ICSE Board
Class X Chemistry
Board Paper - 2019

Time: 2 hrs. **Max. Marks: 80**

Answers 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.

Section I is compulsory. Attempt any four questions from S**ection II**.
The intended marks for questions or parts of questions are given in brackets [ ].

SECTION I (40 Marks)
Attempt all questions from this Section

Question 1

(a) Choose the correct answer from the options given below: [5]

(i) An electrolyte which completely dissociates into ions is
A. Alcohol
B. Carbonic acid
C. Sucrose
D. Sodium hydroxide

(ii) The most electronegative element from the following elements is
A. Magnesium
B. Chlorine
C. Aluminium
D. Sulphur

(iii) The reason for using aluminium in the alloy duralumin is
A. Aluminium is brittle.
B. Aluminium gives strength.
C. Aluminium brings lightness.
D. Aluminium lowers melting point.

(iv) The drying agent used to dry HCI gas is
A. Conc. H_2SO_4
B. ZnO
C. Al_2O_3
D. CaO

(v) A hydrocarbon which is a greenhouse gas is
A. Acetylene
B. Ethylene
C. Ethane
D. Methane

(b) Fill in the blanks with the choices given in brackets: [5]

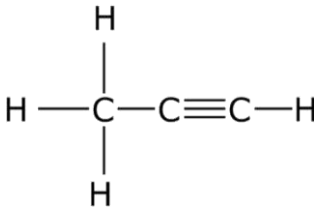
(i) Conversion of ethanol to ethene by the action of concentrated sulphuric acid is an example of _____. (Dehydration/dehydrogenation/dehydrohalogenation)
(ii) When sodium chloride is heated with concentrated sulphuric acid below 200°C, one of the products formed is _____. (Sodium hydrogen sulphate/sodium sulphate/chlorine)
(iii) Ammonia reacts with excess chlorine to form _____. (Nitrogen/nitrogen trichloride/ammonium chloride)
(iv) Substitution reactions are characteristic reactions of _____. (Alkynes/alkenes/alkanes)
(v) In Period 3, the most metallic element is _____. (Sodium/magnesium/aluminium)

(c) Write a balanced chemical equation for each of the following reactions: [5]
(i) Reduction of copper (II) oxide by hydrogen.
(ii) Action of dilute sulphuric acid on sodium hydroxide.
(iii) Action of dilute sulphuric acid on zinc sulphide.
(iv) Ammonium hydroxide is added to ferrous sulphate solution.
(v) Chlorine gas is reacted with ethane.

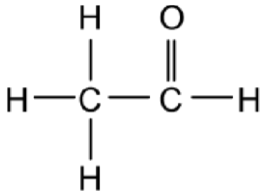
(d) State one observation for each of the following: [5]
(i) Concentrated nitric acid is reacted with sulphur.
(ii) Ammonia gas is passed over heated copper (II) oxide.
(iii) Copper sulphate solution is electrolysed using copper electrodes.
(iv) A small piece of zinc is added to dilute hydrochloric acid.
(v) Lead nitrate is heated strongly in a test tube.

(e) (i) Calculate: [5]
1. The number of moles in 12g of oxygen gas. [O = 16]
2. The weight of 10^{22} atoms of carbon. [C = 12, Avogadro's No. = 6×10^{23}]
(ii) Molecular formula of a compound is $C_6H_{18}O_3$. Find its empirical formula.

(f) (i) Give the IUPAC name of the following organic compounds: [5]
1.



2.



(ii) What is the special feature of the structure of ethyne?
(iii) Name the saturated hydrocarbon containing two carbon atoms.
(iv) Give the structural formula of acetic acid.

(g) Give the appropriate term defined by the statements given below: [5]
(i) The formula that represents the simplest ratio of the various elements present in one molecule of the compound.
(ii) The substance that releases hydronium ion as the only positive ion when dissolved in water.
(iii) The process by which certain ores, specially carbonates, are converted to oxides in the absence of air.
(iv) The covalent bond in which the electrons are shared equally between the combining atoms.

