

Date: 20/03/2023



Question Paper Code

T23 522

Corporate Office : Aakash Tower, 8, Pusa Road, New Delhi-110005 | Ph.: 011-47623456

Time: 2 Hrs.

Max. Marks: 80

Class-X
CHEMISTRY
(Science Paper-2)
(ICSE 2022-23)
Answers & Solutions

GENERAL INSTRUCTIONS

Read the following instructions very carefully and follow them:

- (i) Duration for the Test is 2 hours.
- (ii) Maximum Marks for Section-**A** and **B** is 40 each.
- (iii) The intended marks for questions or parts of questions are given in brackets [].
- (iv) **Section A** is compulsory. Attempt all questions from this section.
- (v) Attempt **any four** questions from **Section B**.
- (vi) Use of calculator is not permitted.
- (vii) It is mandatory to use Blue/Black ballpoint pen to write the answers on the paper provided separately.

SECTION-A (40 Marks)

(Attempt **all** questions from this Section.)

1. **Choose the correct answers to the questions from the given options.** **[15]**

(Do not copy the questions, write the correct answers only.)

(i) An element in period 3, whose electron *affinity* is zero: **[1]**

- | | |
|------------|-------------|
| (a) Neon | (b) Sulphur |
| (c) Sodium | (d) Argon |

Answer (d)

(ii) An element with the *largest* atomic radius among the following is: **[1]**

- | | |
|-------------|---------------|
| (a) Carbon | (b) Nitrogen |
| (c) Lithium | (d) Beryllium |

Answer (c)

(iii) The compound that is **not** an ore of aluminium: **[1]**

- | | |
|---------------|--------------|
| (a) Cryolite | (b) Corundum |
| (c) Fluorspar | (d) Bauxite |

Answer (c)

(iv) The vapour density of CH_3OH is _____. (At. Wt. C = 12, H = 1, O = 16) **[1]**

- | | |
|--------|--------|
| (a) 32 | (b) 18 |
| (c) 16 | (d) 34 |

Answer (c)

(v) Which of the following reactions takes place at the anode during the electroplating of an article with silver? **[1]**

- | | |
|---|---|
| (a) $\text{Ag} - 1e^- \rightarrow \text{Ag}^{1+}$ | (b) $\text{Ag} + 1e^- \rightarrow \text{Ag}^{1-}$ |
| (c) $\text{Ag} - 1e^- \rightarrow \text{Ag}$ | (d) None of the above |

Answer (a)

(vi) The metallic hydroxide which forms a deep inky blue solution with excess ammonium hydroxide solution is: **[1]**

- | | |
|------------------------------|------------------------------|
| (a) $\text{Fe}(\text{OH})_2$ | (b) $\text{Cu}(\text{OH})_2$ |
| (c) $\text{Ca}(\text{OH})_2$ | (d) $\text{Fe}(\text{OH})_3$ |

Answer (b)

(vii) An example of a cyclic organic compound is: **[1]**

- | | |
|-------------|-------------|
| (a) Propene | (b) Pentene |
| (c) Butene | (d) Benzene |

Answer (d)

2. (i) Match the *Column A* with *Column B*:

[5]

Column A

- (a) Sodium Chloride
- (b) Methane
- (c) Hydrogen chloride gas
- (d) Oxidation reaction
- (e) Water

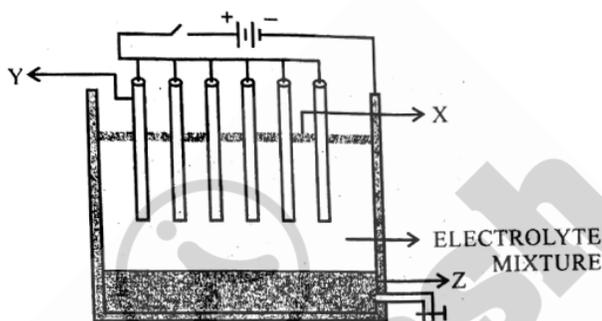
Column B

- 1. has two shared pair of electrons
- 2. has high melting and boiling points
- 3. a greenhouse gas
- 4. has low melting and boiling points
- 5. $\text{Zn} - 2\text{e}^- \rightarrow \text{Zn}^{2+}$
- 6. $\text{S} + 2\text{e}^- \rightarrow \text{S}^{2-}$

(ii) The following sketch illustrates the process of conversion of **Alumina** to Aluminium:

[5]

Study the diagram and answer the following:



- (a) Name the constituent of the electrolyte mixture which has a divalent metal in it.
- (b) Name the powdered substance 'X' sprinkled on the surface of the electrolyte mixture.
- (c) What is the name of the process?
- (d) Write the reactions taking place at the electrodes 'Y' (anode) and 'Z' (cathode) respectively.

