Unit 6

Solutions

Long Answer Questions

QI. Define the following

i. Aqueous solution ii. Universal Solvent iii. Solute iv. Solvent v. Saturated solution Ans.

(i) Aqueous Solution

The solution which is formed by dissolving a substance in water is called an aqueous solution. For example, sugar in water and table salt in water. -2 (ii) Universal Solvent

Water is called a universal solvent because it dissolves majority of compounds present in earth's crust (iii) Solute

Thecomponentof solution which is present in smaller quantity is called solute e.g. In salt solution, salt is solute. More than one solute may be present in a solution.

(iv)— Solvent

The component of a solution which is present in larger quantity is called solvent. For example, in soft drinks water is solvent while other substances like sugar, salts and C02 are solutes.

(v) Saturated Solution:

A solution containing maximum amount of solute at a given temperature IS called saturated solution. In saturated solution undissolved solute is in equilibrium with dissolved solute.

Q2. Write the preparation of saturated solution.

Ans. When a small amount of solute is added in a solvent, solute dissolves very easily 111 solvent. If the addition of solute is kept on, a stage is reached when solvent cannot dissolve more solute. At this stage solute remains undissolved and it settles down at the bottom of the container.

AL this stage dynamic equilibrium is established between undissolved solute with dissolved solute. Although dissolution and crystallization continues at a given temperature but the net amount of dissolved solute remains constant.

Solute (Crystallized) Solute (dissolved)

Q3. Define supersaturated solution. Explain it.

Ans. The solution that is more concentrated than a saturated solution, is known as supersaturated solution.

Explanation

When saturated solutions are heated, they develop further capacity to dissolvc more solute. Such solutions contain greater amount of solute than is required to form a saturated solution and they become more concentrated.

Supersaturated solutions are not stable. Therefore an easy way to get a supersaturated solution is to prepare a saturated solution at high temperature. It is then cooled to a temperature where excess solute crystallizes out and leaves behind a saturated solution. For example, a saturated solution of sodium thiosulphate (Na2S203) in water at 20^0C has 20.9g of salt per 100cm^3 of water. Less than this amount of salt per 100 cm^3 of water at 20^0C Will bc unsaturated solution. A solution having more amount than 20.9g Of salt per of water at 20^0C will be supersaturated solution.

Q4. Write the types of solutions with examples.

Ans. Each solution consists of two components solute and solvent, The solute as well as solvent may exists as gas, liquid or solid

There are nine typcsof solutions depending upon physical states of solute and solvent

Different types of solutions with example			
	Solute	Solvent	Example of solution
1	Gas	Gas	Air, mixture of H2 and He in weather balloons, mixture of NP and 02 in cylinders for respiration.
2	Gas	Liquid	Oxygen in water, carbon dioxide in water.
3	Gas	Solid	Hydrogen adsorbed on palladium.
4	Liquid	Gas	Mist, fog, liquid air pollutants.

5	Liquid	Liquid	Alcohol in water, benzene and toluene.
6	Liquid	Solid	Butter, cheese.
7	Solid	Gas	Dust particles or smoke in air.
8	Solid	Liquid	Sugar in water.
9	Solid	Solid	Metal alloys (brass, bronze), opals.

Q5. Write the Concentration units?

Ans. The proportion of a solute in a solution is called concentration. It is also ratio of amount of solute to the amount of solution or ratio of amount of solute to amount of solvent. Concentration does not depend upon the total volume or total amount of solution. For example a sample taken from the bulk solution will have the same concentration .There are various types of unite used to express concentration of solutions. Percentage

Percentage unit of concentration refers to the percentage of solute present in a solution. The percentage of solute can be expressed by mass or by volume.

i) Percentage- mass/mass (% m/m)

It is the number of grams of solute in 100 grams of solution. For example 10 % m/m sugar solution means that I()g of sugar is dissolved in 90 g of water to make of solution.

$$\% \text{ by mass} = \frac{\text{Mass of solute}}{\text{Mass of solution}}$$

ii) Percentage-mass/volume (% m/v)

It is the number of grams of solute dissolved in of solution. For example 10%m/v sugar solution contains I()g of sugar in cm^3 of the solution. The exact volume of solvent is not known.

$$\% \text{ m/v} = \frac{\text{Mass of solute}_{(g)}}{\text{Volume of solution}_{(cm^3)}} \times 100$$

iii) Percentage-Volume/mass (%/v/m)

It is theVölume in cm- Of a solute dissolved in' 100g of the solution. For example 10% v/m alcohol solution In water means of alcohol is dissolved m unknown volume of water so that total weight of solution is IOOg.In such solutions total volume of the solution is not considered.

$$\% \text{ v/m} = \frac{\text{Volume of solute}}{\text{Mass of solution (g)}}$$

iv) Percentage-volume /volume (%/v/v)

It is the volume in cm• of a solute dissolved per 100 cm- of the solution. For example 30% v/v alcohol solution means 3()cm^3 of alcohol dissolved in sufficient amount of water, so that total volume of solution becomes100cm^3.

$$^{O}/\text{o by volume} = \frac{\text{Volume of solute}_{(cm^3)}}{\text{Volume of solution}_{(cm^3)}} \times 100$$

Q6. Define molarity and write its formula to prepare molar solution.