(h) Arrange the following according to the instructions given in brackets: [5]
(i) K, Pb, Ca, Zn (In the increasing order of reactivity)
(ii) Mg^{2+}, Cu^{2+}, Na^{1+}, H^{1+} (In the order of preferential discharge at the cathode)
(iii) Li, K, Na, H (In the decreasing order of their ionisation potential)
(iv) F, B, N, O (In the increasing order of electron affinity)
(v) Ethane, methane, ethane, ethyne (In the increasing order of molecular weight)
[H = 1, C = 12]

Solution 1:

(a) (i) (D) Sodium hydroxide

(ii) (B) Chlorine

(iii) (C) Aluminium brings lightness.

(iv) (A) Conc. H_2SO_4

(v) (D) Methane

(b) (i) Conversion of ethanol to ethene by the action of concentrated sulphuric acid is an example of dehydration.

(ii) When sodium chloride is heated with concentrated sulphuric acid below 200°C, one of the products formed is sodium sulphate.

(iii) Ammonia reacts with excess chlorine to form nitrogen trichloride.

(iv) Substitution reactions are characteristic reactions of alkanes.

(v) In Period 3, the most metallic element is sodium.

(c) (i) The reduction of copper (II) oxide by hydrogen is
$CuO(s) + H_2(g) \rightarrow CU(s) + H_2O(g)$

(ii) Action of dilute sulphuric acid on sodium hydroxide is:
$H_2SO_4(aq) + 2NaOH(aq) \rightarrow Na_2SO_4(aq) + H_2O(l)$

(iii) Action of dilute sulphuric acid on zinc sulphide is:

$$ZnS + 4H_2SO_4 \rightarrow ZnSO_4 + 4SO_2 + 4H_2O$$

(iv) Ammonium hydroxide is added to ferrous sulphate solution:

$$FeSO_4 + 2NH_4OH \rightarrow (NH_4)SO_4 + Fe(OH)_2$$

(v) Chlorine gas is reacted with ethane.

$$C_2H_6 + Cl_2 \rightarrow C_2H_5Cl + HCl$$

(d) (i) When concentrated nitric acid is added to sulphur, it gives a deep red-orange or brown-coloured gas which has an irritating (pungent) odour.

$$6HNO_3(conc.) + S(s) \rightarrow H_2SO_4(g) + 6NO_2 \uparrow (g) + 2H_2O(l)$$

(ii) When ammonia gas is passed over heated copper (II) oxide, reddish brown copper metal is obtained and black copper oxide is used up.

$$2NH_3 + 3CuO \xrightarrow{Heat} 3Cu + 3H_2O + N_2$$

(iii) The blue colour of the copper sulphate solution remains unchanged during its electrolysis due to the copper electrodes and the cathode increase in size due to deposition of copper metal, whereas the copper anode gets thin due to loss of copper metal into the solution as Cu^{2+} ions. The electrolytic solution contains following ions:

$$CuSO_2(s) + H_2O \rightarrow Cu^{2+}(aq) + SO_4^{2-}(aq) + H^+(aq) + OH^-(aq)$$

At cathode:

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

At anode made up of copper:

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

(iv) When a small piece of zinc is added to dilute hydrochloric acid, white coloured zinc chloride is formed, and colourless and odourless hydrogen gas is evolved.

$$Zn(s) + 2HCl(aq) \rightarrow ZnCl_2 + H_2(g) \uparrow$$

(v) When lead nitrate is heated strongly in a test tube, the yellow compound formed and gives off a deep red-orange or brown coloured gas which having an irritating (pungent) odour.

$$2Pb(NO_3)_2(s) \xrightarrow{Heat} 2PbO + 4NO_2 \uparrow + O_2(g)$$

(e) (i) 1. It is given that

Atomic mass of oxygen is 16g,

Thus, the molar mass of $O_2 = 16 \times 2 = 32g$

That is 32g oxygen gas has one molecule of O^2 molecules.

Therefore, 12g of oxygen gas would contain

$\left(\frac{1}{32}\right) \times 12 = 0.375$ moles .

2. It is given that atomic weight of carbon is 12, and Avogadro's No. = 6 x 10^{23}.

Now, weight of one mole of Carbon is12g.

