

ICSE Board
Class X Chemistry
Board Paper – 2009

Time: 1½ hrs

Total Marks: 80

General Instructions:

1. Answers to this paper must be written on the paper provided separately.
2. You will NOT be allowed to write during the first 15 minutes. This time is to be spent in reading the question paper.

The time given at the head of this paper is the time allowed for writing the answers.

This question paper is divided into two sections.

3. **Section I** contains one question with parts (a) to (h); all the eight parts are to be answered.
4. **Section II** contains six questions numbered 2 to 7. You are to answer any four of these questions.

The intended marks of questions or for parts of questions are given in brackets [].

SECTION I (40 Marks)

*Attempt **all** questions from this section.*

Question 1

(a) Name the gas evolved in each case (formula is not acceptable). [5]

- i. The gas produced by the action of concentrated sulphuric acid on sodium chloride.
- ii. The gas produced by the action of dilute nitric acid on copper.
- iii. The gas produced on heating sodium nitrate.
- iv. The gas which burns in oxygen with a green flame.
- v. The gas which can be oxidised to sulphur. **

(b) Match each substance A to E listed below with the appropriate description in parts (i) to (v). [5]

(A) Sulphur (B) Silver chloride (C) Hydrogen chloride (D) Copper (II) sulphate
(E) Graphite

- i. A non-metal which is a good conductor of electricity.
- ii. A covalent compound which behaves like an ionic compound in aqueous solution.
- iii. A compound which is insoluble in cold water but soluble in excess of ammonia solution.
- iv. A pink metal which is deposited at the cathode during the electrolysis of the solution of this salt.
- v. A non-metal which reacts with concentrated nitric acid to form its own acid as one of the product.

(c) For part c (i)–(x), select the correct answer from the choices A, B, C and D which are given. [10]

Write only the letter corresponding to the correct answer:

- i. Among the period 2 elements, the one which has high electron affinity is
 - (A) Lithium
 - (B) Carbon
 - (C) Fluorine
 - (D) Neon
- ii. Among the following, the one which is composed of all the three kinds of bonds (ionic, covalent and coordinate bond) is
 - (A) Sodium chloride
 - (B) Ammonia
 - (C) Carbon tetrachloride
 - (D) Ammonium chloride
- iii. Which of the following statements is wrong about alkanes?
 - (A) They are all saturated hydrocarbons.
 - (B) They can undergo addition as well as substitution reactions.
 - (C) They are almost non-polar in nature.
 - (D) On complete combustion give out carbon dioxide and water.
- iv. Select the acid which contains four hydrogen atoms in it.
 - (A) Formic acid
 - (B) Sulphuric acid
 - (C) Nitric acid
 - (D) Acetic acid
- v. A gas cylinder of capacity of 20 dm^3 is filled with gas X, the mass of which is 10g. When the same cylinder is filled with hydrogen at the same temperature and pressure, the mass of the hydrogen is 2 g; hence, the relative molecular mass of the gas is
 - (A) 5
 - (B) 10
 - (C) 15
 - (D) 20
- vi. The aqueous solution of the following compounds which contains both ions and molecules is
 - (A) Sulphuric acid
 - (B) Hydrochloric acid
 - (C) Nitric acid
 - (D) Acetic acid

- vii. The metal oxide which can react with acid as well as alkali is
(A) Silver oxide
(B) Copper(II) oxide
(C) Aluminium oxide
(D) Calcium oxide
- viii. Carbon dioxide and sulphur dioxide gas can be distinguished by using
(A) Moist blue litmus paper
(B) Lime water
(C) Acidified potassium dichromate paper
(D) None of the above
- ix. The organic compound obtained as the end-product of the fermentation of sugar solution is
(A) Methanol
(B) Ethanol
(C) Ethane
(D) Methanoic acid
- x. A black colour solid which on reaction with dilute sulphuric acid forms a blue coloured solution is**
(A) Carbon
(B) Manganese(IV) oxide
(C) Lead(II) oxide
(D) Copper(II) oxide

(d) Write a fully balanced equation for each of the following cases: [5]

- Red lead is warmed with concentrated hydrochloric acid.
- Magnesium metal is treated with dilute hydrochloric acid.
- Lead nitrate is heated in a dry test tube.
- Magnesium nitride is treated with warm water.
- Acetic acid is warmed with ethanol in the presence of concentrated sulphuric acid.

