ICSE Board
Class IX Chemistry
Paper – 3 Solution

SECTION I

Answer 1

(a)

i. The number of electrons, that atom can lose, gain or share during a chemical reaction is called its valency.

ii. **Solute:** A solute is the substance which dissolves in a solvent to form a solution.

iii. **Cation** is a positively charged ion which is formed when an atom loses one or more electrons; for example, Na^{+}, Hg^{2+} and Ca^{2+}.

iv. A **symbol** is the short form which stands for the atom of a specific element or the abbreviations used for the names of elements.

v. **Element** is a substance which cannot be split up into two or more simple substances by usual chemical methods of applying heat, light or electric energy; for example, hydrogen, oxygen and chlorine.

(b)

i. Thermal decomposition reaction
ii. Synthesis
iii. Direct combination
iv. Thermal decomposition
v. Thermal dissociation

(c)

1. The actual result of a chemical change.
2. The substances take part in a chemical reaction, and the substances are formed as a result of the reaction.
3. The number of atoms of each element participating in the reaction.
4. The number of molecules of different substances taking part in the chemical reaction.

   For example: $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$

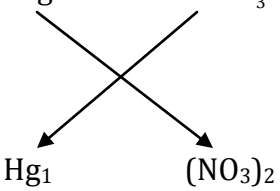
   Here, one molecule of zinc and one molecule of sulphuric acid react to give one molecule of zinc sulphate and one molecule of hydrogen.
5. Composition of respective molecules, i.e. one molecule of sulphuric acid contains

two atoms of hydrogen, one atom of sulphur and four atoms of oxygen.

6. Relative molecular masses of different substances, i.e. molecular mass of
   $Zn = 65$, H_2SO_4 $(2 + 32 + 64) =$ **98**
   $ZnSO_4$ $(65 + 32 + 64) =$ **161**
   $H_2 =$ **2**
7. It tells about the volumes of gaseous reactants and products.
   Example: $N_2 + 3H_2 \rightarrow 2NH_3$
   1 Vol. 3 Vol. 2 Vol.
   Volume of nitrogen, hydrogen and ammonia

(d)

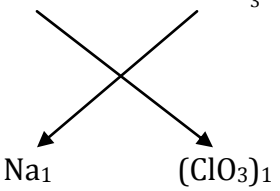
i. Hg^{2+} NO_3^-



Hg_1 $(NO_3)_2$

$= Hg(NO_3)_2$

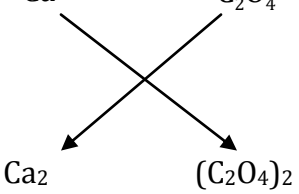
ii. Na^+ ClO_3^-



Na_1 $(ClO_3)_1$

$= NaClO_3$

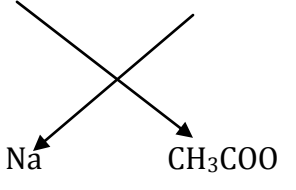
iii. Ca^{2+} $C_2O_4^{2-}$



Ca_2 $(C_2O_4)_2$

$= CaC_2O_4$

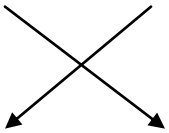
iv. Na^+ CH_3COO^-



Na CH_3COO

$= CH_3COONa$

v. Cu^{2+} OH^-



Cu_1 $(OH)_2$

$= Cu(OH)_2$

(e)

i. $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$
ii. $2KHCO_3 + H_2SO_4 \rightarrow K_2SO_4 + 2CO_2 + 2H_2O$
iii. $Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$
iv. $Cl_2 + SO_2 + 2H_2O \rightarrow H_2SO_4 + 2HCl$
v. $2AgNO_3 \rightarrow 2Ag + 2NO_2 + O_2$

(f)

i. False. During an endothermic reaction, heat is absorbed.
ii. True..
iii. True
iv. False. Sodium nitrate is unstable towards heat.
v. True

(g)

i. Element A

Atomic number = 7 = Number of electrons = 2, 5

Valency of A = 8 – 5 = 3

ii. Element B

Electronic configuration 2, 8, 8

Valency of B = Zero

iii. Element C has 13 electrons
Electronic configuration = 2, 8, 3
Valency of C = 3

iv. Element D

Protons = 18 = Electrons = 2, 8, 8

Valency of D = Zero

v. Element E
Electronic configuration = 2, 8, 8, 1

(h)

i. (d) Ozone
ii. (a) HCl
iii. (b) Alkaline
iv. (b) Decrease
v. (b) Atomic number

SECTION II

Answer 2

Dalton was right that atoms take part in chemical reactions.

