Solution

IS MATTER AROUND US PURE

Class 09 - Science

Section A

1.

(c) 0.01g of NaCl + 99.99g of water

Explanation:

$\text{Mass\%} = \frac{\text{mass of solute}}{(\text{mass of solute} + \text{mass of solvent})} \times 100$

$= \frac{0.01g \times 100}{(0.01 + 99.99)0} = \frac{0.01 \times 100}{100.00} = 0.01\%$

Hence, the mass of solute =0.01 g and the mass of solvent = 99.99gms.

2. **(a)** colloid

Explanation:

The colloid of starch is prepared by the dispersion method. 2-3 g of powdered/crushed starch is dissolved in 3- 4 ml of water to make a thin paste. This paste is added to100 ml of boiling water while stirring. Allow the solution to cool and filter. The filtrate is colloid of starch.

3.

(c) It is transparent

Explanation:

A solution is always transparent, light passes through it without scattering as the solute particles are very small in size. So, the solution of sugar in water is transparent.

4.

(b) iodine

Explanation:

Place a slice of a potato on a paper towel at top of a paper plate and add a drop of the iodine solution to the potato slice. Note the color change. A change of color to blue-black or purple color suggests that starch is present. If there is no change in color, this suggests no starch is detectable.

5.

(b) X, Y, Z, W

Explanation:

The gas having lowest boiling point i.e., highly volatile will be distilled out first and the gas having highest boiling point i.e., least volatile will be distilled out at the last. So, the correct order of gases distilling out is X, Y, Z, W.

6.

(d) Q and S

Explanation:

Chromatogram of food sample does not match with the chromatograms of components Q and S.

7.

(c) (i) and (iv)

Explanation:

A mixture is said to be a homogeneous mixture if its constituents are distributed uniformly and are not physically distinct. Wood and soil are heterogeneous mixtures. Ice is made up of water and water is a pure compound. Air is a mixture of various gases.

Ice and air are homogeneous in nature.

8.

(d) iodine in alcohol

Explanation:

Tincture of iodine solution is made by dissolving iodine in alcohol. It contains around 2 - 7% iodine dissolved in a mixture of ethanol and water.

9.

(c) Egg albumin in water

Explanation:

Egg albumin in water will not give a stable solution. The protein in egg albumin coagulated to form a lump in hot water.

10.

(c) Muddy water

Explanation:

Muddy water will settle down because particles are heavy and settle due to gravity. Setting down of coarse particles under the influence of gravity is called sedimentation. During sedimentation, heavier particles settle down faster than finer particles.

11. A substance is a matter which has a specific composition and specific properties.Every pure element or pure compound is a substance. A substance can not be separated by any physical method. The properties/composition of a pure substance is fixed.
12. The maximum quantity of solute, which can dissolve in 100 gram of a solvent is called solubility of solute in that solvent, at a given temperature.
13. Solubility of a solute (other than gas) increase with the increase in temperature. On heating the liquid develops the capacity of dissolving some more solute to it. That is the saturated solution becomes unsaturated due to increase in the solubility.
14. A pure substance is a substance which contains particles of only one kind and has a definite set of properties.
    e.g. Sugar, salt, water and nitrogen are pure substances.
15. **Mass percentage of a solution** is defined as the mass of a solute (in grams) present in one hundred gram of a solution.
    Mass percentage = (Mass of solute / Mass of solution) x 100
16. The hard substance is a metal. Actually metals are sonorous and produce tinkling sound when bent.
17. It is a colloidal solution known as emulsion.
18. Air containing suspended particles is an heterogeneous mixture.
19. It ranges from 1 nm (10^{-9} m) to 100 nm (10^{-7}m).
20. This indicates that the solution of the substance 'A' in water is of saturated nature. The solution is known as saturated solution.
21. Elements **mercury** and **bromine** exist in liquid state at room temperature.
22. No, it is not a pure substance but it is a homogeneous mixture of several gases (e.g., nitrogen, oxygen, carbon dioxide, water vapours etc.).
23. Fog and cloud are the examples in which liquid is the dispersed phase and gas (air) is the dispersion medium. The only difference between them is that clouds are formed in the upper atmosphere while fog gets formed in the region close to earth.
24. Combustion of Liquefied Petroleum Gas (LPG) is a chemical change because after its combustion, the new substance formed changes chemically and cannot be turned back into LPG.
25. Chemical change can be explained as a change in which a new substance is formed and the process is irreversible. The rust is a brown chemical compound known as hydrated ferric oxide ($Fe_2O_3.xH_2O$) which is formed when iron reacts with oxygen and water. Formula of rust shows that iron has undergone a chemical change.

