ICSE Board
Class IX Chemistry
Paper – 4 Solution

SECTION I

Answer 1

(a)

i. False. $Cl_2 + 2NaOH \rightarrow NaCl + NaOCl + H_2O$ is a balanced reaction.
ii. True
iii. True
iv. False. Na_2SO_4 is named sodium sulphate.
v. True

(b)

i.

Neutralisation reactions	Precipitation reactions
1. Neutralisation reactions are those reactions in which H^+ ions of an acid react with OH^- ions of a base to form salt and water.	1. During a chemical reaction, an insoluble solid product is formed which can be separated from the solution by filtration; the solid product is known as a precipitate, and the reaction is known as a precipitation reaction.
2. A solid salt is formed which is soluble in water.	2. A solid substance settles down as a precipitate which is insoluble in water.
3. Soluble salts are prepared by neutralisation reactions.	3. Insoluble salts are prepared by precipitation reactions.
4. Example: Hydrochloric acid reacts with sodium hydroxide (base) to form sodium chloride (salt) and water. $HCl + NaOH \rightarrow NaCl + H_2O$	4. Example: When a solution of sodium chloride is added to a solution of silver nitrate, a white precipitate of silver chloride is formed. $NaCl\ (aq) + AgNO_3\ (aq) \rightarrow NaNO_3\ (aq) + AgCl \downarrow$

ii. Soluble salts are prepared by neutralisation reactions, and insoluble salts are prepared by precipitation reactions.

(c)

i. Sodium peroxide
ii. Zinc hydroxide
iii. Potassium bicarbonate
iv. Potassium ferrocyanide
v. Sodium hypochlorite

(d)

i. $3Mg + N_2 \longrightarrow Mg_3N_2$
ii. $Mg_3N_2 + 6H_2O \longrightarrow 3\ Mg(OH)_2 + 2NH_3$
iii. $Cu(OH)_2 \xrightarrow{\Delta} CuO + H_2O$
iv. $2KClO_3 \xrightarrow{\Delta} 2\ KCl + 3O_2$
v. $2ZnS + 3\ O_2 \longrightarrow 2\ ZnO + 2SO_2$

(e)

i. +2
ii. +1
iii. +1
iv. +3
v. +2

(f) There are **certain substances** which undergo **physical** and **chemical changes simultaneously.**

For example,

i. Heating of zinc carbonate

$ZnCO_3 \xrightarrow{\Delta} ZnO + CO_2$ (Chemical change)

$ZnO \xrightarrow{\Delta} ZnO$ (Physical change)

white yellow

ii. Heating of sodium nitrate

$2NaNO_3\ (s) \xrightarrow{\Delta} 2NaNO_3(l)$ (Physical change)

$2NaNO_3 \xrightarrow{\Delta} 2NaNO_2 + O_2$ (Chemical change)

iii. Heating of lead nitrate

$2Pb(NO_3)_2 \xrightarrow{\Delta} 2PbO + 4NO_2 + O_2$ (Chemical change)

$PbO \xrightarrow{\Delta} PbO$ (Physical change)

Light yellow reddish

(g)

i. Water is an excellent liquid to use in cooling systems because of its ability to absorb large quantities of heat as a cooling agent.

ii. A water-soluble solid disappears in a solution where the solvent is water, and water has the property of being clear and transparent. So, the solution is also always clear and transparent.

iii. Lakes and rivers do not freeze suddenly in winters because of the high specific latent heat of solidification, i.e. the amount of heat released when 1 g of water solidifies to form 1 g of ice at 0°C. It is about 336 J/g or 80 cal/g.

iv. The component which dissolves in a solvent is known as a solute. So, it can be separated from a solution by the filtration process. However, the filtration process is applicable only when the solute is insoluble in the solution. So, the solute cannot be separated from the solution by filtration.

v. Fused $CaCl_2$ or concentrated H_2SO_4 is deliquescent in nature, i.e. it absorbs moisture, and hence, these are used in desiccators as drying agents.

vi. Carbon dioxide is dissolved in soda water under pressure. On opening the bottle, the pressure on the surface of water suddenly decreases; therefore, the solubility of CO_2 in water decreases and the gas rapidly bubbles out.

(h)

i. Aluminium forms a protective coating of Al_2O_3 due to its great affinity for oxygen. Hence, it prevents the further reaction of acid with metal.

ii. We classify combination reactions on the basis of the kind of reactants which participate in a chemical reaction. Combination reactions are of three types:

1. In the first kind of combination reactions, an element combines with another element to form a new compound.
Example: Nitrogen and hydrogen when passed over finely divided iron combine to produce the pungent smelling gas ammonia.
$N_2 + 3H_2 \rightarrow 2NH_3$

2. In the second kind of combination reactions, an element combines with a compound.
Example: A reaction takes place between a compound SO_2 and an element oxygen to produce sulphur trioxide.
$2SO_2 + O_2 \rightarrow 2SO_3$

3. The third kind of combination reactions are those in which two or more compounds combine to form a new compound.
Example: A reaction in which lime reacts vigorously with water to form a white powder of calcium hydroxide known as slaked lime.
$CaO + H_2O \rightarrow Ca(OH)_2$