(iii) Fill in the blanks with the *choices* given in the brackets:

[5]

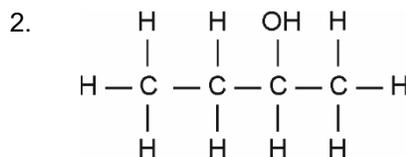
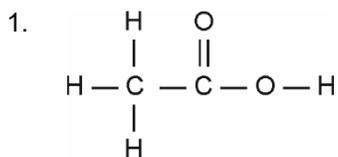
- (a) Metals are good _____. [*oxidizing agents / reducing agents*]
- (b) Non-polar covalent compounds are _____ [*good / bad*] conductors of heat and electricity.
- (c) Higher the pH value of a solution, the more _____ [*acidic / alkaline*] it is.
- (d) _____, [*Silver chloride / Lead chloride*] is a white precipitate that is soluble in excess of Ammonium hydroxide solution.
- (e) Conversion of ethene to ethane is an example of _____. [*hydration / hydrogenation*]

(iv) State the terms/process for the following:

[5]

- (a) The energy released when an atom in the gaseous state accepts an electron to form an anion.
- (b) Tendency of an element to form *chains* of identical atoms.
- (c) The name of the process by which *Ammonia* is manufactured on a large scale.
- (d) A type of salt formed by partial replacement of hydroxyl radicals with an acid radical.
- (e) The ratio of the mass of a certain volume of gas to the same volume of hydrogen measured under the same conditions of temperature and pressure.

- (v) (a) Give the *structural formula* of the following organic compounds: [5]
- 2-chlorobutane
 - Methanal
 - But-2-yne
- (b) Give the IUPAC name of the following organic compounds:



Sol. (i)

Column A**Column B**

- | | | |
|---------------------------|---|-----|
| (a) Sodium Chloride | 2. has high melting and boiling points | [1] |
| (b) Methane | 3. a greenhouse gas | [1] |
| (c) Hydrogen chloride gas | 4. has low melting and boiling points | [1] |
| (d) Oxidation reaction | 5. $\text{Zn} - 2\text{e}^- \rightarrow \text{Zn}^{2+}$ | [1] |
| (e) Water | 1. has two shared pair of electrons | [1] |
- (ii) (a) Fluorspar (CaF_2) [1]
- (b) X = Powdered coke [1]
- (c) Hall-Heroult's process [1]
- (d) **At cathode:** [1]
- $$4\text{Al}^{3+} + 12\text{e}^- \rightarrow 4\text{Al}$$
- At anode:**
- Thick rod of graphite are suspended in fused electrolyte.
- $$6\text{O}^{2-} + 12\text{e}^- \rightarrow 6[\text{O}]$$
- $$3\text{O} + 3\text{O} \rightarrow 3\text{O}_2$$
- Anode is oxidised to CO which further forms CO_2
- $$2\text{C} + \text{O}_2 \rightarrow 2\text{CO}$$
- $$2\text{CO} + \text{O}_2 \rightarrow 2\text{CO}_2$$
- (iii) (a) Reducing agents [1]
- (b) Bad [1]
- (c) Alkaline [1]
- (d) Silver chloride [1]
- (e) Hydrogenation [1]
- (iv) (a) Electron gain enthalpy/ Electron affinity [1]
- (b) Catenation [1]
- (c) Haber's process [1]
- (d) Basic salt [1]
- (e) Vapour density [1]

- (v) (a) 1.
$$\begin{array}{cccc} \text{H} & \text{H} & \text{H} & \text{H} \\ | & | & | & | \\ \text{H}-\text{C} & -\text{C} & -\text{C} & -\text{C}-\text{H} \\ | & | & | & | \\ \text{H} & \text{Cl} & \text{H} & \text{H} \end{array}$$