Ans. Number of moles of solute dissolved in one drn of solution is called molarity It is represented by M. It is a concentration unit.

$$\text{Molarity (M)} = \frac{\text{No- of moles of solute}}{\text{Volume of solution (dlli}^{j}\text{)}}$$

or $$\text{Molarity (M)} = \frac{\text{Mass of solute (g)}}{\text{Molar mass of solute x volume of solution}}$$

Preparation of Molar solution:

One Molar solution is prepared by dissolving I mole (molar mass) of the solute in sufficient amount of water to make the total volume of the solution up to I drn• in a r¿casaring flask

For example 1M solution of NaOH is prepared by dissolving 40g of NaOH in sufficient water to make the total volume I dm^{g}.

Molarity increases with increase of solute. 2M solution IS more concentrated than 1M solution.

Q.7. Explain, How dilute solutions are prepared from concentrated solution?

Ans.

Dilute molar solution is prepared from a concentrated solution of explained below:

Suppose we are to make 100 cm^{v} of 0.01 M solution from given 0.1 M solution of potassium permanganate. First 0.1 M solution is prepared by dissolving 15.8 g of potassium permanganate in I dm^{3} of solution. Then 0.01 M solution 'is prepared by the dilution according to following calculations:

	Concentrated solution		Dilute solution
	M_1V_1	=	M_2V_2
Where	M_1	=	0.1 M
	V_1	=	?

And

IOO

0.01 M

Concen trated solution Dilute solution

V xo. I=0.01 x 100

0.01 x 100

0.1

Take 10cm^3 of this solution with the help of a graduated pipette and put in a measuring flask of I ()0cm^3 . Add water up to mark present at the neck of flask.

(28. Define solubility. What is general principle of solubility?

Ans. The number of grams of the solute dissolved in of solvent to prepare a saturated solution at a particular temperature is called solubility. The general principle of solubility is, like dissolves like.

(i) Polar substances are soluble in polar solvents. Ionic solids and polar covalent compounds are soluble in water. e.g. KCI, Na2C03 , CuS04 , sugar and alcohol are all soluble in water

(ii) Non-polar substances are not soluble in polar solvents. Non-polar covalent compounds are not soluble In water such as ether, benzene and petrol are insoluble in water.

(iii) Non-polar covalent substances are soluble in non-polar solvents. Grease, paints, naphthalene are soluble in ether or carbon tetrachloride (29. Explain solute — solvent interaction effect on solubility.

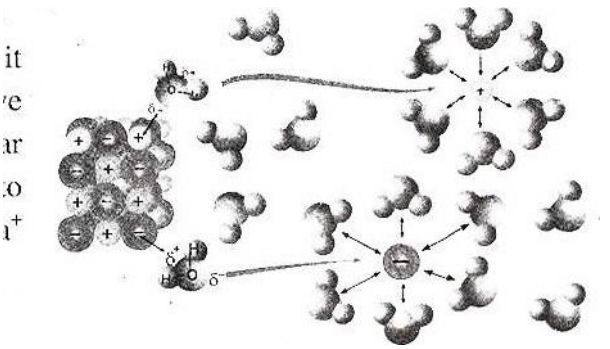
Ans. Solute-solvent interaction can be explained in terms of creation of attractive force. between the particles of solute and those of solvent. For dissolution of solute in solvent followino three events must occur:

i. Solute particles must separate from each other.
ii. Solvent particles must separate to provide space for splute particles. iii. Solute and solvent particlesanust attract and mix up.

Dissolution of solute depends upon the relative strength of attractive forces between solute-solute, solvent-solvent and solute and solvent. Generally solutes are solids. Ionic solids are arranged in such a regúlar pattern that the inter-ionic forces are at a maximum. If the new forces developed between solute and solvent particles overcome the solute-solute attractive forces, then solute dissolves and makes a solution. If forces between solute particles are strong enough than solute-solvent forces. Solute remains Insoluble and solution is not formed. During dissolution the solvent molecules first pull apart the solute ions and then surround them. In this way solute dissolves and solution forms.

Example of Dissolution of sodium chloride:

When NaCl is added in water it dissolves readily because the attractive interaction between the ions of NaCl and polar molecules of water are strong enough to overcome the attractive forces between Na and Cl- ions in solid NaCl crystal.