SECTION II

Answer 2

(a)

i. acid rain
ii. greenhouse
iii. ultraviolet
iv. ozone
v. chlorine

(b)

i. Chlorine
ii. MnO_2
iii. H_2S
iv. Hydrogen peroxide
v. MnO_2

Answer 3

(a)

i. $2Pb_3O_4 \xrightarrow{\Delta} 6PbO + O_2$

ii. $2PbO_2 \xrightarrow{\Delta} 2PbO + O_2$

iii. $4K_2Cr_2O_7 \xrightarrow{\Delta} 4K_2CrO_4 + 2Cr_2O_3 + 3O_2$

iv. $2Ag_2O \xrightarrow{\Delta} 4Ag + O_2$

v. $2HgO \xrightarrow{\Delta} 2Hg + O_2$

(b)

i. $V_1 = V_2 = V$

$P_1 = 100$ cmHg

$T_1 = 273$ K

$P_2 = 10$ cmHg

$T_2 = ?$

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

$$\frac{100 \times V}{273} = \frac{10 \times V}{T_2}$$

$$T_2 = 27.3\ K$$

ii. $V_1 = V_2 = V$

$P_1 = 100$ cmHg

$P_2 = ?$

$T_1 = 273$ K

$T_2 = 373$ K

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

$$\frac{100 \times V}{273} = \frac{P_2 \times V}{373}$$

$$P_2 = 136.63\ cm\ of\ Hg$$

Answer 4

(a)

i. $2Na + 2H_2O \longrightarrow 2NaOH + H_2\uparrow$

ii. $2K + 2H_2O \longrightarrow 2KOH + H_2\uparrow$

iii. $Ca + 2H_2O \longrightarrow Ca(OH)_2 + H_2\uparrow$

iv. $Mg + H_2O \longrightarrow MgO + H_2\uparrow$

v. $3Fe + 4H_2O \xrightarrow{heat} Fe_3O_4 + 4H_2\uparrow$

(b)

i. A – Hydrogen
B – Oxygen
C – Water

ii. $2H2 + O2 \rightarrow 2H2O$

iii. Liquid 'C' can be tested by the following two ways:
It turns white-coloured anhydrous copper sulphate blue.
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

Answer 5

(a)

i. Lithium

ii. Magnesium

iii. Carbon

(b) As the number of protons remains the same and are neither lost nor gained.

(c)

i. $2Ag_2O(s) \xrightarrow{Heat} 4Ag + O_2\uparrow$

ii. $2Pb_3O_4 \xrightarrow{Heat} 6PbO + O_2\uparrow$

iii. $2HgO \xrightarrow{Heat} 2Hg + O_2\uparrow$

(d) Substances which easily absorb moisture from other substances are called drying agents.

i. Concentrated sulphuric acid is used for drying chlorine gas.

ii. Calcium oxide is used for drying ammonia gas.

Answer 6

(a)

i.

Element	Mass No.	Atomic No.	p	n	e
A	1	1	1	**0**	**1**
B	14	**7**	7	**7**	7
C	**24**	12	12	12	**12**
D	35	**17**	17	**18**	17

ii. Electronic configuration of A = 1
Electronic configuration of B = 2, 5
Electronic configuration of C = 2, 8, 2
Electronic configuration of D = 2, 8, 7

iii. A = Hydrogen, B = Nitrogen, C = Magnesium, D = Chlorine

iv. A = 1, B = 5, C = 2, D = 7

v. A = 1, B = 3, C =2, D = 1

(b)

Hydrogen is commercially obtained by the electrolysis of water.
Water is a poor conductor of electricity. Thus, a less volatile acid such as sulphuric acid is added to water to make it a good conductor of electricity. This is called acidulated water.
On passing electric current through this acidulated water, water dissociates.

$H_2O \rightarrow H^+ + OH^-$

H^+ being positively charged moves towards the cathode (negatively charged electrode).

At cathode,

$H^+ + e^- \rightarrow H$

$H + H \rightarrow H_2$

Thus, the hydrogen gas is evolved at the cathode.

OH^-, being negatively charged, moves towards the anode (positively charged electrode).

At anode,

$OH^- - e^- \rightarrow OH$

$OH + OH \rightarrow H_2O + O$

$O + O \rightarrow O_2$

Oxygen is evolved at the anode.

Hence, water dissociates to give hydrogen and oxygen by passing an electric current through acidulated water.

$$2\,H_2O \rightarrow 2\,H_2 + O_2$$

(Acidulated) (At cathode) (At anode)

Answer 7

(a)

$P_1 = Z$ $P_2 = 5$ atm

$V_1 = 400 cm^3$ $V_2 = 200\ cm^3$

$P_1V_1 = P_2V_2$

$Z \times 400 = 5 \times 200$

$$Z = \frac{5 \times 200}{400}$$

$= 2.5$ atm

(b) Charles' law: Pressure remaining constant, the volume of a given mass of a dry gas increases or decreases by $\frac{1}{273}$ of its original volume at 0°C for each degree centigrade rise or fall in temperature.

Using the absolute scale, Charles' law can be generalised as pressure remaining constant, the volume of a given mass of a gas is directly proportional to the absolute temperature.

(c) Isotopes are the atoms of the same element having the same atomic number but different mass number.

There are three isotopes of hydrogen: protium (^1_1H), deuterium (^2_1H), tritium (^3_1H)
There are two isotopes of carbon: carbon-12 (^{12}C) and carbon-14 (^{14}C)
There are two isotopes of oxygen: ^{16}O and ^{18}O

Isotopes show similar chemical properties because the number of valence electrons in these atoms is the same.