure when it comprises of only one kind of molecules, atoms or compounds without adulteration with any other substance or any divergence in the structural arrangement. Example: Sulphur, diamonds

(c) Colloid: A Colloid is an intermediate between solution and suspension. It has particles of various sizes, that ranges between 2 to 1000 nanometers. Colloids can be distinguished from solutions using the Tyndall effect. Tyndall effect is defined as the scattering of light (light beam) through a colloidal solution. Example: Milk, gelatin.

(d) Suspension: It is a heterogeneous mixture that comprises of solute particles that are insoluble but are suspended in the medium. These particles that are suspended are not microscopic but visible to bare eyes and are large enough (usually larger than a micrometre) to undergo sedimentation.

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

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

Solution:

The following is the classification of the given substances into homogenous and heterogenous mixture.

Homogenous mixture	**Heterogeneous mixture**
Soda water	wood
vinegar	soil
Filtered tea	
Air	

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

Solution:

We can confirm if a colourless liquid is pure by setting it to boil. If it boils at 100°C it is said to be pure. But if there is a decrease or increase in the boiling point, we infer that water has added impurities hence 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

(e)Wood

(f)Air.

Solution:

Following substances from the above-mentioned list are pure substances:

- Iron
- Ice
- Hydrochloric acid
- Calcium oxide
- Mercury

8. Identify the solutions among the following mixtures.

(a) Soil

(b) Sea water

(c) Air

(d) Coal

(e) Soda water

Solution:

The following are the solutions from the above-mentioned list of mixture:

- Sea water
- Air
- Soda water

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

(a) Salt solution

(b) Milk

(c) Copper sulphate solution

(d) Starch solution.

Solution:

Tyndall effect is exhibited by only milk and starch solution from the above-mentioned list of solutions.

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	Carbon dioxide	Sugar solution
Tin	Methane	Coal
Silicon		Air
		Blood
		Soap

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 candle

Solution:

Out of the given, the following are chemical changes:

Growth of plant, rusting of iron, cooking of food, digestion of food and burning of candle.