In this process the positive end of the water dipole is oriented towards the Cl ions and negative end of water dipole is oriented towards the Na ions. These ions-dipole attraction between Na ions and water molecules, Cl ions and water molecules are so strong that they pull these ions from their position in the crystal and thus NaCl dissolves.

QIO. Discuss the effect of temperature on solubility.

Ans. Change of temperature can change the solubility of the substances. Generally it seems that solubility increases with the increase of temperature but it is not always true. When a solution is formed by adding a salt in solvent there are different possibilities with reference to effect on solubility. These possibilities are:

(i) Heat is absorbed:

When salts like KN03, NaN03 and KCI are added in water, heat is absorbed. It means dissolution of these salts is endothermic process

Solute + Solvent + heat solution

Whenever temperature of solution of such salt is increased, the solubility of solute increased. It means heat is required to break the attractive forces between the ions of solute When such salts are dissolved in water, container become cold because heat is absorbed and temperature falls down.

(ii) Heat is given out

A few substances like Li2S04 and dissolve in water with the evolution of heat. It means dissolution of such substances is exothermic process. Therefore container becomes hot.

$$\text{Solvent} + \text{solute} \rightarrow \text{solution} + \text{heat}$$

In such cases, the solubility of salt decreases with the increase of temperature. In such cases attractive forces among the solute particles are weaker and solute-solvent interactionš are stronger. As a result, there is release of energy.

(iii) No change in heat

In some cases during a dissolution process neither heat is absorbed nor released.

When salt like NaCl is added in water, the solution temperature remains same. In such cases temperature has minimum effect on solubility.

QII. Give the five characteristics of colloid. Ans.

i. The particles of colloid are large consisting of many atoms, ions or molecules.

ii. A colloid appears to be a homogeneous but actually it is a heterogeneous mixture. Hence, they are not true solutions. Particles do not settle down tor a long time, therefore, colloids are quite stable

111. Particles are large but can't be seen with naked eye.

IV. Although particles of colloid are big but they can pass through a filter paper.

v. Particles scatter the path of light rays thus emitting the beam of light i.e. exhibit the tyndall effcct.

Q12. Give at least five characteristics of suspension.

Ans.

i. Thc particles of suspension are of largest size. They are larger than] (Y' cm in diameter.

11. Particles remain undissolved and form a heterogeneous mixture, particles settle down after sometime.

111. Particles of suspension are big enough to be seen with naked eye.

iv. Solute particles cannot pass through tilter paper

v.Particles of suspension are so big that light is blocked and difficult to pass

Q13. Comparison of solution, suspension and colloid <u>Solutions:</u>

Solutions are the homooeneous mixtures of two or more than two components. Each component is mixed in such a way that their individual identity is not visible e,a• drop of ink mixed in water is an example of true solutions.

<u>Colloid:</u>

These are the solutions in which the Solute particles are larger than those present in the true solution but not large enough to be seen by naked eye. The particles in such system dissolve and do not settle down for a long time. But particles of colloids are big enough to scatter the beam of light. It is called Tyndall ettèct. Tyndall affect is the main characteristic which distinguishes colloids from solutions.

Hence these solutions are called false solutions or colloidal solutions.

Examples are starch, albumin and soap solutions, blood, milk, ink, jelly, toothpaste etc. <u>Suspension:</u>

Suspension is a heterogeneous mixture of undissolved particles in a given medium. Particles are big enough to be seen with naked eye.

Examples are chalk in water (milky suspension), paints and milk of Magnesia (suspension ot magnesium oxide in water).

(214. Give Comparison of the Characteristics of Solution, Colloid and Suspension.

Ans.

ıtion	Colloid	
exist in form i.e. as r ions. Their	The particles are large consisting of nutny atoms, ions or molecules.	The laroest larger

Suspension The particles particles are of their simplest size. They are molecules othan I (P cm in

diameter is IO- cm.		diameter.
Particles dissolve uniformly throughout and form a homogeneous mixture.	A colloid appears to be a homogeneous but actually it is a heterogeneous mixture. Hence, they are not true solution. Particles do not settle down for a long time, therefore, colloids are uitc stable.	Particles remain undissolved and form a heterogeneous mixture, particles settle down after sometime
Particles are so small that they can't be seen with naked e e.	Particles are large but can't be seen With naked	Particles are big enough to be seen with naked
Solute particles can pass easily through a filter a er.	Although particles are big but they can pass throggh a filter a cr.	Solute particles cannot pass through filter paper.
Panicles are so small that they cannot scatter the rays of light, thus do not show tyndall effect.	Particles scatter the path of light rays thus emitting the beam of light i.e. exhibit the t ndall effect.	Particles are so big that light is blocked and difficult to pass.

(215. Write the relationship of solutions to different products in the community.

Ans.