Section B

26. Concentration of the solution is 40 percent
    This means that
    100 gm of the solution contains 40 g of
    H_2SO_4
    Density = $\frac{mass}{volume}$
    $1.3gm/l = \frac{100g}{volume}$
    Volume of the solution = $\frac{100}{1.3}$
    $= \frac{100}{1.3}ml$

$\frac{100}{1.3} ml$ of solution contains 40g of
H_2SO_4

Therefore 100ml of the solution will contain
$\frac{100 \times 40 \times 1.3}{100} g$
H_2SO_4

= 52grm H_2SO_4

The concentration is 52 percent (m/v)

27. The strength of solution = $\frac{\text{Mass of solute}}{\text{Volume of solution in litres}}$

Mass of glucose = 5g
Volume of solution = 200m L = $\frac{200}{1000} = 0.2\text{L}$
Strength of solution = $\frac{5\text{g}}{0.2\text{L}} = 25\text{g/L}$

28. Mass of solute (Sodium chloride) = 36g
Mass of solvent (water) = 100g
Mass of solution = Mass of Solute + Mass of solvent
= 36g + 100g = 136g
Concentration = $\left(\frac{\text{mass of solute}}{\text{mass of solution}}\right) \times 100$
= $\left(\frac{36g}{136g}\right) \times 100$ = 26.47%

29. Given, Mass of urea present in solution = 16 g
Mass of solution =120 g
Mass percentage of urea = $\frac{\text{Mass of urea}}{\text{Mass of solution}} \times 100 = \frac{16\text{g}}{120\text{g}} \times 100$ = 13.33 %
Therefore, Mass percentage of urea in solution =13.33%.

30. Mass percent = $\frac{\text{Mas of solute}}{\text{Mass of solution}} \times 100$
Mass percent = 25, Mass of solution = 250 g
25 = $\frac{\text{Mass of cane sugar}}{(250\text{g})} \times 100$
Mass of cane sugar = $\frac{25 \times (250\text{g})}{100}$ = 62.5 g
Mass of water = 250 - 62.5 = 187.5 g

31. Solubility (in saturated solution) = $\frac{\text{Mass of solute}}{\text{Mass of solvent}} \times 100$
Mass of solute = 4 g
Mass of solvent = 40 g
Solubility (in saturated solution) = $\frac{(4\text{g})}{(40\text{g})} \times (100\text{g}) = 10\text{g}$

32. Mass of given saturated solution = 25g
Mass of salt in the solution = 5g
So, mass of water in the solution = 25 - 5 = 20g
Now, 20g of water has dissolved 5g of salt
$\therefore$ 1000g of water has dissolved = $\frac{5}{20} \times 1000$ = 250g
As solubility of the salt is its mass present in 100g (100mL) of water.
$\therefore$ 100g of water has salt = $\frac{5}{20} \times 100 = 25g$
So, the solubility of this salt is 25g at 25^{o}C.

