ICSE Board
Class IX Chemistry
Paper – 9 Solution

SECTION I

Answer 1

(a)

Compound	Acidic radical	Basic radical
$MgSO_4$	SO_4^-	Mg^+
$(NH_4)_2SO_4$	SO_4^-	NH_4^+
$Al_2(SO_4)_3$	SO_4^-	Al^{3+}
$ZnCO_3$	CO_3^-	Zn^{2+}
$Mg(OH)_2$	OH^-	Mg^{2+}

(b)

i. $2Cu(NO_3)_2 \xrightarrow{\Delta} 2CuO + 4NO_2 + O_2$
ii. $PCl_5 \xrightarrow{\Delta} PCl_3 + Cl_2$
iii. $2Mg + O_2 \longrightarrow 2MgO$
iv. $2H_2 + O_2 \longrightarrow 2H_2O$
v. $CO_2 + Ca(OH)_2 \longrightarrow CaCO_3 + H_2O$

(c)

Radicals	Formula	Valency
(i) Nitride	N^{3-}	−3
(ii) Phosphide	P^{3-}	−3
(iii) Carbide	C^{4-}	−4
(iv) Peroxide	O_2^{2-}	−2
(v) Bicarbonate	HCO^{3-}	−1

(d) Electronic configuration and valence electron for the given elements are as follows:

Sr. No.	Element	Symbol	Atomic number	K shell	L shell	M shell	N shell	Valence electrons
(i)	Fluorine	O	9	2	7			7
(ii)	Carbon	C	6	2	4			4
(iii)	Oxygen	Br	8	2	6			6
(iv)	Calcium	Ca	20	2	8	8	2	2
(v)	Argon	Ar	18	2	8	8	0	0

(e)

i. Fluorides cause destruction of vegetation and affect teeth and bones.
ii. Smoke particles cause asthma and other lung diseases.
iii. Lead impairs the body's metabolic activities.
iv. They cause disease like Minamata commonly found in fishermen.
v. Smog reduces visibility and induces respiratory troubles.
vi. Nitrogen dioxide causes death of many animals.

(f)

Substances	Colour before heating	Colour of the residue	Name of the gas	Name of the residue
(i) Cupric carbonate	Green	Black	Carbon dioxide	Copper oxide
(ii) Lead nitrate	White	Reddish yellow light yellow	Nitrogen dioxide and oxygen	Lead oxide
(iii) Ammonium dichromate	Orange	Green	Nitrogen and water vapour	Chromium oxide

(g)

i. Lead chloride
ii. Alkaline pyrogallol solution
iii. Oxygen
iv. Nitrogen dioxide and sulphur dioxide
v. Carbon (graphite)

(h)

i. False
ii. False
iii. True
iv. False
v. False

SECTION II

Answer 2

(a) Kinetic theory of matter

Any substance whether solid, liquid or gas is made of tiny particles (atoms, molecules or ions) which are in constant motion. This is called the kinetic theory of matter.

Postulates of the kinetic theory of gases

1. Composition of matter: Matter is composed of small particles – atoms, molecules and ions.
2. Interparticle space: Particles have spaces between them. These spaces are referred to as interparticle/intermolecular spaces.
3. Interparticle attraction: Particles attract each other with a force. This force of attraction between the particles of a given substance is called interparticle attraction/intermolecular force. The interparticle attraction decreases with increasing distance and *vice versa*.
4. Collision of particles: Particles collide with each other and with the walls of the container in both gaseous and liquid states. The total energy of the colliding particles remains the same.
5. Motion of particles: Particles are always in a state of motion. In solids, they vibrate about their fixed mean position. Liquids and gases move randomly. Due to their motion, they possess kinetic energy.
6. Energy possessed by matter: Particles are in a state of constant motion. This random movement of molecules is due to kinetic energy.

(b)

i. Low
ii. Less
iii. Chlorofluorocarbon
iv. Ultraviolet
v. 2

Answer 3

(a) Pollutant: Toxic and otherwise harmful substances which have an undesirable impact on different components of the environment and life forms are known as pollutants.
Particulate pollutants are dust, smoke, mist, spray and fumes.