Thus, weight of 6 x 10^{23} carbon atoms is 12g.
Hence, weight of 10^{22} carbon atoms is,

$$\left(\frac{12}{6\times10^{23}}\right)\times10^{22} = 0.199 = 0.2\text{g}$$

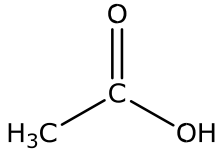
(ii) Empirical formula can be obtained by dividing the number of atoms in molecule by the smallest number in the molecular formula-
It is given that Molecular formula of a compound is $C_6H_{18}O_3$.
Thus, the smallest number in formula is 3.
Now, dividing all the atoms by 3, we get,
The ratio of elements C:H:O is 2:6:1.
Therefore, the empirical formula of the compound is C_2H_6O.

(f) (i) 1. The IUPAC name of the compound is Propylene.
2. The IUPAC name of the compound is Ethanal.

(ii) In ethyne, each carbon atom is attached to one hydrogen atom by a single covalent bond and to another carbon by a triple covalent bond. The shape of the ethyne molecule is linear due to *sp* hybridization in carbon atoms.

(iii) The saturated hydrocarbon containing two carbon atoms is Ethane (C_2H_6).

(iv) The structural formula of acetic acid is



Acetic acid

(g) (i) Empirical formula

(ii) Acids

(iii) Electronegativity

(iv) Calcination

(v) Non-polar covalent bond

(h) (i) Pb < Zn < Ca < K

(ii) $Cu^{2+} > H^{1+} > Mg^{2+} > Na^{1+}$

(iii) H>Li>Na>K

(iv) B < N < O < F

(v) Methane < Ethyne < Ethene < Ethane

SECTION II (40 Marks)

Attempt any **four** questions from this Section

Question 2

(a) Draw the electron dot structure of **[3]**

(i) Nitrogen molecule [N = 7]

(ii) Sodium chloride [Na = 11, Cl = 17]

(iii) Ammonium ion [N = 7, H = 1]

(b) The pH values of three solutions A, B and C are given in the table. Answer the following questions:

[3]

Solution	**pH value**
A	12
B	2
C	7

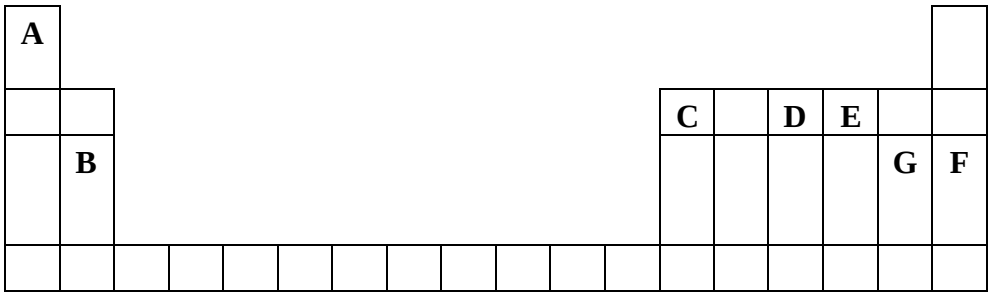
(i) Which solution will have no effect on litmus solution?

(ii) Which solution will liberate CO_2 when reacted with sodium carbonate?

(iii) Which solution will turn red litmus solution blue?

(c) Study the extract of the periodic table given below and answer the questions that follow. Give the letter corresponding to the element in question.

DO NOT repeat an element. **[4]**



(i) Which element forms an electrovalent compound with G?

(ii) The ion of which element will migrate towards the cathode during electrolysis?

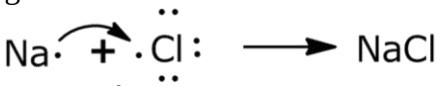
(iii) Which non-metallic element has the valency of 2?

(iv) Which is an inert gas?