Our body is made up of tissues which are all composed of water based chemicals. The water becomes the best solvent in our body We need an adequate supply of chemicals in the form of food, vitamins, hormones and enzymes. For taking care of our health we need medicines. Wc found that Chemicals and chemistry penetrate into every aspect of our life. Paper. sugar, starch, Vegetables oils, ghee, essential oils, tannery, soap, cosmetics rubber, dyes, plastics, petroleum, in fact there is almost noting that we use in our daily life that is not a chemical. Some are used as solid or gas but majority of them are used as solutions or suspensions.

Solved Examples of Book

Example 6.1

If we add $5cm^3$ of acetone in water to prepare $90cm^3$ of aqueous solution. Calculate the concentration (VIV) of this solution.

Solution

Volume of solute

Concentrationof solution (v /*100

Volume of solution

$$=\frac{5}{90}\times 100=5.5$$

The concentration of solution is 5.5 percent by volumes Example 6.2

Calculate the molarity of a solution which is prepared by dissolving 28.4g of Na2S04 in $400cm^1$ of solution.

Solution

Conversion of mass of solute into moles

No.of moles of Na2SO $_4$ $=\frac{\text{Mass dissolved (g)}}{\text{Molar mass (gmol}^{-1})}$

$_1 =$

0.5 dm

mass of solute(g)

Molarity – molar mass (g mop) x volume of sotution(dm^3)

$$\text{s of } Na_2SO_4 = \frac{28.4g}{142\ gmol^{-1}} = 0.2mol$$

Conversion of volume into dm^3 $= \frac{400cm^3}{1000cm^3} \times 1dm^3$

$= 0.4\ dm^3$

$$\textbf{Molarity} = \frac{\text{No. of moles}}{\text{Volume of solution } dm^3}$$

$$= \frac{0.2}{0.4} = 0.5\ mol\,dm^{-3}$$

No.of moles of Na2S04

Example 6.3

How much NaOH is required to prepare its 500 cm^3 of 0.4 M solution?

ion

Molar mass of NaOH

Solution

=40 $gmol^{-1}$

3

Volume in $dm^3 = \frac{500cm^3}{1000cm^3}$ X I dm^3

Mass of solute Molarityx molar mass X volume

= 40 x 0.5

= 8g

Example 6.4

10cm^3 of 0.01 molar KMn04 solution has been diluted to IOOcm^3. Find out the molarity of this solution?

Given Data

Data

Ml 0.01 M M_2 = ?

V_1 = IOcm^3 V_2 = 100cm^3

Solution

$$= M_2V_2$$

$$= \frac{M_1V_1}{V_2}$$

$$= \frac{0.01\times10}{100} = 0.001\ M$$

Numericals

QI. A solution contains 50g of sugar dissolved in 450g of water. What is concentration

Ans.

Given Data

Mass of sugar = 50g

Mass of water = 450g

Solution: Concentration of solution = ?

$$= \frac{\text{Mass of solute}}{\text{Mass of solute} + \text{Mass of solvent}}$$

$$= \frac{50g}{50g+450g}\times100$$

$$= \frac{50g}{500g}\times100$$

Concentration of solution

Concentration of solution = 10% m/m

Q2. If $60cm^3$ of alcohol is dissolved in $940cm^3$ of water. What is concentration of this solution?

Ans.

Given Data

Volume of alcohol = $60cm^3$

Volume of water = $940cm^3$

Concentration of solution= ?

Solution

$$\text{Concentration of solution} = \frac{\text{Volume of solute}}{\text{Volume of solute + Volumeof solvent}}$$

$$= \frac{60cm^3}{60cm^3 + 940cm^3} \times 100$$

60cm3

1000cm

Concentration of solution = 6% Ans. v/v

Q.3. How much salt will be required to prepare following solutions (atomic masses: K =39 , Na = 23, S = 32, O = 16, H = 1)

(a) $250cm^3$ of KOH solution of 0.5M

(b) $600cm^3$ of $NaNO_3$ solution of 0.25M

(c) $800cm^3$ of Na_2SO_4 solution of 1.0M

Ans. (a) $250cm^3$ of KOH solution of 0.5M

Given data

Molarity of solution = 0.5M

Volume of solution = $250cm^3$

$$\text{Volume of solution in } dm^3 = \frac{250cm^3}{1000cm^3} = 0.25dm^3$$

1000cm3

Molar mass of KOH -39+16+1=56gm011

Solution

$$\text{Molarity} = \frac{\text{Mass of solute (g)}}{\text{Molar mass of solute (gmorl) x volume of solution (dm3)}}$$

$$0.5M = \frac{\text{Mass of solute (g)}}{56ggmol\text{-}l \times 0.25dm^3}$$

Volume of solution — 600cm3

Volume of solution in dm^3 = $\frac{600cm3}{1000cm3}$

= $0.6dm^3$

Mass of solute = 0.5 X 56 x 0.25

(b) $600cm^3$ of NaN03 solution of 0.25M

Given data

Molarity of NaN03 solution =0.25M

Molar mass of NaN03 = 23+ 14+(16x3)

= 85grnol⁻

Solution

(g) Molarity = $\frac{\text{Mass of solute}}{\text{Molar mass of solute}}$

$$= \frac{\text{Mass of solute (g)}}{\text{Molar mass of solute (gmol}^{-1}) \times \text{volume of solution (dm}^3)}$$

$$0.25M = \frac{\text{Mass of solute}}{85gmoI\text{-}l \times 0.6dm^3}$$

Mass of solute 0.25 x 85 x 0.6

= 12.75 g Ans.

