ICSE Board
Class IX Chemistry
Paper – 10 Solution

SECTION I

Answer 1

(a)

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

(b)

i. Hydrogen gas
ii. Hydrogen sulphide gas
iii. Oxygen gas
iv. Carbon dioxide gas
v. Oxygen gas

(c)

Radicals	Formula	Valency
Acetate	CH_3COO^-	−1
Stannate	SnO_3^{2-}	−2
Nitrite	NO_2^-	−1
Aluminate	AlO_2^-	−1
Zincate	ZnO_2^{2-}	−2

(d)

i. K^+ HS^-

K_1 $(HS)_1$

= KHS

ii. Na^+ NO_2^-

Na_1 $(NO_2)_1$

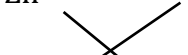
= $NaNO_2$

iii. Ca^{2+} CO_3^{2-}

Ca_1 $(CO_3)_1$

$= CaCO_3$

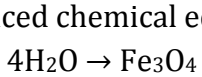
iv. Al^{3+} C^{4-}



Al_4 C_3

$= Al_4C_3$

v. Zn^{2+} P^{3-}



Zn_3 P_2

$= Zn_3P_2$

(e) (i) +2 (ii) +4 (iii) +2 (iv) −1 (v) −1

(f) Balanced chemical equations:

i. $3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$
ii. $3Ca + N_2 \rightarrow Ca_3N_2$
iii. $Zn + 2KOH \rightarrow K_2ZnO_2 + H_2$
iv. $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$
v. $3PbO + 2NH_3 \rightarrow 3Pb + 3H_2O + N_2$

(g)

i. Ammonia
ii. Sulphur dioxide
iii. Helium
iv. Nickel
v. Iron

(h)

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

SECTION II

Answer 2

(a)

i. Zinc is the most preferred metal in the laboratory preparation of hydrogen.

ii. Dilute sulphuric acid.

Conc. nitric acid, even in its dilute form, is not used in the preparation of hydrogen from metals because it is a powerful oxidising agent. Oxygen formed due to its decomposition oxidises hydrogen to give water, thus defeating the purpose of the reaction.

Conc. sulphuric acid is not used in the preparation of hydrogen as it will produce sulphur dioxide.

iii. The gas is collected by the downward displacement of water.

Common drying agents such as fused calcium chloride, caustic potash stick and phosphorous pentoxide remove water vapour.

(b)

i. Boyle's law

ii. Charles' law

(c)

Column A	**Answers**
(a) Element short by 1 electron in octet	(v) Halogens
(b) Highly reactive metals	(iii) Alkali metals
(c) Non-reactive elements	(ii) Noble gases
(d) Elements of Groups 3 to 12	(i) Transition elements
(e) Radioactive elements	(vi) Actinides
(f) Elements with 2 electrons in the outermost orbit	(iv) Alkali earth metals

Answer 3

(a)

i. Cathode rays are negatively charged as they consist of negatively charged particles called electrons.

ii. Properties of cathode rays:

a) They travel from the cathode to the anode in straight lines.
b) They cause a greenish yellow fluorescence on a soda-glass screen placed in the tube.
c) They are affected by an electric field, i.e. they are inflected towards the positive field and deflected from the negative field. This shows that they carry a negative charge.
d) When a beam of cathode rays is made to fall upon hard metallic targets like tungsten, X-rays are produced.
e) They penetrate matter.
f) They cause ionisation of the gas through which they pass.
g) The ratio of the charge (s) to mass (m) of the particles constituting cathode rays remains the same (e/m = 1.76 × 1011 coulomb/kg) irrespective of the nature of the gas taken and of the metal forming the cathode.
h) They produce the shadow of an opaque object placed in their path and make a light paddle wheel rotate.

(b)

Relative molecular mass of $MgSO_4 \cdot 7H_2O$

$= 24 + 32 + (16 \times 4) + 7(2 + 16)$

$= 24 + 32 + 64 + 126$

$= 246$

26 g of epsom salt contains 126 g of water of crystallisation.

Hence, 100 g of epsom salt contains

$$\frac{100 \times 126}{246} = 51.2$$

The % of H_2O in $MgSO_4 \cdot 7H_2O = 51.2$

(c)

i. $N_2 + O_2 \rightarrow 2NO$

ii. $2NO + O_2 \rightarrow 2NO_2$

iii. $2S + 3O_2 \rightarrow 2SO_3$

iv. $SO_3 + H_2O \rightarrow H_2SO_4$

v. $2KNO_3 \xrightarrow{\Delta} 2KNO_2 + O_2$

Answer 4

(a)

i. Common salt, which is chemically sodium chloride, contains the impurity of magnesium chloride which is deliquescent (absorbs moisture from the atmosphere and gets converted to a saturated solution). Therefore, common salt becomes wet during the rainy season. Sodium chloride is neither hygroscopic nor deliquescent.
ii. Concentrated sulphuric acid is highly hygroscopic in nature; therefore, when exposed to the atmosphere, it absorbs moisture. Thus, the level of sulphuric acid in the jar increases.
iii. Washing soda is an efflorescent salt (when exposed to the atmosphere, it crumbles down to form powder); thus, it loses weight when exposed to the atmosphere.
iv. Copper lies below hydrogen in the metal activity series; therefore, it does not displace hydrogen from water.
v. Ferric chloride is highly deliquescent in nature, i.e. when exposed to the atmosphere, it absorbs moisture and gets converted to its saturated solution. Therefore, it should be stored in an airtight bottle.