(e) Find the odd one out and explain your choice (Note: Valency is not a criterion.): [5]

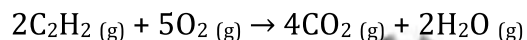
- $\text{Al}(\text{OH})_3$, $\text{Pb}(\text{OH})_2$, $\text{Mg}(\text{OH})_2$, $\text{Zn}(\text{OH})_2$
- C_3H_8 , C_5H_{10} , C_2H_6 , CH_4
- Sulphur, Phosphorus, Carbon, Iodine
- Copper, Lead, Zinc, Mercury
- Formic acid, Nitric acid, Acetic acid, Propanoic acid

(f) Identify the substances P, Q, R, S and T in each case based on the information given below: [5]

- i. The deliquescent salt P turns yellow on dissolving in water and gives a reddish brown precipitate with sodium hydroxide solution.
- ii. The white crystalline solid Q is soluble in water. It liberates a pungent smelling gas when heated with sodium hydroxide solution.
- iii. The pale green solid R turns reddish brown on heating. Its aqueous solution gives a white precipitate with barium chloride solution. The precipitate is insoluble in mineral acids.
- iv. The reddish brown liquid S is dissolved in water. When ethyne gas is passed through it, it turns colourless.
- v. The nitrate T does not leave any residue on heating. **

(g) [5]

- i. Calcium carbide is used for the artificial ripening of fruits. Actually, the fruit ripens because of the heat evolved, while calcium carbide reacts with moisture. During this reaction, calcium hydroxide and acetylene gas are formed. If 200 cm^3 of acetylene is formed from a certain mass of calcium dioxide during the complete combustion, then the combustion reaction can be represented as below:



- ii. A gaseous compound of nitrogen and hydrogen contains 12.5% hydrogen by mass. Find the molecular formula of the compound if its relative molecular mass is 37.
[N = 14, H = 1]

SECTION II (40 Marks)

Attempt any **four** questions from this section.

Question 2

[10]

(a) Correct the following statements.

For example: 'Chlorine is a bleaching agent'.

Should read as 'Moist chlorine is a bleaching agent'.

- Lead bromide conducts electricity.
- Copper reacts with nitric acid to produce nitrogen dioxide.
- Haematite is the chief ore of aluminium.
- Equal masses of all gases under identical conditions contain the same number of molecules.
- Hydrochloric acid is prepared in the laboratory by passing hydrogen chloride directly through water.

(b) Consider the section of the periodic table given below:

Group numbers	IA 1	IIA 2	IIIA 13	IVA 14	VA 15	VIA 16	VIIA 17	0 18
	Li		D			O	J	Ne
	A	Mg	E	Si		H	K	
	B	C		F	G			L

Note: In this table, B does *not* represent boron,
C does *not* represent carbon,
F does *not* represent fluorine,
H does *not* represent hydrogen,
K does *not* represent potassium.

You must see the position of the element in the periodic table.

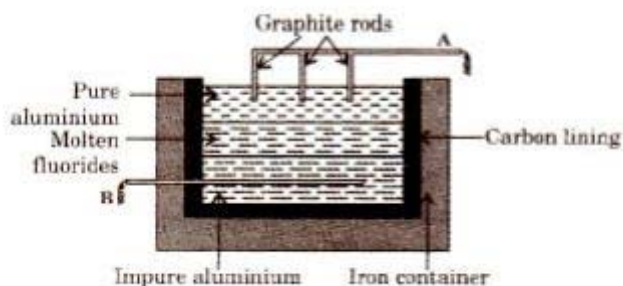
Some elements are given in their own symbol and position in the periodic table, while others are shown with a letter. With reference to the table:

- Which is the most electronegative?
- How many valence electrons are present in G?
- Write the formula of the compound between B and H.
- In the compound between F and J, what type of bond will be formed?
- Draw the electron dot structure for the compound formed between C and K.

(a) A metal article is to be electroplated with silver. The electrolyte selected is sodium argentocyanide.