2-chlorobutane [1]
2.
$$\begin{array}{c} \text{H}-\text{C}-\text{H} \\ || \\ \text{O} \end{array}$$

Methanal [1]
3.
$$\begin{array}{cccc} \text{H} & & & \text{H} \\ | & & & | \\ \text{H}-\text{C} & -\text{C} \equiv \text{C} & -\text{C} & -\text{H} \\ | & & & | \\ \text{H} & & & \text{H} \end{array}$$

But-2-yne [1]
- (b) 1. Ethanoic acid [1]
2. Butan-2-ol [1]

SECTION-B (40 Marks)

(Attempt any four questions from this Section.)

3. (i) Identify the **cation** in each of the following cases : [2]
- (a) Ammonium hydroxide solution when added to Solution **B** gives a white precipitate which does not dissolve in excess of ammonium hydroxide solution.
- (b) Sodium hydroxide solution when added to Solution **C** gives a white precipitate which is insoluble in excess of sodium hydroxide solution.
- (ii) Fill in the blanks by choosing the correct answer from the brackets : [2]
- (a) During electrolysis, the compound _____ in its molten state liberates reddish brown fumes at the anode. [NaCl/PbBr₂]
- (b) The ion which could be discharged most readily during electrolysis is _____. [Fe²⁺/Cu²⁺]
- (iii) Arrange the following as per the instruction given in the brackets : [3]
- (a) Al, K, Mg, Ca (*decreasing order of its reactivity*)
- (b) N, Be, O, C (*increasing order of non-metallic character*)
- (c) P, Si, F, Be (*decreasing order of valence electrons*)
- (iv) Complete and balance the following equations : [3]
- (a) $\text{NH}_4\text{Cl} + \text{Ca}(\text{OH})_2 \rightarrow$
- (b) $\text{CuSO}_4 + \text{NH}_4\text{OH} \rightarrow$
- (c) $\text{Cu} + \text{Conc. HNO}_3 \rightarrow$
- Sol.** (i) (a) Pb²⁺ [1]
(b) Mg²⁺ [1]
- (ii) (a) PbBr₂ [1]
(b) Cu²⁺ [1]

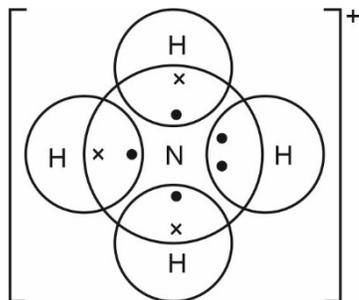
- (iv) (a) $\text{Mg}_3\text{N}_2 + 6\text{H}_2\text{O} \longrightarrow 3\text{Mg}(\text{OH})_2 + 2\text{NH}_3\uparrow$ [1]
 (b) This method is very costly. [1]
 (c) Ammonia gas is identified by its pungent smell (odour). [1]

OR

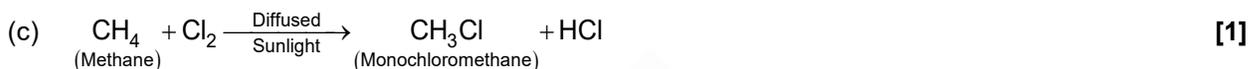
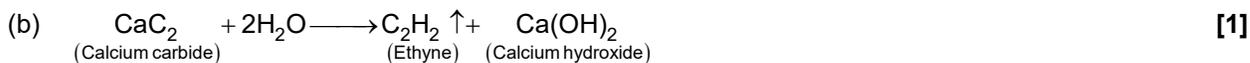
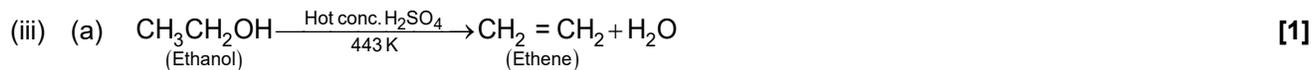
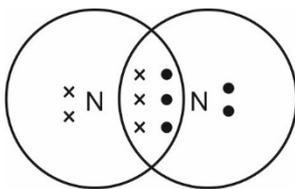
It forms thick white fumes of ammonium chloride with concentrated HCl.