Comparisons of Dalton's atomic theory with the modern atomic theory.

Dalton's atomic theory:

(i) Atoms are indivisible.

(ii) Atoms of the same element are similar in every respect.

(iii) Atoms combine in a simple whole number ratio to form molecules.

(iv) Atoms of different elements are different.

(v) Atoms can neither be created nor be destroyed.

Modern atomic theory:

(i) Atoms are no longer indivisible and consist of electrons, protons, neutrons and even more sub-particles.

(ii) Atoms of the same element may differ from one another called isotopes.

(iii) Atoms of different elements may be similar called isobars.

(iv) Atoms combine in a ratio which is not a simple whole number ratio; e.g. in sugar, the $C_{12}H_{22}O_{11}$ ratio is not a whole number ratio.

(a)

Constituents of mixture	Nature of mixture	Examples
(i) Solid–Solid	Homogeneous	Alloys
(ii) Solid–Liquid	Homogeneous	Salt in water
(iii) Gas–Gas	Homogeneous	Air
(iv) Liquid–Liquid	Homogeneous	Milk in water
(v) Gas–Solid	Heterogeneous	Smoke

Answer 3

(a)

i. $S^{2-} \rightarrow S$

$S^{2-} - 2e^{-} \rightarrow S$ (Oxidation)

ii. $Cl^{-} \rightarrow Cl$

$Cl^{-} - e^{-} \rightarrow Cl$ (Oxidation)

iii. $Mn^{5+} \rightarrow Mn^{7+}$

$Mn^{5+} - 2e^{-} \rightarrow Mn^{7+}$ (Oxidation)

iv. $Cl2 \rightarrow Cl^{-}$

$Cl2 + 2e^{-} \rightarrow 2Cl^{-}$ (Reduction)

v. $Cr^{7+} \rightarrow Cr^{5+}$

$Cr^{7+} + 2e^{-} \rightarrow Cr^{5+}$ (Reduction)

(b)

Gases are made of tiny particles which move in all possible directions at all possible speeds. The size of molecules is small as compared to the volume of the occupied gas.

There is no force of attraction between gas particles or between the particles and the walls of the container. So, the particles are free to move in the entire space available to them.

The moving particles of gas collide with each other and with the walls of the container. Because of these collisions, gas molecules exert pressure. Gases exert the same pressure in all directions.

There is large interparticle space between gas molecules, and this accounts for high compressibility of gases.

Volume of a gas increases with a decrease in pressure and increase in temperature.

Gases have low density as they have large intermolecular spaces between their molecules.

Gases have a natural tendency to mix with one and other because of large intermolecular spaces. So, two gases when mixed form a homogeneous gaseous mixture.

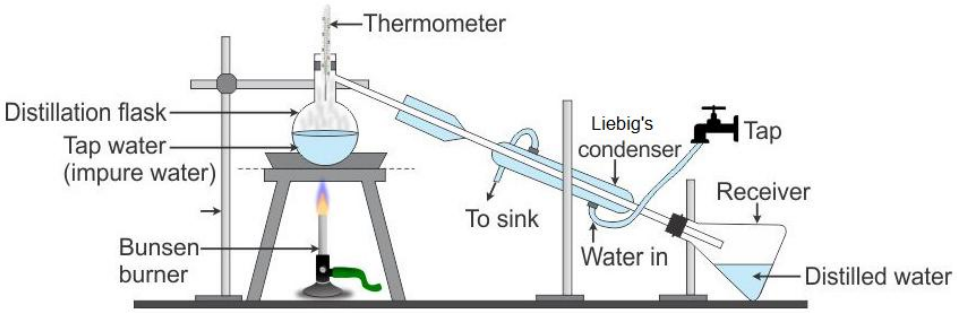
The intermolecular space of a gas is reduced because of cooling. Molecules come closer resulting in liquefaction of the gas.