- What kind of salt is sodium argentocyanide?
- Why is it preferred to silver nitrate as an electrolyte?
- State one condition to ensure that the deposit is smooth, firm and long lasting.
- Write the reaction taking place at the cathode.
- Write the reaction taking place at the anode.

(b) The sketch below illustrates the refining of aluminium by Hoopes process.



- Which of A and B is the cathode and which one is the anode?
- What is the electrolyte in the tank?
- What material is used for the cathode?

(c) State the property of the metal being utilised in the following:

Use of metal	Property
Zinc in galvanisation	
Aluminium in thermite welding	

(a)

- i. A gas cylinder contains 24×10^{24} molecules of nitrogen gas. If Avogadro's number is 6×10^{23} and the relative atomic mass of nitrogen is 14, calculate:
 1. Mass of nitrogen gas in the cylinder.
 2. Volume of nitrogen at STP in dm^3 .
- ii. Commercial sodium hydroxide weighing 30 g has some sodium chloride in it. The mixture on dissolving in water and subsequent treatment with excess silver nitrate solution formed a precipitate weighing 14.3 g. What is the percentage of sodium chloride in the commercial sample of sodium hydroxide? The equation for the reaction is $\text{NaCl} + \text{AgNO}_3 \rightarrow \text{AgCl} + \text{NaNO}_3$.
[Relative molecular mass of $\text{NaCl} = 58$; $\text{AgCl} = 143$]
- iii. A certain gas 'X' occupies a volume of 100 cm^3 at STP and weighs 0.5 g. Find its relative molecular mass.

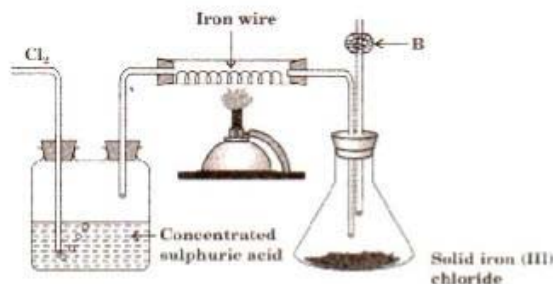
(b) Solution A is a strong acid.

Solution B is a weak acid.

Solution C is a strong alkali.

- i. Which solution contains solute molecules in addition to water molecules?
- ii. Which solution will give a gelatinous white precipitate with zinc sulphate solution?
The precipitate disappears when an excess of the solution is added.
- iii. Which solution could be a solution of glacial acetic acid?
- iv. Give an example of a solution which is a weak alkali.

(a) The diagram given below is to prepare iron(III) chloride in the laboratory:



- What is substance B?
- What is the purpose of B?
- Why is iron (III) chloride to be stored in a closed container?
- Write the equation for the reaction between iron and chlorine.

(b)

- Write the equation(s) for the reaction(s) to prepare lead sulphate from lead carbonate.
- Methane, the first member of alkanes, when treated with excess of chlorine in the presence of diffused sunlight forms carbon tetrachloride. Draw the appropriate structural formula of carbon tetrachloride and state the type of bond present in it.

(c) Aqueous solution of nickel sulphate contains Ni^{2+} and SO_4^{2-} ions.

- Which ion moves towards the cathode?
- What is the product at the anode?

Question 6

[10]

(a) Give one chemical test to distinguish between the following pairs of compounds.

- Zinc sulphate solution and zinc chloride solution.
- Iron (II) chloride solution and iron (III) chloride solution.
- Calcium nitrate solution and calcium chloride solution.

(b) Define the following terms:

- Mole
- Neutralisation
- Ionisation potential

(c) Fill in the blanks with the correct words from the brackets:

Generally, ionic compounds exist in (i) _____ (solid/liquid/gas) state. Melting and boiling points of covalent compounds are generally (ii) _____ (low/high). The general formula for alkane is (iii) _____ (C_nH_{2n} / C_nH_{2n-2} / C_nH_{2n+2}). For alkynes, the general formula is (iv) _____ (C_nH_{2n} / C_nH_{2n-2} / C_nH_{2n+2}).

