Is Matter Around Us Pure?

Case Study Based Questions

Case Study 1

A homogeneous mixture of two or more substances is called a true solution. A solution has a solute and a solvent as its component. The particles of a true solution are smaller than 1nm in diameter. A suspension is a heterogeneous mixture in which the solute particles do not dissolve but remain suspended throughout the bulk of the medium. A colloid is a mixture that is actually heterogeneous but appears to be homogeneous as the particles are uniformly spread throughout the solution.

Read the given passage carefully and give the answer of the following questions:

Q1. The correct sequence which describes the true solution, suspension and colloidal solution in order of their increasing stability is:

a. colloidal solution < true solution < suspension

b. suspension < colloidal solution < true solution

c. colloidal solution < suspension < true solution

d. true solution < colloidal solution < suspension

Q2. Which type of mixture can be separated by filtration?

a. Colloid

b. True solution

c. Suspension

d. All of these

Q3. Colloids are classified on the basis of:

a. nature of dispersed phase and dispersion medium

b. phase of solution

c. temperature of solution

d. None of the above

Q4. Component present in larger amount in solution is known as:

a. Dispersed phase

b. Solvent

c. Solute

d. None of these

Q5. The teacher instructed three students Ali, Aisha and Arvind respectively to prepare a 50% (volume by volume) solution of NaOH. Ali dissolves 50 mL of NaOH in 100 mL of water, dissolves 100 mL of NaOH in 500 g of water while Arvind dissolves 50 mL of NaOH in water to make 100 mL of solution. Which one of them has made the desired solution?

a. Ali

b. Aisha

c. Arvind

d. All of these

Solutions

1. (b) suspension < colloidal solution < true solution

2. (c) Suspension

3. (a) nature of dispersed phase and dispersion medium

4. (b) Solvent

5. (c) Arvind

$$\text{Volume by volume percentage of a solution} = \frac{\text{Volume of solute}}{\text{Volume of solution}} \times 100$$

For Ali,

$$\text{Volume by volume \%} = \frac{50}{150} \times 100 = 33.33\%$$

For Aisha,

$$\text{Volume by volume \%} = \frac{100}{500} \times 100 = 20\% \quad [\because 500\ g = 500\ mL]$$

For Arvind,

$$\text{Volume by volume \%} = \frac{50}{100} \times 100 = 50\%$$

Hence, Arvind has made the desired solution.

Case Study 2

A suspension is a heterogeneous mixture in which the small particles of solid are spread throughout a liquid without dissolving in it. If a beam of light is passed through a suspension, it scatters the beam of light and renders its path visible inside it. On the other hand, colloidal solution appears to be homogeneous to us but actually, it is a heterogeneous mixture. The particles of a colloid are uniformly spread

throughout the solution and its particles are big enough to scatter a beam of light passing through it.

Read the given passage carefully and give the answer of the following questions:

Q1. Which one of the following couldn't be classified as a colloid?

a. Blood

b. Soap solution

c. Chalk powder in water

d. Milk

Q2. Which of the following solutions shows Tyndall effect?

a. A solution of common salt

b. Sugar solution

c. Lemonade

d. Starch solution

Q3. The size of particles in suspension, true solution and colloidal solution varies in the order of:

a. suspension > colloidal > true solution

b. true solution > suspension > colloidal

c. suspension > colloidal = true solution

d. None of the above

Q4. Consider the following table:

Dispersed Phase	Dispersing Medium	Type
Liquid	Gas	Aerosol
Gas	Solid	Foam
Solid	Solid	Gel
Liquid	Liquid	Emulsion

Which are correct options?

a. 1, 2 and 3 only

b. 1, 3 and 4 only

c. 1, 2 and 4 only

d. All are correct

Q5. Automobile exhaust is an example of:

a. liquid dispersed in gas

b. solid dispersed in liquid

c. liquid dispersed in solid

d. solid dispersed in gas

Solutions

1. (c) Chalk powder in water

It is an example of suspension.

2. (d) Starch solution

Starch solution is a colloidal solution, so it will show Tyndall effect.

Sugar solution, common salt solution and lemonade are all true solutions.

3. (a) suspension > colloidal > true solution

4. (c) 1, 2 and 4 only

In gel, dispersed phase is liquid.

5. (d) solid dispersed in gas

Case Study 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
	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

Read the given passage carefully and give the answer of the following questions:

Q1. What mass of potassium nitrate would be needed to produce a saturated solution of potassium nitrate in 50 grams of water at 313 K?

Q2. 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.

Q3. Find the solubility of each salt at 293 K. Which salt has the highest solubility at this temperature?

Q4. What is the effect of change of temperature on the solubility of a salt?

Solutions

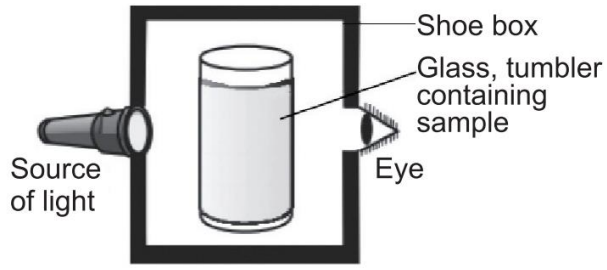
1. Mass of KNO_3 needed to produce a saturated solution KNO_3 in 100 grams of water at 313 K = 62 g
   ∴ Mass of KNO_3 needed in 50 grams of water at 313 K

$$= \frac{62.0 \times 50}{100} = 31.0 \text{ g}$$

2. Crystals of potassium chloride will be obtained on cooling the saturated solution.
3. Solubility of each salt at 293 K is
   (i) Potassium nitrate → 32 g
   (ii) Sodium chloride → 36 g
   (iii) Potassium chloride → 35 g
   (iv) Ammonium chloride → 37 g
   Ammonium chloride has the highest solubility at this temperature.
4. The given data shows that the solubility of a salt increases on increasing the temperature.

Case Study 4

A group of students took an old shoe box and covered it with a black paper from all sides. They fixed a source of light (a torch) at one end of the box by making a hole in it and made another hole on the other side to view the light. They placed a milk sample contained in a tumbler in the box as shown in the figure below. They were amazed to see that milk taken in the tumbler was illuminated. They tried the same activity by taking a salt solution but found that light simply passed through it.



Read the given passage carefully and give the answer of the following questions:

Q1. Explain why the milk sample was illuminated? Name the phenomenon involved.

Q2. Same results were not observed with a salt solution. Explain.

Q3. Can you suggest two more solutions which would show the same effect as shown by the milk solution?

Q4. Give one example of above phenomenon observed in our surroundings.

Solutions

1. Because milk is a colloidal solution and would show Tyndall effect.

2. Salt solution is a true solution and would not scatter light.

3. Soap solution and ink solution.

4. Tyndall effect is observed when sunlight passes through the canopy of a dense forest.