33. Concentration of solution = $\frac{\text{Mas 5 of solute}}{\text{Mass of solution}} \times 100$
Mass of common salt = 35 g
Mass of water = 300 g
Mass of solution = (300 + 35) = 335 g
Concentration of solution = $\frac{(35\text{g})}{(335\text{g})} \times 100 = 10.45\%$

34. Let the mass of sodium sulphate required be 'x' g
The mass of water = 100 g
The mass of solution =(mass of sodium sulphate + mass of water) = (x + 100)g
Percentage of sodium sulphate in solution = $\frac{Mass\ of\ sodium\ sulphate}{Mass\ of\ solution} \times 100$

$20 = \frac{x}{x+100} \times 100$

20x + 2000 = 100x

80x = 2000

x = $\frac{2000}{80}$

= 25 g

Therefore, the mass of sodium sulphate required is 25 g.

35. Concentration of solution = $\frac{\text{Volume of solute}}{\text{Volum e of solution}} \times 100$

Volume of alcohol = 5 ml

Volume of solution = (5 + 75) = 80 ml

Concentration of solution = $\frac{(5mL)}{(80mL)} \times 100 = 6.25\%$

36. Given, Mass of salt present = 0.5 g

Mass of water present in solution = 25 g

Mass of solution = Mass of salt + Mass of solvent =0.5 + 25= 25.5 g

∴ Percentage amount of the salt in solution= $\frac{Mass\ of\ salt}{Mass\ of\ solution} \times 100 = \frac{0.5}{25.5} \times 100 = 1.96\%$

37. Mass percent (Mass %) = $\frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$

Mass of urea = 5g, Mass of water = 95g

Mass percent of urea = $\frac{(5g)}{(5g+95g)} \times 100$ = 5%

38. Metals are sonorous and highly ductile; hence, this element can be classified as a metal. Other characteristics expected to be possessed by this element are – lustre, malleability, heat and electrical conductivity.

39. The solution is a homogeneous mixture of two or more substances. Among the given mixtures solution are as follows:-

(b) Sea water: Seawater can be considered as a solution since it has dissolved salts (solid solute) in water (liquid solvent).

(c) Air: Air is a gas-in-gas solution.

(e) Soda water: Aerated drinks like soda water are gas-in-liquid solutions. Soda water contains carbon dioxide as a gaseous solute and water as a liquid solvent.

40. Diamond is probably the hardest substance known. It is used in scientific researches and medical field. It gives sharp and long lasting fine edges which is otherwise rarely possible. Therefore, a knife made from a special type of diamond is used for cutting glass.

41. Pure gold (24-carat gold) is very soft. It is alloyed with silver or copper to impart strength while making ornaments. An alloy that contains 20 parts of gold and 4 parts of silver is called a 20-carat gold.

42. Given, Volume of alcohol present in solution = 5.6 ml

Volume of water = 75 ml

Total volume of solution = (75 + 5.6) ml = 80.6 ml

Percentage volume of alcohol in solution = $\frac{\text{Volume of alcohol}}{\text{Total volume of solution}} \times 100 = \frac{5.6\text{mL}}{80.6\text{mL}} \times 100$ = 6.95 %

Therefore, Volume percentage of alcohol in solution = 6.95%.

43.

Sr.No	Aqueous solution	Non-aqueous solution
1.	Solutions prepared in water are called aqueous solution.	The solutions formed by dissolving substances in liquids like-alcohol, acetone and carbon disulphide are called non-aqueous solutions.
2	These solutions ionize easily and hence can conduct electricity. eg. solution of sodium chloride, solution of sugar.	These solutions do not ionize and therefore, do not conduct electricity. e.g. solution of sulphur dissolved in carbon disulphide, solution of Iodine dissolves in alcohol.

44. A compound is always a single substance in which two or more elements are combined chemically. A mixture is a combination of elements or compounds or both. Thus, a compound fulfils the definition of a pure substance but not a mixture. Moreover, a compound has a sharp melting or boiling point while a mixture does not have.