(b) Photosynthesis

(c)

i. **Exothermic reaction:** The reaction in which heat energy is liberated is called exothermic reaction.
ii. **Endothermic reaction:** The reaction in which heat energy is absorbed is called endothermic reaction.

(d) The outermost shell of all the noble gases is complete. Thus, its valency is zero. 'M' has three electrons more than the noble gas. Thus, the valency of the element 'M' is +3.

i. MCl_3
ii. $M_2(SO_4)_3$
iii. $M(OH)_3$
iv. MPO_4
v. M_2O_3

Answer 4

(a)

i.
A – Hydrogen
B – Oxygen
C – Water

ii. $2H_2 + O_2 \rightarrow 2H_2O$
Hydrogen Oxygen Water

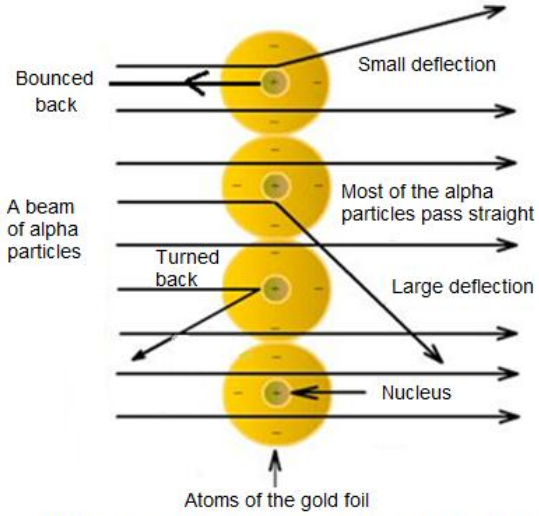
iii. Liquid 'C' can be tested by the following two ways:
(a) It turns white-coloured anhydrous copper sulphate blue.
(b) It turns blue-coloured anhydrous cobalt chloride pink.

iv.
(a) $SO_2 + H_2O \rightarrow H_2SO_3$
Sulphurous acid
(b) $Na_2O + H_2O \rightarrow 2NaOH$
Sodium hydroxide
(c) $NH_3 + H_2O \rightarrow NH_4OH$
Ammonium hydroxide
(d) $CO_2 + H_2O \rightarrow H_2CO_3$
Carbonic acid

(b) In 1911, Earnest Rutherford, a scientist from New Zealand, overturned Thomson's atomic model by his gold foil experiment. His experiment demonstrated that the atom has a tiny massive nucleus. It thus rejected Thomson's model of the atom.

Rutherford's scattering experiment

- Rutherford selected a gold foil as he wanted a very thin layer.
- In his experiment, fast-moving alpha particles were made to fall on a thin gold foil.
- Alpha particles are helium ions with +2 charge and have a considerable amount of energy.
- These particles were studied by the flashes of light they produced on striking a zinc sulphide screen.
- He expected the alpha particles to pass through the gold foil with little deflections and to strike the fluorescent screen.



Deflection of Alpha Particles from the Gold foil

However, the observations he made were unexpected.

- He observed that most of the alpha particles passed straight through the gold foil.
- Some were deflected through small angles, and some were deflected through large angles.
- Very few appeared to bounce back.

  From the experiment, he concluded that
- As most of the alpha particles passed through the gold foil without getting deflected, most of the space inside the atom is empty.
- Very few particles deflected from their path; this indicated that the positive charge of the atom occupies very little space.
- A small fraction of alpha particles bounced back by 180°, this indicated that the entire positive charge and mass of the atom were concentrated in a very small volume within the atom.

  Based on his observations, he formulated his **'Theory of atom'**.

Main features of Rutherford's theory of atom

- There is a positively charged centre in the atom called the **nucleus** in which nearly all the mass of the atom is concentrated.
- Negatively charged particles called **electrons** revolve around the nucleus in paths called **orbits**.
- The size of the nucleus is very small as compared to the size of the atom.
- His model can be compared to the solar system, where the planets are compared with electrons and the Sun with the nucleus.