5. (i) Write *one use* of the following *alloys*: [2]
 (a) Bronze
 (b) Fuse metal
- (ii) Draw the *electron dot* structure for the following: [2]
 (a) Ammonium ion
 (b) A molecule of nitrogen
 [At. No.: N=7, H=1]
- (iii) Give a *balanced chemical* equation for the following conversions with conditions: [3]
 (a) Ethene from ethanol
 (b) Ethyne from calcium carbide
 (c) Monochloromethane from methane
- (iv) Study the following observations and name the **anions** present in each of the reactions. [3]
 (a) When a crystalline solid 'P' is warmed with concentrated H_2SO_4 and copper turnings a *reddish brown* gas is released.
 (b) When few drops of dilute sulphuric acid is added to Salt 'R' and heated, a colourless gas is released which turns moist lead acetate paper *silvery black*.
 (c) When few drops of barium nitrate solution is added to the salt solution 'Q', a *white precipitate* is formed which is insoluble in HCl.

- Sol.** (i) (a) Bronze is used in making statues. (or any other) [1]
 (b) Fuse metal is used to make fuse wires [1]
- (ii) (a) Electron dot structure of ammonium ion ($[\text{NH}_4]^+$): [1]



- (b) Electron dot structure of nitrogen molecule (N₂): [1]



- (iv) (a) Nitrate [1]
 (b) Sulphide [1]
 (c) Sulphate [1]

6. (i) Define/State: [2]

- (a) Electronegativity
 (b) Gay-Lussac's Law of combining volumes

- (ii) The *Empirical* formula of an organic compound is CHCl₂. [2]

If its relative molecular mass is 168, what is its molecular formula?

[At. Wt. C = 12, H = 1, Cl = 35.5]

- (iii) Choose the substances given in the box below to answer the following questions: [3]

Iron	Magnesium sulphite	Zinc	Sodium sulphide
Lead	Ferric chloride	Copper	Ferrous sulphate

- (a) The metal that will **not** produce hydrogen gas when reacted with dilute acids.
 (b) The compound that will produce sulphur dioxide gas when reacted with dilute HCl.
 (c) The solution of this compound produces dirty green precipitate with NaOH.
- (iv) State one *relevant observation* for each of the following: [3]
- (a) To the copper nitrate solution, initially few drops of sodium hydroxide solution is added and then added in excess.
 (b) Burning of ammonia in excess of oxygen.
 (c) Dry ammonia gas is passed over heated PbO.

- Sol.** (i) (a) Electronegativity: The tendency of the atom of an element to attract the shared pair of electrons present between bonded atoms in a molecule. [1]
 (b) Gay Lussac's law of combining volumes: When gases react together, they always do so in volumes which bear a simple ratio to one another and also to the volumes of the gaseous products, provided all measurement of volumes are done under similar conditions of temperature and pressure. [1]

- (ii) Empirical formula = CHCl_2
 Empirical formula mass = $12 + 1 + (35.5 \times 2)$
 $= 84 \text{ u}$

Relative molecular mass = 168 u

$$n = \frac{168}{84} = 2 \quad [1]$$

Molecular formula = $n \times$ Empirical formula



- (iii) (a) Copper [1]
 (b) Magnesium sulphite [1]
 (c) Ferrous sulphate [1]
- (iv) (a) A pale blue coloured precipitate is formed which is insoluble in excess of sodium hydroxide [1]
 (b) Ammonia burns with a greenish yellow flame. [1]
 (c) Yellow lead monoxide is reduced to greyish metallic lead. [1]

7. (i) Name the following: [2]

- (a) Organic compounds with *same* molecular formula but *different* structural formula.
 (b) Group of organic compounds where the successive members follow a regular structural pattern, successive compounds differ by a 'CH₂' group.

- (ii) Give reason for the following: [2]

- (a) Ionisation potential decreases down a group.
 (b) Ionic compounds do not conduct electricity in solid state.

- (iii) Calculate: [3]

- (a) The *percentage* of phosphorus in the fertilizer super phosphate $\text{Ca}(\text{H}_2\text{PO}_4)_2$ correct to 1 decimal point [At. Wt. H = 1, P = 31, O = 16, Ca = 40]
 (b) Write the empirical formula of C_8H_{18} .

- (iv) Answer the following questions with reference to electrorefining of copper. [3]

- (a) What is the anode made of?
 (b) What do you observe at the cathode?
 (c) Write the reaction taking place at the cathode.