45. Following are some examples of Tyndall effect:-
    i. Sunlight entering a room through ventilation near the ceiling.
    ii. A beam of light coming inside a forest through a canopy of trees.
    iii. Shining a flashlight beam into a glass of milk.
    iv. The visible beam of headlights in fog.
46. i. Physical property of iron: Steel is an alloy of iron with about 1 percent carbon.
    ii. The chemical property of zinc: Zinc is a reactive metal. It displaces hydrogen from hydrochloric acid and forms zinc chloride.
    iii. The physical property of sodium: Sodium is a soft metal.
    iv. The chemical property of metallic oxides: Metallic oxides react with water and form alkalies.
47. Both - fog and smoke - have gas as the dispersion medium (the continuous phase). The difference lies in the dispersed phase (the suspended phase). The dispersed phase in fog is liquid (water droplets) whereas the dispersed phase in smoke is solid (particulate matter).
48. We know that the particles in a colloid show random zigzag motion called brownian movements. These brownian movements counters the force of gravity acting on colloidal particles and helps in providing stability to colloidal particles by not allowing them to settle down. On the other hand, Particle size in a suspension is larger than those in a colloidal solution. Also molecular interaction in a suspension is not strong enough to keep the particles suspended and hence they settle down.
49. A colloid is a kind of heterogeneous mixture/solution in which the particle size is between 10^{-7}cm and 10^{-5}cm such that the solute particles neither dissolve nor settle down. Colloids have a dispersion medium and a dispersed phase. E.g. Smoke, milk, shaving cream, jelly, cheese, etc.
50. When we try to melt brass, it does not have a sharp melting point. This shows that it is not a compound. It is a homogeneous mixture of copper and zinc and is called alloy.
51. The chemical change cannot be normally reversed because the products formed are totally different from the reactants.
52. No, they have not resulted in a mixture because they have combined with each other to form ammonium chloride which is a new substance. A mixture is always formed by mixing non-reacting substances.
    Ammonia (gas) + Hydrogen chloride (gas) → Ammonium chloride (solid).
53. This can be confirmed by the following experiments.
    i. Filter the colourless liquid through a very fine filter paper. If no residue is left on the filter paper, this means that the liquid is pure water and has no suspended impurities present in it.
    ii. Evaporate the colourless liquid in a china dish or beaker. In case no residue is left, this means that it is pure water and has no dissolved impurities present in it.
    iii. Determine the boiling point of pure liquid. If it comes out to be nearly 373 K (100^{o}C), this means that the pure liquid is water.
54. Alloys are the homogeneous mixtures of two or more metals. For example, brass is a mixture of a copper and zinc. Actually, copper is a crystalline solid in which the atoms are closely packed to form a crystal lattice. Some of these atoms have been replaced or substituted by atoms of zinc.
55. The colloidal solution is an example in which solid acts as the dispersion medium while liquid as the dispersed phase. It is also called gel.
    Because, on pressing butter, liquid drops come out of it leaving behind a solid. This clearly shows that butter is a gel.
56. Seawater is a mixture of several gases and salts in water. Therefore, seawater is considered as a homogeneous mixture. But other than salts and water, seawater also contains mud, decayed plants, etc. So it is considered as a heterogeneous mixture. Therefore, seawater can be classified as a homogeneous as well as a heterogeneous mixture.
57. The two elements sodium and chlorine have combined with each other by chemical reaction to form sodium chloride (NaCl) which is a chemical compound. Since these elements cannot be separated from each other by any physical process, sodium chloride is a pure substance.

Section C

58.

Homogeneous mixture	Heterogeneous mixture
These are called as solutions.	These are called as suspensions/colloids.
Substances are Uniformly distributed.	These substances are Unevenly distributed.
These are not visible to the naked eye, but visible through the microscope.	These are easily visible to the naked eye and also through microscope.
The particles appear smaller in size.	The particles are either smaller or larger in size.

These are pure substances.	These are not pure substances.
They represent same physical properties.	They do not possess same physical properties.
Examples include milk, gasoline, sugar solution, corn oil, fog etc	Examples are mixture of mud & water, beach sand, vinegar, air cloud etc

59. Since the experimentally determined melting point of the solid is more than the standard value of the melting point, this means that the solid is not in pure state. It has some impurities present. The purity of a solid can be determined by finding its melting point and comparing it with the standard value.
60. **Homogeneous Mixtures:** A mixture in which different constituents are mixed uniformly is called a homogeneous mixture. E.g. sugar in water, sulphur in CS_2 etc.

    Heterogeneous Mixtures: A mixture in which various constituents are not mixed uniformly is called a heterogeneous mixture E.g. A mixture of sand and salt. A handful of soil.
61.

Sr.No.	Saturated Solution	Unsaturated Solution
1.	It is solution in which no more solute can be dissolved at a given temperature.	It is a solution in which more amount of solute can be dissolved without raising the temperature.
2.	When temperature of saturated solution is decreased then the solute starts separating from the solution in the form of crystalline solid.	When temperature of unsaturated solution is decreased then it becomes saturated.

62. The component which is present in larger amount will be the solvent and the other which is present in lesser quantity will be the solute.
63.

Element	**Compound**
1. An element is made up of same kind of atoms.	1. A compound is obtained from different kinds of atoms.
2. An element cannot be split by physical or chemical methods	2. A compound can be split into new substances by chemical methods.
3. All the atoms or the molecules of the element show identical properties.	3. It may or may not show the properties of its constituent elements.
4.For example: Hydrogen, Oxygen, sodium, potassium etc.	4. For example, Water, Carbon dioxide etc.

64. They do not come closer because of the presence of either positive or negative charge on them. Due to mutual repulsion, these particles remain scattered in a colloidal solution.
65. Student 'C' has made the desired solution.

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

    $= \frac{50g}{100ml} \times 100 = 50\%$ mass by volume
66. Alcohol is soluble in water. Therefore, it will form true solution. sand will form suspension. Milk and soap will form colloidal solution
67.

Parameter	Mixture	Compound
Nature	A mixture is formed when two or more elements and/or compounds are mixed together such that they do not combine chemically. E.g. A mixture of iron and sulphur.	A compound is formed when two or more elements combine chemically. E.g. Water is formed when the elements hydrogen and oxygen combine together chemically.
Composition	A mixture has a variable composition. The constituents can be present in any ratio. E.g. A	A compound has a fixed composition. The constituents are present in a fixed ratio by mass. E.g. When water is formed, 2

	mixture of iron and sulphur can have iron and sulphur in any ratio.	atoms of hydrogen (2 g) combine with 1 atom of oxygen (16 g) to form 1 molecule of water (18 g).
Structure	Mixtures may be heterogeneous or homogeneous. E.g. A salt solution is homogeneous whereas milk is heterogeneous.	Compounds are always homogeneous.
Properties	A mixture shows the properties of the constituent substances. The constituents retain their properties. E.g. Iron and sulphur retain their properties in the mixture of iron and sulphur.	A compound has properties that are totally different from that of its constituents. E.g. The properties of water from that of its constituents - hydrogen and oxygen.
Separation of the constituents	The constituent particles of a mixture can be separated by physical methods. E.g. Iron can be separated from a mixture of iron and sulphur by means of a magnet.	The constituent particles of a compound can be separated by chemical or electrochemical reactions only. E.g. Hydrogen and oxygen can be separated from water (their compound) by means of electrolysis of water (H_2O).
Energy	No energy changes take place during the formation of a mixture.	Energy is either absorbed or given out during the formation of a compound.
Examples	Example: Air is a mixture of various gases.	Example: Sodium bicarbonate ($NaHCO_3$) and calcium sulphate ($CaSO_4$)