Question 7

[10]

(a) Give chemical equation for

- The laboratory preparation of methane from sodium acetate.
- The industrial preparation of methanol from water gas. **
- The reaction of one mole of ethene with one mole of chlorine gas.
- The preparation of ethyne from 1, 2-dibromoethane.

(b) State how the following conversions can be carried out.

- Ethyl chloride to ethyl alcohol.
- Ethyl chloride to ethene.
- Ethene to ethyl alcohol.
- Ethyl alcohol to ethene.

(c) i. Define isomerism.

- Give the IUPAC name of the isomer C_4H_{10} which has a branched chain.

SECTION I

Answer 1

(a)

- i. Hydrogen chloride
- ii. Nitric oxide
- iii. Oxygen
- iv. Ammonia

(b) (i) (E), (ii) (C), (iii) (B), (iv) (D), (v) (A)

(c) (i) (C), (ii) (D), (iii) (B), (iv) (D), (v) (B), (vi) (D), (vii) (C), (viii) (C), (ix) (B), (x) (D)

(d)

- i. $\text{Pb}_3\text{O}_4 + 8\text{HCl} \rightarrow 3\text{PbCl}_2 + 4\text{H}_2\text{O} + \text{Cl}_2$
- ii. $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$
- iii. $2\text{Pb}(\text{NO}_3)_2 \xrightarrow{\Delta} 2\text{PbO} + 4\text{NO}_2 + \text{O}_2$
- iv. $\text{Mg}_3\text{N}_2 + 6\text{H}_2\text{O} \rightarrow 3\text{Mg}(\text{OH})_2 + 2\text{NH}_3$
- v. $\text{C}_2\text{H}_5\text{OH} + \text{CH}_3\text{COOH} \xrightarrow[\Delta]{\text{conc. H}_2\text{SO}_4} \text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O}$

(e)

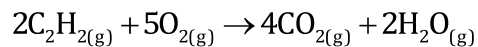
- i. $\text{Mg}(\text{OH})_2$: It is basic while the rest are amphoteric.
- ii. C_5H_{10} : It is an alkene while the rest are alkanes.
- iii. Iodine: The crystals of iodine are lustrous.
- iv. Mercury: It is a liquid while the rest are solid.
- v. Nitric acid: It is a mineral acid while the rest are organic acids.

(f)

- i. P is ferric chloride.
- ii. Q is an ammonium salt.
- iii. R is ferrous sulphate.
- iv. S is bromine.

(g)

i. Applying Gay-Lussac's law to the equation,



2 vol. 5 vol. 4 vol.

2 vol. of $\text{C}_2\text{H}_2 = 200 \text{ cm}^3$

1 vol. of $\text{C}_2\text{H}_2 = 100 \text{ cm}^3$

Vol. of O_2 required = 5 vol

$$= 5 \times 100 = 500 \text{ cm}^3$$

Vol. of CO_2 formed = 4 vol.

$$= 4 \times 100 = 400 \text{ cm}^3$$

ii. Calculation of empirical formula

Elements	% by mass	At. wt.	No. of atoms	Simple ratio
H	12.5	1	12.5	$12.5 \div 6.25 = 2$
N	87.5	14	6.25	$6.25 \div 6.25 = 1$

\therefore Empirical formula is NH_2 .

Given Mol. Wt. = 37

Empirical wt. = $14 + 2 \times 1 = 16$

$$n = \frac{\text{Molecular mass}}{\text{Empirical formula mass}} = \frac{37}{16} = 2.3 = 2$$

Molecular formula = (Empirical formula) n

$$= (\text{NH}_2)_2 = \text{N}_2\text{H}_4.$$

Answer 4

(a) i.

1. Molecular mass of $N_2 = 2 \times 14 = 28$ g

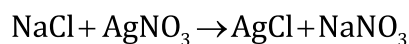
6×10^{23} molecules of nitrogen weigh 28 g

$$24 \times 10^{24} \text{ molecules of nitrogen will weigh} = \frac{28}{6 \times 10^{23}} \times 24 \times 10^{24}$$
$$= 28 \times 40 = 1120 \text{ g.}$$

2. $\therefore 6 \times 10^{23}$ molecules of nitrogen occupy 22.4 litres at STP.

$$24 \times 10^{24} \text{ molecules of nitrogen will occupy} = \frac{22.4 \times 24 \times 10^{24}}{6 \times 10^{23}}$$
$$= 22.4 \times 40 = 896 \text{ dm}^3$$

ii.