(b)

i. Increases
ii. Increases
iii. Decreases
iv. Increases
v. Increases

Answer 5

(a) Merits of Mendeleev's periodic table

- Mendeleev generalised the study of the elements, then known as the study of mere groups.
- Mendeleev's periodic table had some blank spaces. These vacant spaces were left for including elements which were not discovered at that time.
- Mendeleev could also predict the properties of these unknown elements on the basis of the properties of the elements lying adjacent to these vacant spaces.
- He predicted the presence of three elements. They were named Eka-boron, Eka-aluminium and Eka-silicon. The properties of these three elements were similar to the actual elements discovered later.
- Eka-boron was similar to Scandium, Eka-aluminium was similar to Gallium and Eka-silicon was similar to Germanium.
- When noble gases were discovered later, they could be accommodated in the periodic table in the form of a separate group without disturbing the positions of the other elements.
- He was able to correct the values of the atomic masses of elements such as gold and platinum; he placed these elements going strictly by the similarities in their properties.

(b)

i. The physical and chemical properties of the elements are periodic functions of their atomic numbers.
ii. Group 17
iii. Atomic number
iv. Periods
v. Alkali

Answer 6

(a)

Element	Atomic no.	Electronic configuration				Valence electrons
		K	L	M	N	
A	4	2	2			2
B	12	2	8	2		2
C	19	2	8	8	1	1

(b) Distribution of electrons in the orbits

- The distribution of electrons in different orbits of an atom was suggested by the scientists Bohr and Bury.
- According to the Bohr's model, electrons occupy certain stable orbits or shells. Each shell has a definite energy.
- These orbits or shells are represented by the letters K, L, M, N and so on… and the numbers n = 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 first orbit or K shell will be = $2 \times 1^2 = 2$, the second orbit or L shell will be = $2 \times 2^2 = 8$, the third orbit or M shell will be = $2 \times 3^2 = 18$, the fourth orbit or N shell will be = $2 \times 4^2 = 32$ and so on.

Shell designation	Shell number (n)	Formula $2n^2$	Maximum number of electrons in each shell
K shell	1	$2 \times (1)^2$	2
L shell	2	$2 \times (2)^2$	8
M shell	3	$2 \times (3)^2$	18
N shell	4	$2 \times (4)^2$	32

- According to the octet rule, 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.
- The electrons are not accommodated in a given shell unless the inner shells are filled.

(c) Position of hydrogen in the periodic table:

Hydrogen is the first element of the periodic table. Its atomic number is 1, which indicates the presence of only one electron in the atom of hydrogen. This electron is present in its first shell. Hydrogen resembles both alkali metals (group I A) as well as halogens (group VII A); therefore, its position is said to be anomalous.

Answer 7

(a) $P_1 = 750$ mm Hg $\quad P_2 = ?$

$V_1 = 1000\ cm^3$

The 40% of initial volume

$$= \frac{40}{100} \times 1000$$

$$= 400\ cm^3$$

$V_2 = 1000 - 400 = 600\ cm^3$

$$P_1V_1 = P_2V_2$$

$$750 \times 1000 = P_2 \times 600$$

$$P_2 = \frac{750 \times 1000}{600}$$

$$= 1250 \text{ mm Hg}$$

(b) $P_1 = 740$ mm Hg $\quad P_2 = 760$ mm Hg

$V_1 = 2.5\ dm^3 \quad V_2 = ?$

$T_1 = 27 + 273\ K = 300\ K \quad T_2 = 273\ K$

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

$$\frac{740 \times 2.5}{300} = \frac{760 \times V_2}{273}$$

$$V_2 = \frac{740 \times 2.5 \times 273}{300 \times 760} = \frac{505050}{22800}$$

$$= 2.21\ dm^3$$

(c) Chemicals responsible for the depletion of the ozone layer

1. <u>Fuel of planes:</u> Burning of fuels of planes emits a large quantity of nitric oxide and other gases in the atmosphere. Nitric oxide reacts with ozone and forms nitrogen dioxide and nitrogen trioxide. This causes depletion of ozone.

$$NO(g) + O_3(g) \rightarrow NO_2(g) + O_2(g)$$

(Nitrogen dioxide)

$$NO_2(g) + O_3(g) \rightarrow NO_3(g) + O_2(g)$$

(Nitrogen trioxide)

2. <u>Excessive use of chlorofluorocarbon:</u> It is released by refrigerators and air conditioning systems.
   It causes reduction in the ozone layer which protects us from harmful ultraviolet rays (UV radiations) of the Sun.

   The chlorofluorocarbons are decomposed by the ultraviolet rays to highly reactive chlorine which is produced in the atomic form.

$$CF_2Cl_2 \xrightarrow{\text{Ultraviolet rays}} CF_2Cl + Cl$$
(Free radical)

   The free radical [Cl] reacts with ozone to form chlorine monoxide.

$$Cl + O_3 \rightarrow ClO + O_2$$
(Chlorine monoxide)

   This causes depletion of the ozone layer. Chlorine monoxide then reacts with atomic oxygen to produce more chlorine free radicals.

$$ClO + O \rightarrow Cl + O_2$$
(Free radical)

   This free radical destroys ozone, and the process continues, depleting the ozone layer.