68. i. Milk is a colloid. The particulate matter present inside milk scatter the light passing through milk and shows Tyndall effect.
    ii. Salt solution is a homogeneous solution. Small particles present in a salt solution do not scatter light and hence, a salt solution does not exhibit Tyndall effect.
    iii. Detergent solution and sulphur solution will also show Tyndall effect.
69. Water is a compound because it is composed of two different elements - hydrogen and oxygen. The constituent elements - hydrogen and oxygen - cannot be separated by physical methods. They can be separated only by electrolysis. The physical and chemical properties of water are entirely different from those of hydrogen and oxygen. E.g. Hydrogen and oxygen are gases at room temperature whereas water is a liquid.
70. i. Concentrations of two solutions are different.
    ii. Solution A has 10 g sugar and 100 g water
    Mass % = $\frac{Mass of solute}{Mass of solution} \times 100 = \frac{10g}{110g} \times 100 = 9.09\%$
    Solution B has 10 g sugar and 90 g water
    Mass % = $\frac{Mass of solute}{Mass of solution} \times 100 = \frac{10g}{110g} \times 100 = 10\%$
71. When sodium chloride is dissolved in water, the process is endothermic in nature. This means that heat energy is absorbed in the process. Therefore, solubility increases with rise in the temperature. In case of lithium carbonate, the process of dissolution is exothermic. This means that heat is evolved in the process. Therefore, its solubility in water decreases with rise in temperature.
72.

Metals	Non-metals
Metals have lustre i.e. they have a shinning glow.	Non-metals do not have lustre. They cannot be polished.
They are mostly solids at room temperature. Exceptions - Mercury and Gallium are liquids at 30 ^oC	They are either gases or brittle solids at room temperatures.
Most of the metals are good conductors of heat and electricity.	They are mostly bad conductors of heat and electricity. Exception: Graphite
They are malleable i.e. they can be beaten into flat sheets. Exception: Zinc	They are non-malleable.
They are ductile i.e. they can be drawn into wires. Exception: Zinc	They are non-ductile.
They are sonorous (produce a sound on being hit)	They are non-sonorous.
They generally have high melting points and high boiling points.	They generally have low melting points and low boiling points.

E.g. Sodium, Magnesium, and Aluminium	E.g. Chlorine, Oxygen and Carbon

Section D

73. i. The maximum amount of solute that can dissolve in a given amount of solvent.

ii. Given, Mass of solute = 20g

Mass of solvent = 500g

Mass-Volume percentage = $\frac{20}{500} \times 100$

= 4%

Solubility of 500 g of solute = $\frac{4}{100} \times 500$

= 20g

Hence, the solubility of 20g of solute in 500g of solvent is 20g.

iii. A saturated solution becomes unsaturated by either heating it or by adding more of the solvent.

OR

Concentration of a solution is defined as the amount of solute that is present in a given amount of solution. It can be expressed in terms of: Mass by the mass percentage of a solution = $\frac{\text{mass of solute}}{\text{mass of solution}} \times 100$.

74. i. Since blood is a colloid, so tyndall effect is observed when a beam of light is passed through it since the dispersed particles of a colloid are large, deflect light.

ii. The phenomenon by which the colloidal particles scatter light is called Tyndall effect. If light is passed through a colloid the light is scattered by the larger colloidal particles and the, beam becomes visible.

iii. Colloidal solutions area mixture in which the substances are regularly suspended in a fluid. A colloid is a very tiny and small material that is spread out uniformly all through another substance.

OR

Fog: Liquid (water drops) acts as dispersed phase and gas (air) as the dispersion medium.

75. i. Dispersion medium is a continuous medium in which the dispersed phase is distributed throughout. Dispersed phase is the phase that is composed of particles that are distributed through another phase.

ii. Homogenous mixtures generally have a uniform composition throughout the mixture whereas Heterogeneous mixtures have composition which may vary from point to point. In Homogenous mixtures, the whole mixture is in the same phase whereas in Heterogeneous mixture, substances can be of two phases and layers may separate.

iii. An emulsion is a mixture of two or more liquids that are usually immiscible but under specific transforming processes will adopt a macroscopic homogeneous aspect and a microscopic heterogeneous one.

OR

Coloured gemstone.