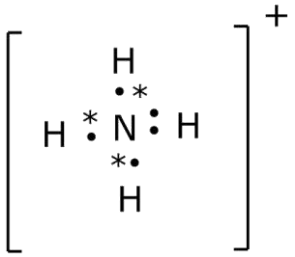
Solution 2:

(i) Electron dot diagram of nitrogen molecule is -

(ii) Electron dot diagram of Sodium Chloride is –



(iii) Electron dot structure of Ammonium ion is-



(b)

Solution	pH value
A	12
B	2
C	7

(i) Solution C will have no effect on litmus solution as its pH is 7 and hence it is neutral.

(ii) Solution B will liberate CO_2 when reacted with sodium carbonate as it is acidic solution.

(iii) Solution A will turn red litmus solution blue as it is basic in nature.

(c)

(i) Element B forms an electrovalent compound with G.
(ii) The ion of element B (B^{2+}) will migrate towards the cathode during electrolysis.
(iii) The non-metallic element which has the valency of 2 is E.
(iv) F is an inert gas.

Question 3

(a) Name the particles present in [3]
(i) Strong electrolyte
(ii) Non-electrolyte
(iii) Weak electrolyte

(b) Distinguish between the following pairs of compounds using the reagent given in the brackets. [3]

(i) Manganese dioxide and copper (II) oxide (using concentrated HCl)

(ii) Ferrous sulphate solution and ferric sulphate solution (using sodium hydroxide solution)

(iii) Dilute hydrochloric acid and dilute sulphuric acid (using lead nitrate solution)

(c) Choose the method of preparation of the following salts from the methods given in the list: [4]

[List: A. Neutralisation B. Precipitation
C. Direct combination D. Substitution]

(i) Lead chloride

(ii) Iron (II) sulphate

(iii) Sodium nitrate

(iv) Iron (III) chloride

Solution 3:

(a) (i) The particles present in strong electrolyte are molecules which easily and completely dissociate into ions.

(ii) The particles present in non-electrolytes are molecules which do not dissociate into ions.

(iii) The particles present in weak electrolytes are molecules which dissociate into ions to a very less extent.

(b) (i) Manganese dioxide on heating with concentrated HCl gives greenish yellow chlorine gas whereas copper(II) oxide reacts with concentrated hydrochloric acid to give $CuCl_2$, but no chlorine gas is evolved.

$$MnO_2 + 4HCl \rightarrow MnCl_2 + Cl_2 \uparrow + 2H_2O$$

And,

Copper (II) oxide does not react with concentrated HCl.

(ii) Ferric sulphate solution on reacting with NaOH gives a reddish brown precipitate of ferric hydroxide $Fe(OH)_3$ whereas no such precipitate is obtained when ferrous sulphate is mixed with sodium hydroxide.

$$Fe_2(SO_4)_3(aq) + 6NaOH(aq) \rightarrow 2Fe(OH)_3(s) + 3Na_2SO_4(aq)$$

(iii) Lead nitrate solution reacts with hydrochloric acid to give white ppt. of lead chloride. This insoluble lead chloride reacts with excess Cl^- ions (of HCl) to form a soluble complex, the tetrachloroplumbate(II) ion,

$$Pb(NO_3)_2 + HCl \rightarrow PbCl_2 \downarrow + 2HNO_3$$

Sulphuric acid on reacting with lead nitrate solution forms an insoluble precipitate of lead sulphate, which does not dissolve further in sulphuric acid solution.

$$Pb(NO_3)_2 + H_2SO_4 \rightarrow PbSO_4 \downarrow + 2HNO_3$$

(c)

(i) Lead chloride: Precipitation

(ii) Iron (II) sulphate: Substitution

(iii) Sodium nitrate: Neutralisation

(iv) Iron (III) chloride: Direct combination

Question 4

(a) Complete the following equations: [3]

(i) S + conc. $HNO_3 \rightarrow$

(ii) C + conc. $H_2SO_4 \rightarrow$

(iii) Cu + dil. $HNO_3 \rightarrow$

(b) Write a balanced chemical equation for the preparation of [3]

(i) Ethene from bromoethane

(ii) Ethyne using calcium carbide

(iii) Methane from sodium acetate

(c) Name the following organic compounds: [4]

(i) The compound with 3 carbon atoms whose functional group is carboxyl.