(c) $800cm^3$ of Na2S04 solution of 1.0M

ata

Molarity of Na_2SO_4 Solution = 1.0 M

Volume of solution = $800cm^3$

Volume of solution in dm^3 = $\frac{800cm^3}{1000cm^3}$

= $0.8dm^3$

Molar mass of Na_2SO_4 = 2(23) +32+(4x16)

= 46+ 32+64

= 142 $gmol^{-1}$

$$\text{Molarity} = \frac{\text{Mass of solute (g)}}{\text{Molar mass of solute (gmol}^{-1}) \times \text{volume of solution (dm}^3)}$$

Given data

Solution

Mass of solute

1.0M -

142gmoI-l x 0.8dm^3

Mass of solute -1.0 x 142 x 0.8

= 113.6 g

Q4. When we dissolve 20g of NaCl in 400cm^3 of solution, what will be its molarity?

Ans.

Given data

Mass of NaCl = 20g

Volume of solution 400cm3

Volume of solution in dm^3 $= \frac{400cm3}{1000cm3}$

=0.4dm3

Molar mass of NaCI = 23+35.5

= 58.5g mor

Molarity of solution = ?

Solution

$$\text{ity} = \frac{\text{Mass of solute (g)}}{\text{Molar mass of solute (gmol}^{-1}) \times \text{volume of solution (dm}^3)}$$

$$\text{ity} = \frac{20g}{58.5\,(\text{gmol}^{-1}) \times 0.4\,\text{dm}^3}$$

$$= \frac{20}{23.4} = 0.85M$$

Mass of solute (g) Molarity

=

Molarity

.Q5., We desire to prepare $100cm^3$ 0.4 M solution of MgC12. How much MgC12 is needed? Ans.

ution of $MgCl_2$. How much $MgCl_2$ is

Give data

Molarity Of solution - 0.4 M

cm^3

Volume of solution in dm^3 = 1 VOIume of solution = IOOcm

100cm3

= 0 IOOOcm3

Molar mass of $MgCl_2$ = 2 = $0.1dm^3$

= 2 = 24+(35.5) x 2

= 9 -24+71

Mass of MgC12 = ? = 95gmoL

Solution

$$\text{Molarity} = \frac{\text{Mass of solute (g)}}{\text{Molar mass of solute (gmol}^{-1}) \times \text{volume of solution (dm}^3)}$$

$$0.4M = \frac{\text{Mass of solute (g)}}{95gmol^{-1} \times 0.1dm^3}$$

Mass of solute = 0.4 x 95 x 0.1

= 3.8g

Q.6. 12M H2S04 solution is available in the laboratory. We need only 500cm^3 of 0.1M Solution, how it will be prepared?

Ans.

Given data

Molarity of H2S04 solution (concenü•ated) Ml -12M volume of H2S04 solution (concentrated) VI = ?

Molarity of H2S04 solution (dilute) M2 -0.1M

Volume of H2S04 solution (dilute) V2 = 500cm^3 Solution

Concentrated Solution = Dilute solution

$$12 \times V_1 = 0.1 \times 500$$

$$V_1 = \frac{0.1 \times 500}{12}$$

$$= 4.16 cm^3$$

We take 4.16 cm^3 of concentrated H2S04 solution with the help of graduated pipette and put in a measuring flask of 500cm^3. Add water of the mark present at the neck of flask. Now it is 0.1 molar solution of H_2SO_4

Short Answer Questions

QI. Define solution

Ans. A homogeneous mixture of two or more substances is called solution e.g. sugar dissolved in water is an example of solution. Q2. What are physical states of solutions?

Ans. Solutions are found in three physical states depending upon the physical state of solvent e.g. brass is a solid solution of Zn and Cu, sea water is liquid solution and air is a gaseous solution. Liquid solutions are the most common solutions because of the most common solvent water.

Q3. How a solution and a pure liquid is distinguished?

Ans. A solution is distinguished from a pure liquid by evaporation the pure liquid leaves no residue, while a liquid which leaves behind a residue on evaporation is solution.

Q4. Brass and bronze cannot be separated by physical means, yet it is considered a mixture why?

Ans. Because Brass or bronze shows the properties of its components and it has a variable composition.

Q5. Why suspension and solutions do not show tyndall effect while colloids do?

Ans. Because particles of colloids are big enough to scatter the beam of light but there is no scattering of light by particles of solution because they are so small they cannot scatter the rays but particles of suspensions are so big that lioht is blocked.

Q6. What is the reason for the difference between solutions, colloidal and suspensions?

Ans. In solution particles are very small. In colloidal solution particles are larger than solution but not enough larger as in suspension.

Q7. Why does not the suspension form a homogeneous mixture?

Ans. Particles in suspension remain un-dissolved and settle down after some time. Therefore suspension does not form a homoueneous mixture.

Q8. How will you test whether given solution is colloidal solution or not?

Ans. If there is scattering of light inside the solution, is colloidal solution. If solution does not show the tyndall effect. Then it is not colloidal solution.

Q9. Classify the following into true solution and colloidal solution. Glucose solution, copper sulphate solution, silver nitrate solution, Blood, starch solution, toothpaste.

Ans.

True solution

Glucose solution, copper sulphate solution,

Colloidal solution

Blood, starch solution, toothpaste.

QIO. Why we stir paints thoroughly before using?

Ans. Because paint is suspension. In suspension particles remain undissolved and settle down.

QII. Which of the following will scatter light and why?

(Sugar solution, Soap solution, Milk of Magnesia).

Ans. Sugar solution

Sugar solution will not scatter light because particles of solution are so small they cannot scatter liaht.

Soap solution

Soap solution scatter the light because it is colloidal solution and its particles are enough large they can scatter light.

Milk of magnesia

Milk of magnesia cannot scatter the light because it is suspension and its particles are so big that light is blocked.

Q12. What do you mean, like dissolves like? Explain with examples.

Ans. Like dissolves like means polar substances are soluble in polar solvents and non-polar ;ubqtances are soluble in non polar solvents.

Ionic solids and polar covalent solids are soluble in water e.g. KCI and sugar is soluble in water. Non polar substances are soluble in non-polar substances e.g. grease is soluble in ether.

Q13. How does nature of attractive forces of solute-solute and solvent-solvent affect the solubility?

Ans. Solubility is greater if the attractive forces between solvent-solvent are stronger similarly if the attractive forces become weaker in solute-solute then solubility will be greater.

Q14. How you can explain the solute-solvent interaction to prepare NaCl solution?

Ans. When NaCl is added in water it dissolves readily because the attractive interaction between ions of NaCl and polar molecules of water are strong enough to overcome attractive forces between Na+ and CI- in solid MCI. In this way NaCl dissolve in water.

Q15. Justify "ith example that solubility increases with increase in temperature.

Ans. When salt like KN03 is dissolved in water, heat is absorbed. It means heat is required to break the attractive forces between ions of solute. Therefore solubility of such salt increases with increases of temperature

Q16. What do you mean by volume/volume % ?

Ans. It is the volume in cm^3 of a solute per $100cm^3$ of the solution.

$$\% \text{ by volume} = \frac{\text{Volume of solute}}{\text{Volume of solution}}$$

Q17. What is aqueous solution?

Ans. The solution which is formed by dissolving a substance in water is called an aqueous solution.

Q18. What is difference between solute and solvent?

The component of solution which is present in smaller quantity is called solute.

The component of a solution which is present in larger quantity in solution is called solvent.

Q19. Define saturated solution.

Ans. A solution containing maximum amount of solute at a given temperature is called saturated solution.

Q20. Define unsaturated solution.

Ans. A solution which contains lesser amount of solute than that which is required to saturate it at a given temperature is called unsaturated solution. Q21. Define supersaturated solution.

Ans. The solution that i} more concentrated than a saturated solution is known as supersaturated solution.

Q22. What is difference between dilute and concentrated solution?

Ans. Dilute solution

Dilute solutions are those which contain relatively small amount of dissolved solute in the solution.

Concentrated solution

Concentrated solutions are those which contain relatively large amount of dissolved solute in the solution are called concentrated solutions.

Q23. What is concentration?

Ans. Ratio of amount of solute to the amount of solution or amount of solute to the amount of solvent.

(224. Define percentage mass/mass (%m/m).

Ans. It is the number of grams of solute in 100 grams of solution

$$\% \text{ by mass} = \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$$

Q25. What is percentage-mass/volume (%m/v)?

Ans. It is the number of grams of solute dissolved in $100cm^3$ of solution

$$\% m/v = \frac{\text{Mass of solute}}{\text{Volume of solution}} \times 100$$

Q26. What is percentage volume by mass (%v/m)?

Ans. It is the volume in cm^3 of a solute dissolved in 100g of the solution

$$\% v/m = \frac{\text{Volume of solute}}{\text{Mass of solution}} \times 100$$

Q27. Define Molarity. Write its formula.

Ans. Number of moles of solute dissolved in 1 dm^3 of solution is called molarity. It is represented by ***M***.

$$\text{Molarity} = \frac{\text{Mass of solute (g)}}{\text{Molar mass of solute } (gmol^{-1}) \times \text{volume of solution } (dm^3)} = \frac{\text{No. of moles of solute}}{\text{Volume of solution } (dm^3)}$$

Q28. Define solubility.

Define solubility.

Ans. Solubility is defined as the number of grams of the solute dissolved in 100g of solvent to prepare a saturated solution at a particular temperature.

Q29. Define colloid.

Ans. Colloids are solutions in which the solute particles are larger than those present in the ü-ue solution but not large enough to be seen by naked eye. e.g. blood.

Q30. Define suspension.

Ans. Suspension is a heterogeneous mixture of undissolved particles in a given medium e.g.

Chalk in water.

Q31. Why solubility of Li2S04 and Ce2(S04) decreases with the increase of temperature?

Ans. Li2S04 and Ce2(S04) dissolve in water with the evolution of heat, therefore solubility

of such salts decrease with the increases of temperature. Q32.

Why solution is considered mixture?

Ans Because components of solution can be separated by physical means.

Q33. Distinguish between the following pairs as compound or solution.

a. Water and salt solution
b. Vinegar and benzene
c. Carbonated water and acetone

Ans. Water and salt solution, water is compound and salt solution is solution

(a) Vinegar is solution and benzene is compound

(b) Carbonated water is solution and acetone is compound

Q34. What is the major difference between a solution and a mixture?

Ans. A solution is always homogeneous but mixture may be homogeneous or heterogeneous.

Q35. Why alloys are considers soltitions?

Ans. Because alloys are also homogeneous mixture.

Q36. Dead sea is so rich with salt that it forms crystals when temperature lowers in winter. Can you comment why is it named as dead sea?

Ans. Because it does not support life.

Q37. Does the percentage calculation require the chemical formula of the solute?

Ans. No. chemical formula is not required.

Q38. You are asked to prepare 15 percent (w/w) solution of common salt. How much amount of water will be required to prepare this solution.

Ansl 85g of water is required to prepare this solution.

Q39. How much water should be mixed with $18cm^3$ of alcohol so as to obtain 18% (v/v) alcohol solution?

Ans. $18cm^3$ of alcohol is dissolved in sufficient amount of water so that the total volume of the solution become $100cm^3$.

Q40. Calculate the concentration % (w/w) of a solution which contains 2.5g of salt dissolved in 50g of water Ans. Solution

Mass of salt = 2.5g

Mass of water = 50g

Mass of solute

Concentration (w / w) x 100

Mass of solute + mass of solvent

2.5

2.5+50

2.5

52.5

(241. Which one of the following is more concentrated one molar or three molar?
Ans. Three molar

Q42. What will happen if the solute-solute forces are stronger than those of solute-solvent forces?

Ans. Solute will not dissoF.'e in the solvent

Q43. When solute-solute forces are weaker than those of solute-solvent forces? Will solution form?

Ans. Solute will dissolve and solution will form.

Q44. Why is iodine soluble in CC14 and not in water?

Ans. Because iodine is non-polar in nature and CC14 is also non-polar but water is polar.

Q45. Why test tube become cold when KN03 is dissolved in water?

Ans. Because when KN03 is dissolved in water heat is absorbed from the surrounding.

Q46. What is difference between colloid and suspension?

Ans. Colloid

In colloid particles are larger than those present in the true solution.

Suspension

Suspension is a heterogeneous mixture of undissolved particles in given medium.

Q47. Can colloids be separated by filtration, if not why?

Ans. Not, because particles are not so big.

Q48. Why are the colloids quite stable?

—Ans. Because particles do not settle down for a long time.

Q49. Why does the colloid show tyndall effect?

Ans. Because their particles scatter the path of light rays.

Q50. What is tyndall effect and on for what factor it depends?

Ans. The scattering of beam of light by particles of colloids is called tyndall effect.
It depends up the size of particles.

Q51. Identify as colloids or suspension from the following:

Paints, milk, milk of magnesia, soap solution

Ans. Suspension

Paints, milk of magnesia

Colloids

Soap solution, milk

Q52. How can you justify that milk in colloid?

Ans. Milk is colloid because it shows tyndall effect.