58

143

143 g of AgCl is obtained from 58 g of NaCl.

$$14.3 \text{ g of AgCl is obtained from } \frac{58 \times 14.3}{143} = 5.8 \text{ g of NaCl}$$

Weight of commercial NaOH = 30 g

$$\% \text{ of NaCl in NaOH} = \frac{5.8 \times 100}{30} = 19.33\%$$

iii. At STP, 100 cc of gas X weighs 0.5 g.

$$\text{At STP, 22400 cc of gas X will weigh} = \frac{0.5}{100} \times 22400 = 112 \text{ g}$$

Molecular weight of gas X is 112 g.

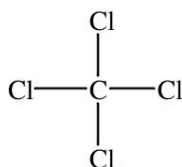
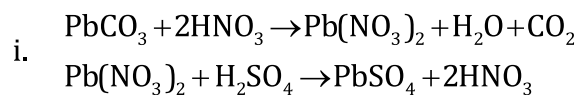
(b) i. Solution B ii. Solution C iii. Solution B iv. Ammonium hydroxide solution

Answer 5

(a)

- i. B is an anhydrous calcium chloride.
- ii. B absorbs moisture from the receiver.
- iii. Because iron (III) chloride is highly deliquescent and it absorbs moisture from the surrounding air to form a saturated solution.
- iv. $2\text{Fe} + 3\text{Cl}_2 \rightarrow 2\text{FeCl}_3$

(b)



- ii. Structural formula of CCl_4 . The type of bond present in CCl_4 is a covalent bond.

(c)

- i. Ni^{2+} ion
- ii. Oxygen

Answer 6

(a)

- i. When BaCl_2 solution is added to the given solutions, ZnSO_4 gives a white ppt. of barium sulphate, while no ppt. is obtained with ZnCl_2 solution.
- ii. When NaOH solution is added to the given solution, iron (II) chloride gives dirty green ppt. of ferrous hydroxide, while reddish brown ppt. of iron (III) hydroxide is obtained with iron (III) chloride.
- iii. When AgNO_3 solution is added to the given solution, CaCl_2 solution will give a white ppt., while no change is observed with calcium nitrate solution.

(b)

- i. **Mole:** A mole is defined as the amount of a substance containing elementary particles such as atoms, molecules or ions in 12 g of carbon (C-12).
- ii. **Neutralisation:** It is the process by which H^+ ions of an acid react completely with the OH^- ions of a base to give salt and water only.
- iii. **Ionisation potential:** It is the amount of energy required to remove a valence electron from an isolated gaseous atom of an element.

(c) i. solid ii. low iii. $\text{C}_n\text{H}_{2n+2}$ iv. $\text{C}_n\text{H}_{2n-2}$

Answer 7

(a)

- i. $\text{CH}_3\text{COONa} + \text{NaOH} \xrightarrow[300^\circ\text{C}]{\text{CaO}} \text{Na}_2\text{CO}_3 + \text{CH}_4$
- ii. **Answer is not given due to change in present syllabus.**
- iii. $\text{CH}_2 = \text{CH}_2 + \text{Cl}_2 \xrightarrow{200\text{atm}, 300^\circ\text{C}} \text{CH}_2\text{Cl}.\text{CH}_2\text{Cl}$
- iv. $\text{CH}_2\text{Br}.\text{CH}_2\text{Br} + 2\text{KOH}_{\text{alc}} \rightarrow \text{CH} \equiv \text{CH} + 2\text{KBr} + 2\text{H}_2\text{O}$

(b)

- i. By treating ethyl chloride with aqueous KOH.
- ii. By heating ethyl chloride with alcoholic KOH.
- iii. By passing ethene into conc. H_2SO_4 at 80°C and high pressure.
- iv. By heating ethyl alcohol with conc. H_2SO_4 at 170°C .

(c)

- i. **Isomerism:** Compounds having the same molecular formula but different structural formula are known as isomers and the phenomenon is known as isomerism.
- ii. The IUPAC name of the branched isomer of butane is 2-methyl propane:

