ICSE Solved Paper 2023
Chemistry

Class-X

(Maximum Marks : 80)

(Time allowed : Two hours)

Answer to this paper must be written on the paper provided separately.

*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.

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*Section A is compulsory. Attempt **any four** questions from Section B.*

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

SECTION-A (40 marks)

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*:
   (a) Neon
   (b) Sulphur
   (c) Sodium
   (d) Argon

   (ii) An element with the *largest* atomic radius among the following is:
   (a) Carbon
   (b) Nitrogen
   (c) Lithium
   (d) Beryllium

   (iii) The compound that is not an one of aluminium:
   (a) Cryolite
   (b) Corundum
   (c) Fluorspar
   (d) Bauxite

   (iv) The vapour density of CH_3OH is .... (At. Wt. C=12, H=1, O=16)
   (a) 32
   (b) 18
   (c) 16
   (d) 34

   (v) Which of the following reactions takes place at the anode during the electroplating of an article with silver?
   (a) $Ag - 1e^- \rightarrow Ag^{1+}$
   (b) $Ag + 1e^- \rightarrow Ag^{1-}$
   (c) $Ag - 1e^- \rightarrow Ag$
   (d) None of the above

   (vi) The metallic hydroxide which forms a deep inky blue solution with excess ammonium hydroxide solution is:
   (a) $Fe(OH)_2$
   (b) $Cu(OH)_2$
   (c) $Ca(OH)_2$
   (d) $Fe(OH)_3$

   (vii) An example of a cyclic organic compound is:
   (a) Propene
   (b) Pentene
   (c) Butene
   (d) Benzene

   (viii) In the laboratory preparation, HCl gas is dried by passing through:
   (a) dilute nitric acid
   (b) concentrated sulphuric acid
   (c) dilute sulphuric acid
   (d) acidified water

   (ix) The nitrate which on thermal decomposition leaves behind a residue which is yellow when hot and white when cold:
   (a) Lead nitrate
   (b) Ammonium nitrate
   (c) Copper nitrate
   (d) Zinc nitrate

   (x) The salt formed when concentrated sulphuric acid reacts with KNO_3 above 200°C:
   (a) K_2SO_4
   (b) K_2SO_3
   (c) $KHSO_4$
   (d) $KHSO_3$

   (xi) The property exhibited by concentrated sulphuric acid when it is used to prepare hydrogen chloride gas from potassium chloride:
   (a) Dehydrating property
   (b) Drying property
   (c) Oxidizing property
   (d) Non-volatile acid property

   (xii) The hydrocarbon formed when sodium propanoate and soda lime are heated together:
   (a) Methane
   (b) Ethane
   (c) Ethene
   (d) Propane

   (xiii) The acid which does not form acid salt by a basic radical:
   (a) H_2CO_3
   (b) H_3PO_4
   (c) H_2SO_4
   (d) CH_3COOH

   (xiv) THe general formula of hydrocarbons with single covalent bonds is:
   (a) C_nH_{2n+2}
   (b) C_nH_{2n}
   (c) C_nH_{2n-2}
   (d) C_nH_{2n-6}

   (xv) The indicator which changes to pink colour in an alkaline solution is:
   (a) Blue Litmus
   (b) Methyl Orange
   (c) Red Litmus
   (d) Phenolphthalein

Ans. (i) Option (d) is correct

Explanation: It is a noble gas of period 3 whose electron affinity is zero.

(ii) Option (c) is correct

Explanation: Atomic radii decreases across the period from left to right.

(iii) Option (c) is correct

Explanation: Others are ore of aluminium. Fluorspar is CaF^{+2}.

(iv) Option (c) is correct

Explanation: Vapour density = molecular mass/2

$CH_3OH = 12 + 3 \times 1 + 16 + 1 = 32$

V.D. = $\dfrac{32}{2}$ = 16

(v) Option (a) is correct

Explanation: Oxidation takes place at anode

(vi) Option (b) is correct

Explanation: Cu^{2+} ions form deep inky blue solution.

(vii) Option (d) is correct

Explanation: It has all carbon atoms in a ring structure.

(viii) Option (b) is correct

Explanation: Other drying agents may react with HCl gas.

(viii) Option (b) is correct

Explanation: Other drying agents may react with HCl gas.

(ix) Option (a) is correct

Explanation: Lead nitrate on thermal decomposition gives lead oxide which is yellow in colour.

(x) Option (c) is correct

Explanation: $KHSO_4$, potassium bisulphate

Potassium bisulphate and nitric acid is formed. The reaction takes place below 200°C because above this temperature nitric acid decomposes to nitrogen dioxide.

(xi) Option (d) is correct

Explanation: Due to its reducing nature it shows non-volatile acid property.

(xii) Option (b) is correct

Explanation: This is decarboxylation reaction.

(xiii) Option (a) is correct

Explanation: It is a weak acid so does not participate in formation of acidic salts.

(xiv) Option (a) is correct

Explanation: Alkane is hydrocarbon with single covalent bond.

(xv) Option (d) is correct

Explanation: It is used as an indicator in acid base titrations and give pink colour in alkaline solution.

2. (i) Match the *Column A* with *Column B*: [5]

	Column A		Column B
(a)	Sodium Chloride	1.	has two shared pair of electrons
(b)	Methane	2.	has high melting and boiling points
(c)	Hydrogen chloride gas	3.	a greenhouse gas
(d)	Oxidation reaction	4.	has low melting and boiling points
(e)	Water	5.	$Zn - 2e^- \rightarrow Zn^{2+}$
		6.	$S + 2e^- \rightarrow S^{2-}$

(ii) The following sketch illustrates the process of conversion of Alumina to Aluminium: [5]

Study the diagram and answer the following:
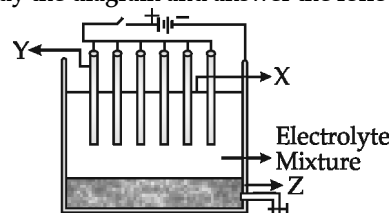
(a) Name the constituent of the electrolyte mixture which has a divalent metal in it.

(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 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.
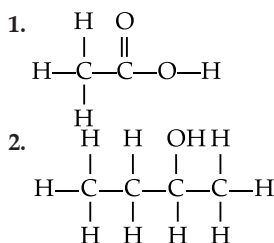
(e) The ratio of the mass of a certain volume of gas to the same volume of hydrogen measured under the same conditions of temperature and pressure.

(v) (a) Given the *structural formula* of the following organic compounds: [5]

1. 2-chlorobutane

2. Methanal

3. But-2-yne

**(b) Given the IUPAC name of the following organic compounds:**

1.

$$H—\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}—\overset{\overset{O}{\|}}{C}—O—H$$

2.

$$H—\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}—\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}—\underset{\underset{H}{|}}{\overset{\overset{OH}{|}}{C}}—\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}—H$$

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

Column A	Column B
(a) Sodium Chloride	**2.** has high melting and boiling point.
(b) Methane	**3.** a green house gas.
(c) Hydrogen chloride gas	**1.** has two shared pair of electrons
(d) Oxidation reaction	**5.** $Za – 2e^- \rightarrow Zn^{2+}$
(e) Water	**4.** has low melting and boiling point.

(ii) (a) Fused alumina + cryolite + Fluorspar

In CaF_2 (Fluorspar) calcium is divalent metal ion.

(b) Powdered coke is sprinkled, to reduce the heat loss by radiation.

(c) Hall-Heroult process

(d) At cathode (Z) : $2 Al^{3+} + 6e^- \rightarrow 2Al$

At anode (Y) $6O^{2-} \rightarrow 3O_2 + 12e^-$
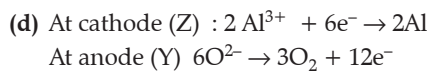
(iii) (a) Reducing agent.

(b) Bad

(c) Alkaline

(d) Silver chloride

(e) hydrogenation

(iv) (a) Electron affinity

(b) Catenation

(c) Haber's process

(d) Basic salt

(e) Vapour density

(v) (a) 1. 2-chlorobutane

$$H_3C — \underset{\underset{}{\overset{\overset{Cl}{|}}{C}}H} — CH_2 — CH_3$$

2. Methanal

$$H — \overset{\overset{O}{\|}}{C} — H$$
Methanal

3. But-2-yne

$$H_3C — C \equiv C — CH_3$$

(b) 1. Acetic acid

2. Butan-2-ol

## 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) $NH_4Cl + Ca(OH)_2 \rightarrow$

(b) $CuSO_4 + NH_4OH \rightarrow$

(c) $Cu + Conc. HNO_3 \rightarrow$

Ans. (i) (a) Pb^{2+} which gives white ppt of $Pb(OH)_2$

(b) Ca^{2+} with NaOH gives white ppt of $Ca(OH)_2$.

(ii) (a) $PbBr_2$

(b) Cu^{2+}

(iii) (a) K > Al > Ca > Mg

(b) Be < C < N < O   (Increases across the period)

(c) F > P > Si > Be   (increases across a period)

(iv) (a) $2NH_4Cl + Ca(OH)_2 \rightarrow CaCl_2 + 2NH_3 + 2H_2O$

(b) $CuSO_4(aq) + 2NH_4OH(aq) \rightarrow Cu(OH)_2(S) + (NH_4)_2SO_4(aq)$

(c) $Cu + 4HNO_3 \rightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$
$3Cu + 8HNO_3 \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$
Any of the above reaction is correct.

4. (i) State a *relevant reason* for the following: [2]

(a) Hydrogen chloride gas cannot be dried over quick lime.

(b) Ammonia gas is not collected over water.

(ii) Identify the alloy in each case from the given composition: [2]

(a) aluminium, magnesium, manganese, copper

(b) iron, nickel, chromium, carbon

(iii) Solve the following *numerical* problem. **[3]**

Ethane burns in oxygen according to the chemical equation:

$$2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$$
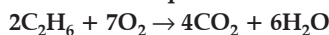
If 80 ml of ethane is burnt in 300 ml of oxygen, find the composition of the resultant gaseous mixture when measured at room temperature.

(iv) The following question are pertaining to the laboratory preparation of Ammonia gas from Magnesium nitride: **[3]**

(a) Write a balanced chemical equation for its preparation.

(b) Why is this method seldom used?

(c) How do you identify the *gas* formed?

Ans. (i) (a) HCl is acidic and quicklime (CaO) is basic in nature. So they undergo chemical reaction when brought together.

$$2HCl + CaO \rightarrow CaCl_2 + H_2O$$
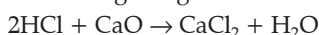
(b) Gas is highly soluble in water so cannot be collected over water.

It is collected by downward displacement of air.

(ii) (a) Duralumin

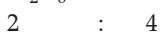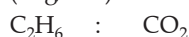**(b)** Stainless steel

(iii) $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$

Molecular weight: 30　32　44　18
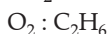
(in g/mol)

C_2H_6 : CO_2

2　:　4

1　:　2

No. of moles of CO_2 is twice that of C_2H_6

So volume will also be twice.

80 ml of ethane will produce $2 \times 80 = 160$ ml of CO_2

$O_2 : C_2H_6$

7 : 2

3.5 : 1

No of moles of oxygen is 3.5 times

So, the volume of oxygen will also be 3.5 times.

To burn 80 ml of ethane, $3.5 \times 80 = 280.0$ ml of oxygen is required

Remaining oxygen = 300 – 280 = 20 ml

The resultant gaseous mixture is 160 ml of CO_2 and 20 ml of oxygen.

(iv) (a) $Mg_3N_2 + 6H_2O \rightarrow 3Mg(OH)_2 + 2NH_3$

(b) As this is very expensive method.

(c) Bring a rod dipped in HCl near it. Dense white fumes of ammonium chloride is formed.

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

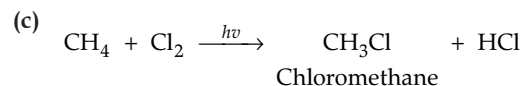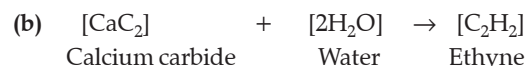**(iv)** Study the following *observations* and name the anions present in each of the reactions. **[3]**
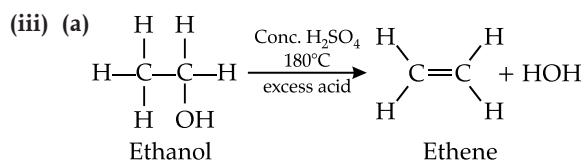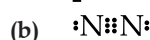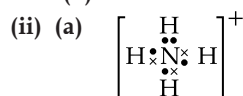
(a) When a crystalline solid 'P' is warmed with concentrated H_2SO_4 and copper turnings a *reddish brown* gas is released.

(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.

Ans. (i) (a) Used in preparation of medals, musical instruments, as a ship propellents.

(b) For soldering of metals.

(ii) (a)

$$\left[H \overset{\overset{\displaystyle H}{\cdot\cdot}}{\underset{\underset{\displaystyle H}{\times\times}}{\overset{\cdot}{\underset{\times}{N}}}} H \right]^{+}$$

(b) :N⫶⫶N:

(iii) (a)

Ethanol　→ (Conc. H_2SO_4, 180°C, excess acid) → Ethene + HOH

(b) $[CaC_2]$ + $[2H_2O]$ → $[C_2H_2]$
Calcium carbide　Water　Ethyne

(c) $CH_4 + Cl_2 \xrightarrow{hv} CH_3Cl + HCl$
Chloromethane

(iv) (a) Copper nitrate is the compound "P".
NO_3^{2-} (nitrate) is the anions.

(b) H_2S is the gas which turns moist lead acetate paper black.
S^{2-} (sulphide) anions.

(c) SO_4^{2-} (sulphate) anions

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

(a) Electronegativity

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

(ii) The *Empirical* formula of an organic compound is $CHCl_2$. **[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.**

Ans. (i) (a) **Electronegativity:** It is the tendency of an atom in a molecule to attract the shared pair of electrons towards itself is known as electronegativity.

(b) **Gay Lussac's Law of combining volumes:** It states that, whenever the gases react, they always do so in volumes , which bear a simple whole number ratio to one another as well as to the gaseous products, if gaseous, all volumes being measured under similar condition of temperature and pressure.

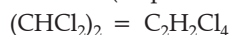(ii) $CHCl_2$

Molecular mass $= 12 + 1 + 2 \times 35.5$

$= 13 + 71.0$

$= 84.0$

n = relative molecular mass/ empirical formula mass

$n = \dfrac{168}{84} = 2$

molecular formula = (empirical formula)n

$(CHCl_2)_2 = C_2H_2Cl_4$

(iii) (a) **Copper:** It does not show reaction with acids.

(b) **Magnesium Sulphite:** $MgSO_3 + dil. HCl \rightarrow MgCl_2 + H_2O + SO_2$

(c) **Ferrous Sulphite:** It gives dirty green ppt with NaOH

(iv) (a) Initially light blue ppt of $Cu(OH)_2$ is formed along with sodium nitrate.

$Cu(NO_3)_2 + 2NaOH \rightarrow Cu(OH)_2 + 2NaNO_3$

The ppt is soluble in excess NaOH solution giving a deep blue coloured solution.

(b) It burns with yellowish green flame due to the formation of NO_2.

(c) Lead monoxide is reduced to grey coloured lead.

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 'CH$_2$' 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 phosphate in the fertilizer super phosphate $Ca(H_2PO_4)_2$ 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.**

Ans. (i) (a) **Isomers:** The compounds with same molecular formula and different structural formulae

(b) Homologous series

(ii) (a) Ionization potential decreases as we go down the group because as we go down:

Atomic size increases, so the force of attraction between nucleus and valence electron reduces.

It becomes easy to remove the electron.

(b) In solid state the ions are not free to move While in molten state they can easy travel in solution thus allowing electricity to flow.

(iii) (a) Molecular weight = $Ca(H_2PO_4)_2$

$40 + (2 \times (2 \times 1 + 31 + 4 \times 16)$

$40 + (2(2 + 31 + 64)$

$40 + 2(97)$

$40 + 194$

$= 234$

Amount of P = $2 \times 31 = 62g$

Percentage of phosphorus = $\dfrac{62 \times 100}{234}$

$= 26.5\%$

(b) Empirical formula for C_8H_{18}

C : H

8 : 18

4 : 9

Thus empirical formula is C_4H_9.

(iv) (a) A block of impure copper metal

(b) At cathode, cupric ions get discharged by gaining electrons from the cathode.

Reddish brown copper is deposited at cathode.

(c) $Cu^{2+} + 2e^- \rightarrow Cu$

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.

Ans. (i) (a)

$$C_2H_2 = 2 \times 12 + 2 \times 1$$
$$= 24 + 2 = 26 \text{ g}$$
$$C_3H_4 = 36 + 4 = 40 \text{ g}$$
$$CH_4 = 16 \text{g}$$
$$C_2H_4 = 28 \text{ g}$$
$$CH_4 < C_2H_2 < C_2H_4 < C_3H_4$$

(b) $Ag^+ > Cu^{2+} > Zn^{2+} > Na^+$

Elements at lower position get discharged easily.

(ii) (a) **Cane sugar:** Results in the formation of black spongy mass of carbon known as sugar charcoal.

Copper sulphate: The blue crystal changes to white powder due to dehydration.

(b) The salts of sulphuric acid are sulphates and bisulphates.

e.g., $NaHSO_4$ while the salts of hydrochloric acid contains Cl^- ions.

(iii) (a) $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$

This is Ostwald's process to produce nitric oxide.

(b) $H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$
(Sulfuric (Sod. (Sod. (Water)
acid) Hydroxide) Sulfate)

(c) $FeS(s) + 2HCl(aq) \rightarrow FeCl_2(s) + H_2S(g)$

(iv) (a) NH_4Cl

(b) PbO : It behaves both as acidic and basic oxide.

(c) CCl_4 : It is formed due to covalent bonding.

❑❑❑