Answer 5

(a)

i. C, I
ii. F, G
iii. D
iv. A
v. H
vi. B and H

(b)

i. The temperature and pressure conditions are written above or below the arrow.
ii. Formation of a precipitate is depicted by a downward arrow ↓.

(c)

i. −100°C = −100 + 273 = 173 K
ii. 273°C = 273 + 273 = 546 K
iii. 20°C = 20 + 273 = 293 K
iv. 5°C = 5 + 273 = 278 K
v. 300°C = 300 + 273 = 573 K

Answer 6

(a)

Element	Electronic configuration	Type of metal	Reason
Chlorine	2, 8, 7	Non-metal	7 electrons in its valence shell.
Magnesium	2, 8, 2	Metal	2 electrons in its valence shell.
Argon	2, 8, 8	Inert gas	8 electrons in its valence shell.
Phosphorus	2, 8, 5	Non-metal	5 electrons in its valence shell.
Potassium	2, 8, 8, 1	Metal	1 electron in its valence shell.

(b)

i. Atomic number of Y = no. of electrons/protons = 8
ii. Mass number of X = no. of protons + no. of neutrons = 8 + 8 = 16
iii. X and Y are isotopes because they have the same atomic number.
iv. X and Y represent oxygen because oxygen has atomic number 8.
v. Atomic number of oxygen is 8. Therefore, electronic configuration will be 2, 6.

Answer 7

(a) Initial volume (V_1) = 400 cm^3

Initial temperature (T_1) = 27 + 273 K = 300 K

Final volume (V_2) = ?

Final temperature (T_2) = 10 + 273 = 283 K

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\Rightarrow \frac{400}{300} = \frac{V_2}{283}$$

$$V_2 = \frac{400 \times 283}{300} = 377.33 \text{ cm}$$

(b) V_1 = 6 dm^3 V_2 = ?

P_1 = 700 mm Hg P_2 = 760 mm Hg

T_1 = 27 + 273K = 300 K T_2 = 273 K

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\frac{700 \times 6}{300} = \frac{760 \times V_2}{273}$$

$$V_2 = \frac{700 \times 6 \times 273}{300 \times 760} = \frac{1146600}{228000}$$

$$= 5.02 \text{ dm}^3$$

(c)

Law of conservation of mass: It states that mass can neither be created nor destroyed in a chemical reaction.

During any change, physical or chemical, matter is neither created nor destroyed. However, it may change from one form to another.

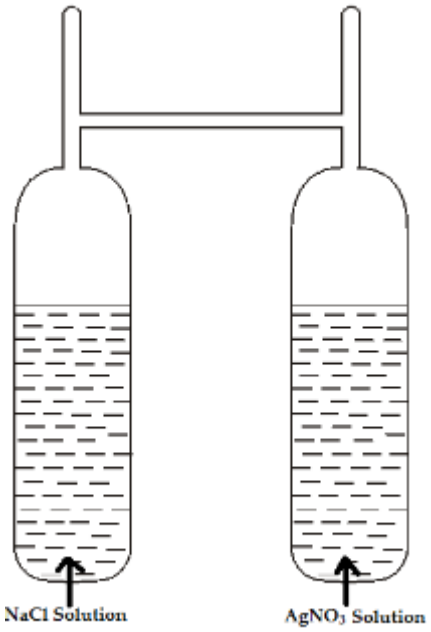
Experimental verification of law of conservation of mass

Requirements: H-shaped tube called Landolt's tube, sodium chloride solution, silver nitrate solution

Procedure: A specially designed H-shaped tube is taken. Sodium chloride solution is taken in one limb of the tube and silver nitrate solution in the other limb as shown in the figure. Both the limbs are sealed and weighed. The tubes are then inverted so that the solutions can mix up together and react chemically. The reaction takes place, and a white precipitate of silver chloride is obtained.

$AgNO_3$ + NaCl → AgCl↓ + $NaNO_3$
Silver nitrate Sodium chloride Silver chloride Sodium nitrate

The tube is weighed again. The mass of the tube is exactly the same as the mass obtained before inverting the tube. Thus, this experiment clearly verifies the law of conservation of mass.



Landolt's tube