- Sol.** (i) (a) Structural isomers [1]

- (b) Homologous series [1]

- (ii) (a) Ionisation potential decreases down the group because atomic size increases. [1]

- (b) Ionic compounds do not conduct electricity in solid state because the ions are held together strongly by electrostatic force and are not free to move. [1]

- (iii) (a) Percentage of phosphorus in $\text{Ca}(\text{H}_2\text{PO}_4)_2 = \frac{\text{Mass of phosphorus in given molecule}}{\text{Molecular mass of compound}} \times 100$

$$= \frac{62}{234} \times 100 \quad [1]$$

$$= 26.5\% \quad [1]$$

- (b) C_4H_9 [1]

- (iv) (a) Anode is made up of slab of impure Cu metal [1]
 (b) Cu^{2+} ions from electrolyte gain electron and get deposited at cathode made of pure Cu strip [1]
 (c) $\text{Cu}^{2+}(\text{aq}) + 2\text{e}^{-} \longrightarrow \text{Cu}(\text{s})$ [1]
8. (i) Arrange the following according to the *instructions* given in brackets: [2]
 (a) C_2H_2 , C_3H_6 , CH_4 , C_2H_4 (*In the increasing order of the molecular weight*)
 (b) Cu^{2+} , Na^{+} , Zn^{2+} , Ag^{+} (*The order of Preferential discharge at the cathode*)
- (ii) Differentiate between the *following pairs* based on the *criteria* given in the brackets: [2]
 (a) Cane sugar and hydrated copper sulphate [*using concentrated H_2SO_4*]
 (b) Sulphuric acid and hydrochloric acid [*type of salts formed*]
- (iii) Convert the following reactions into a *balanced chemical equation*: [3]
 (a) Ammonia to nitric oxide using oxygen and platinum catalyst.
 (b) Sodium hydroxide to sodium sulphate using sulphuric acid.
 (c) Ferrous sulphide to hydrogen sulphide using hydrochloric acid.
- (iv) Choose the answer from the *list* which *fits* in the *description*: [3]
 [CCl_4 , PbO , NaCl , CuO , NH_4Cl]
 (a) A compound which undergoes thermal dissociation.
 (b) An amphoteric oxide.
 (c) A compound which is a non-electrolyte.
- Sol.** (i) (a) $\text{CH}_4 < \text{C}_2\text{H}_2 < \text{C}_2\text{H}_4 < \text{C}_3\text{H}_6$ [1]
 (b) $\text{Ag}^{+} > \text{Cu}^{2+} > \text{Zn}^{2+} > \text{Na}^{+}$ [1]
- (ii) (a) When few drops of conc. sulphuric acid are added to the blue coloured hydrated copper sulphate, it becomes white anhydrous copper sulphate whereas when cane sugar reacts with conc. sulphuric acid, it gives a black spongy mass of carbon which rises up and finally leads to the formation of sugar charcoal. [1]
- $$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}(\text{s}) \xrightarrow{\text{Conc. H}_2\text{SO}_4} \text{CuSO}_4(\text{s}) + 5\text{H}_2\text{O}(\text{l})$$
- (Blue) (Dirty white)
- $$\text{C}_{12}\text{H}_{22}\text{O}_{11}(\text{s}) \xrightarrow{\text{Conc. H}_2\text{SO}_4} 12\text{C}(\text{s}) + 11\text{H}_2\text{O}(\text{g})$$
- Cane sugar Sugar charcoal
- (b) Sulphuric acid can form both normal salt (e.g., Na_2SO_4) or acid salt (e.g. NaHSO_4) whereas hydrochloric acid forms normal salt only (e.g. NaCl) [1]
- (iii) (a) $4\text{NH}_3 + 5\text{O}_2 \xrightarrow{\text{Pt}} 4\text{NO} \uparrow + 6\text{H}_2\text{O} + \text{Heat}$ [1]
 (b) $2\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$ [1]
 (c) $\text{FeS} + 2\text{HCl} \rightarrow \text{FeCl}_2 + \text{H}_2\text{S} \uparrow$ [1]
- (iv) (a) NH_4Cl [1]
 (b) PbO [1]
 (c) CCl_4 [1]