(ii) The first homologue whose general formula is C_nH_{2n}.

(iii) The compound that reacts with acetic acid to form ethyl ethanoate.

(iv) The compound formed by complete chlorination of ethyne.

Solution 4:

(i) $S_8(s) + 48HNO_3(conc.) \rightarrow 8H_2SO_4 + 48NO_2 + 16H_2O$

(ii) $C + 4HNO_3(conc.) \rightarrow CO_2 + 2H_2O + 4NO_2$

(iii) $3Cu + 8HNO_3(aq, dil.) \rightarrow 3Cu(NO_3)_2(aq) + 4H_2O(l) + 2NO(g)$

(b) (i) Ethene from bromoethane

$$\underset{\text{Bromoethane}}{H_2CBr - CH_3} + KOH \rightarrow \underset{\text{Ethene}}{H_2C = CH_2} + KBr + H_2O$$

(ii) Ethyne using calcium carbide

$$\underset{\text{calcium carbide}}{CaC_2} + H_2O \rightarrow \underset{\text{Ethyne}}{HC \equiv CH} + Ca(OH)_2$$

(iii) Methane from Sodium acetate

$$\underset{\text{Sodium acetate}}{CH_3COONa} + \underset{\text{Sodium Hydroxide}}{NaOH} \xrightarrow[CaO]{\Delta} \underset{\text{Methane}}{CH_4} + \underset{\text{Sodium Carbonate}}{Na_2CO_3}$$

(c) (i) Propanoic acid

(ii) Ethene

(iii) Ethanol

(iv) Acetylene tetrachloride

Question 5

(a) Give the chemical formula of [3]
   (i) Bauxite
   (ii) Cryolite
   (iii) Sodium aluminate

(b) Answer the following question based on the extraction of aluminium from alumina by **Hall-Heroult's process:** [3]
   (i) What is the function of cryolite used along with alumina as the electrolyte?
   (ii) Why is powdered coke sprinkled on top of the electrolyte?
   (iii) Name the electrode from which aluminium is collected.

(c) Match the alloys given in column I to the uses given in column II. [4]

COLUMN I	**COLUMN II**
(i) Duralumin	A. Electrical fuse
(ii) Solder	B. Surgical instruments
(iii) Brass	C. Aircraft body
(iv) Stainless steel	D. Decorative articles

Solution 5:

(a) Chemical formula of

(i) Bauxite: $Al_2O_3.2H_2O$

(ii) Cryolite: Na_3AlF_6

(iii) Sodium aluminate: $NaAlO_2$

(b)

(i) Cryolite is mixed with alumina to bring downlowers the fusion temperature from 2050°C to 950°C and enhances conductivity.

(ii) Powdered coke is sprinkled on top of the electrolyte. It reduces heat loss the melting point of electrolyte mixture and to increase its electrical conductivity.

(iii) Aluminium is collected at the cathode which is carbon lining covering the inside portion of vessel.

COLUMN I	COLUMN II
(i) Duralumin	Aircraft body
(ii) Solder	Electrical fuse
(iii) Brass	Decorative articles
(iv) Stainless steel	Surgical instruments

Question 6

(a) Identify the substances underlined: [3]
(i) The catalyst used to oxidise ammonia.
(ii) The organic compound which when solidified forms an ice-like mass.
(iii) The dilute acid which is an oxidising agent.

(b) Copper sulphate solution reacts with sodium hydroxide solution to form a precipitate of copper hydroxide according to the equation: [3]

$$2NaOH + CuSO_4 \rightarrow Na_2SO_4 + Cu(OH)_2 \downarrow$$

(i) What mass of copper hydroxide is precipitated by using 200 gm of sodium hydroxide? [H = 1, O = 16, Na = 23, S = 32, Cu = 64]
(ii) What is the colour of the precipitate formed?