(c) The chemical reactions which proceed in the presence of light are called photochemical reactions. Example: Photosynthesis

Answer 4

(a) A saturated solution is converted to unsaturated solution by the following two ways:

- For scientific purposes, pure water is obtained by repeated distillation of ordinary water.
- The process of converting liquid into vapour by heating and the subsequent condensation of the vapour back into a liquid is called distillation.
- This method is used to remove impurities from water. The water so obtained is called distilled water. It is the purest form of water. It is used for scientific purposes for experiments in the laboratory, for preparing solutions for medical purposes, for car batteries etc.
- Impure water is kept in the distilling flask and then boiled. Water turns into steam and passes through the Liebig condenser. Steam on coming in contact with the cooler parts of the condenser condenses water and gets collected as distillate (distilled water) in the receiver.
- The dissolved impurities remain in the flask.



Distillation

(b)

Deliquescent substances	Hygroscopic substances
1. These are solids, crystalline in nature. 2. They absorb moisture from the atmosphere and dissolve in it to form a saturated solution.	1. They may be crystalline solids or liquids. 2. They absorb moisture from the atmosphere and become wet (in case of solids) but do not form a saturated solution.

(c)

i. True
ii. False
iii. False
iv. False
v. True
vi. False. Inter molecular spaces in gases are very large.

Answer 5

(a)

i. H
ii. Ca
iii. Si
iv. Al
v. K
vi. Ge

(b)

i. Rubidium
ii. Copper
iii. Oxygen
iv. Chlorine
v. Krypton
vi. Magnesium

(c)

i. Water has an unusual physical property. When cooled, it first contracts in volume, like other liquids, but at 4 °C (maximum density), it starts expanding, and continues to do so till the temperature reaches 0°C, the point at which it freezes into ice.

The property of anomalous expansion of water enables marine life to exist in the colder regions of the world, because even when the water freezes on the top, it is still liquid below the ice layer.

ii. The nature of the solid is ionic.

Ionic compounds are hard crystalline solids with high melting points because of a strong force of attraction between the oppositely charged ions. So, a large amount of energy is required to break the strong bonding force between ions.

Electrovalent compounds are soluble in water. As water is a polar compound, it decreases the electrostatic forces of attraction, resulting in free ions in aqueous solution. Hence, they dissolve.

Answer 6

(a)

i.

Element	Atomic	Electronic Configuration		
		K	L	M
A	8	2	6	–
B	9	2	8	–
C	11	2	8	1
D	12	2	8	2

ii. Electropositive elements are C and D.
Electronegative elements are A and B.

(b) Distribution of electrons in orbits

- According to Bohr's model, electrons occupy certain stable orbits or shells. Each shell has definite energy.
- These orbits or shells are represented by the letters K, L, M, N… or the numbers 1, 2, 3, 4….
- The maximum number of electrons present in the shell is given by the formula ($2n^2$), where n is the orbit number or shell number.
- The maximum number of electrons in different shells is as follows:
  - The first orbit or K shell will have $2 \times 1^2 = 2$ electrons.
  - The second shell will have $2 \times 2^2 = 8$ electrons.
  - The third shell will have $2 \times 3^2 = 18$ electrons.
  - The fourth shell will have $2 \times 4^2 = 32$ electrons and so on.
- The maximum number of electrons which can be accommodated in the outermost orbit is 8.
- The orbits or shells are filled in a step-wise manner.
- Electrons are not accommodated in a given shell unless the inner shells are filled.

(c) In the laboratory, hydrogen is not prepared by the reaction of lead with dilute sulphuric acid or dilute hydrochloric acid because it forms insoluble lead sulphate and insoluble lead chloride, respectively, which prevents the reaction of metals with acids.

Answer 7

(a)

i. Less
ii. Atmosphere
iii. Troposphere
iv. Nitrogen, oxygen
v. Acid rain

(b) 76, 760

(c) Initial volume of the gas, $V_1 = 2000\ cm^3$
Initial pressure of the gas, $P_1 = 740$ mm Hg
Final volume of the gas, $V_2 = 500\ cm^3$
Final pressure of the gas, $P_2 = ?$

$$P_1V_1 = P_2V_2$$
$$740 \times 2000 = P_2V_2$$
$$P_2 = \frac{2000 \times 740}{500}$$
$$= 2960 \text{ mm Hg}$$