Multiple Choice Questions

1. Butter is example of solution
   (a) Gas-gas
   (c) solid-solid
2. Sea water is a source of naturally occurring elements
   (a) 18 (b) 92
   (c) 118 (d) 95
3. Brass is a solid solution of Zn and
   (b) Sn
   (d) cu
4. Brass and Bronze are considered
   (a) Compounds (b) mixtures
   (c) Elements
5. In soft drink C02 is
   (a) Solvent
   (c) Solution 6. Which salt supersaturated solution
   (a) Na2S04 (b) NaC1
   (c) N Sd2S203 (d) NaHS04
7. Air is a example of solution
   (a) gas in liquid
   (c) gas in gas
8. Hydrogen absorbed in palladium is example of solution
   (a) solid in gas (b)
   (c) gas in gas (d)
9. Example of liquid-gas solution is
   (a) Mist (b) fog
   (c) air pollutants (d) All of
10. Example of liquid in solid
    (a) Butter (b) Cheese
    (c) both a and b (d) none of these
11. Smoke in air is example of solution
    (a) gas in gas (b) solid in liquid
    (c) solid in gas (d) All of these
12. Example of solid in solid solution is
    (a) Brass (b) Bronze
    (c) Opals (d) All of these

Alcohol in water is example of solution
(a) Liquid-gas (b) Liquid-liquid
(c) gas-liquid (d) None of these

14. 10% m/v sugar solution contains 10g of sugar in solution
    (a) 90g (b) 100g
    m^3 (d) 90cm3
15. 10% v/m alcohol solution contains $10cm^3$ of sugar in solution
    (a) IOOcm (b) 100g
    (c) 90cm (d) 90g
16. One molar solution contains one mole of solute in 3 volume. (a) IOOcm3 (b) lcm

(c) Idm (d) lcm3

17. Ionic solids and polar covalent Compounds are soluble in

(a) Benzene (b) ether

(c) Water (d) petrol

Which one of the following solvent is polar?

(a) benzene (b) water

(c) ether (d) petrol 19. Grease, paints, naphthalene are soluble in

(a) Water (b) ether

(c) Carbon tetrachloride

(d) both b and c

20. The compounds soluble in water are

(a) KCI (b) Na2C03

(c) cuS04 (d) All of these 21. Solubility of salt increases with the increase of temperature

(a) KN03 (b) NaN03

(c) KCI (d) all of these 22. The sohibility of which salt decreases with the increase of temperature

(a) KN03 (b) NaN03

(c) Li2S04 (d) KCI 23. Which of the following shows tyndall effect?

(a) Albumin (b) milk

(c) paints (d) both a and b

24. Which one is example of colloid?

(a) Jelly (b) paints

(c) Milk of magnesia

(d) None of these

25. Which one is a suspension?

(a) Blood (b) Toothpaste

(c) Ink (d) Chalk in water

26. Size of particles in true solution is (a) IOcm-2 (b) I O*cm

(c) 1 Ocm-5žJi (d) 10cm 12

27. Mist is an example of solution:

(a) Liquid in gas (b) gas in liquid

(c) Solid in gas (d) gas in solid

28. Which one of the following is a liquid in solid solution?

(a) Sugar in water (b) butter (c) Opal (d) fog

29. Concentration is ratio of:

(a) Solvent to solute

(b) Solute to solution

(c) Solvent to solution

30. Which one of the following solutions contains more water?

(c) 0.5M (d) 0.25M 31. A 5 percent (w/w) sugar solution means that:

(a) 5 g of sugar is dissolved in 90 g of water (b) 5 g of sugar is dissolved in 105 g of water

(c) 5 g of sugar is dissolved in 105 g of water

(d) 5 g of sugar is dissolved in 95 g of water

32. • If the solute-solute forces are strong- enough than those of solutesolvent forces. The solute: (a) Dissolves readily

(b) does not dissolve

(c) dissolves slowly

(d) dissolves and precipitates.

33. Which one of the following will show negligible effect of temperature on its solubility?

(a) KCI (b) KN03

(c) NaN03 (d) NaC1

.34. Which one of the following is heterogeneous mixture? (a) Milk (b) Ink

(c) Milk of magnesia

(d) Sugar solution

35. Tyndall effect is shown by:

(a) Sugar solution (b) paints

(c) Jelly (d) chalk solution

36. Tyndall effect is due to:

(a)Blockage of beam of light

(d) Solute to solute

:

(a) % w/w

(c) % v/w

diluted it turns into:

(a) Supersaturated solution

(b) Saturated solution

(c) A concentrated solution

(d) Unsaturated solution

39. Molarity is the number of moles of solute dissolved in:

(a) Ikg of solution

(b) 100 g of solvent

(c) 1 dm^3 of solvent

(d) I dm^3 of solution

Answer Key

1.	b	**2.**	b	**3.**	d	**4.**	b	**5.**	b
6.	c	**7.**	c	**8.**	d	**9.**	d	**10.**	c
11.	c	**12.**	d	**13.**	b	**14.**	c	**15.**	b
16.	c	**17.**	c	**18.**	b	**19.**	d	**20.**	d
21.	d	**22.**	c	**23.**	d	**24.**	a	**25.**	d
26.	b	**27.**	a	**28.**	b	**29.**	b	**30.**	d
31.	d	**32.**	b	**33.**	d	**34.**	c	**35.**	C
36.	c	**37.**	c	**38.**	d	**39.**	d		