(c) Find the **empirical formula** and the **molecular formula** of an organic compound from the data given below: [4]

C = 75.92%, H = 6.32% and N = 17.76%
The vapour density of the compound is 39.5.
[C = 12, H = 1, N = 14]

Solution 6:

(a) (i) Platinum is used as a catalyst to oxidise ammonia.
(ii) Acetic acid (CH_3COOH)
(iii) Nitric acid (HNO_3)

(b) The given equation is

$$2NaOH + CuSO_4 \rightarrow Na_2SO_4 + Cu(OH)_2 \downarrow$$

(i) Molecular weight of NaOH, Sodium hydroxide = 23+16+1=40

Molecular weight of $Cu(OH)_2$,
Copper hydroxide= 64+16+1+16+1=98
Now, 40g of NaOH is used to precipitate 98g of $Cu(OH)_2$.

Hence, 200g of NaOH will be used to precipitate (98/40)200 g of $Cu(OH)_2$ =490g of $Cu(OH)_2$.
So, 490g of copper hydroxide would be prepared using 200g of sodium hydroxide.

(ii) A light blue precipitate of $Cu(OH)_2$ will be formed.

(c)

Element	% composition	Atomic mass	Atomic ratio	Simplest ratio
C	75.92	12	$\frac{75.92}{12} = 6.32$	$\frac{6.32}{1.26} = 5$
H	6.32	1	$\frac{6.32}{1} = 6.32$	$\frac{6.32}{1.26} = 5$
N	17.76	14	$\frac{17.76}{14} = 1.26$	$\frac{1.26}{1.26} = 1$

So, the compound has the empirical formula of the compound is C_5H_5N.

Now,

Molecular weight = 2 × vapour density

= 2 × 39.5

= 79

So, molecular mass of the given compound is 79.

Thus, empirical formula mass is 79.

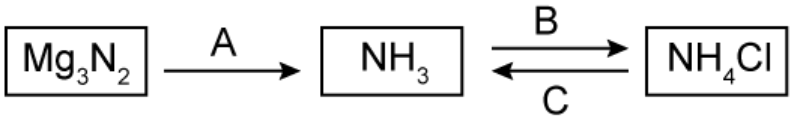
Since, Empirical formula mass = molecular mass

Therefore, the molecular formula is C_5H_5N.

Question 7

(a) Name the gas evolved in each of the following cases. [3]
   (i) Alumina undergoes electrolytic reduction.
   (ii) Ethene undergoes hydrogenation reaction.
   (iii) Ammonia reacts with heated copper oxide.

(b) Study the flow chart given and give balanced equations to represent the reactions A, B and C:
   [3]



(c) Copy and complete the following table which refers to the **industrial method for the preparation** of ammonia and sulphuric acid: [4]

Name of the compound	Name of the process	Catalytic equation (with the catalyst)
Ammonia	(i) _____	(ii) _____
Sulphuric acid	(iii) _____	(iv) _____

Solution 7:

(a) (i) Carbon dioxide gas

(ii) Ethane gas

(iii) Nitrogen gas

(b) The flow chart can be completed as follows:

$$Mg_3N_2 \xrightarrow{H_2O(A)} NH_3 \underset{Ca(OH)_2(C)}{\overset{HCl(B)}{\rightleftharpoons}} NH_4Cl$$

The full reaction is follows:

$$Mg_3N_2 + \underset{A}{6H_2O} \rightarrow 3Mg(OH)_2 + 2NH_3$$

$$\underset{(B)}{NH_3} + HCl \rightarrow NH_4Cl$$

$$\underset{(C)}{NH_4Cl} + Ca(OH)_2 \rightarrow 2NH_3 + 2H_2O + CaCl_2$$

(c) Details of industrial processes-

Name of the compound	Name of the process	Catalytic equation (with the catalyst)

Ammonia	(i) Haber's Process	(ii) $N_2(g) + H_2(g) \underset{K_2O+Al2O_3}{\overset{\text{Iron oxide}}{\rightleftharpoons}} \underset{\text{Ammonia}}{2NH_3(g)}$
Sulphuric acid	(iii) Contact Process	(iv) $2SO_2 + O_2(g) \xrightarrow{V_2O_5} 2SO_3(g) \xrightarrow{H_2SO_4} \underset{\text{Oleum}}{H_2S_2O_7}$