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**CHEMISTRY**  
**SCIENCE Paper – 2**

(Two hours)

*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.*

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**Section I** is compulsory. Attempt **any four** questions from **Section II**.

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

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**SECTION I (40 Marks)**

*Attempt all questions from this Section*

**Question 1**

- (a) Select from the list **the gas** that matches the description given in each case:

*[ammonia, ethane, hydrogen chloride, hydrogen sulphide, ethyne]*

- (i) This gas is used as a reducing agent in reducing copper oxide to copper.
- (ii) This gas produces dense white fumes with ammonia gas.
- (iii) This gas is used for welding purposes.
- (iv) This gas is also a saturated hydrocarbon.
- (v) This gas has a characteristic rotten egg smell. [5]

- (b) Choose the **most appropriate** answer for each of the following:

- (i) Among the elements given below, the element with the least electronegativity is:
  - (A) Lithium
  - (B) Carbon
  - (C) Boron
  - (D) Fluorine

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**This Paper consists of 8 printed pages.**

**T15 522**

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**Turn over**

- (ii) Identify the statement which does **not** describe the property of alkenes:
- (A) They are unsaturated hydrocarbons
  - (B) They decolourise bromine water
  - (C) They can undergo addition as well as substitution reactions
  - (D) They undergo combustion with oxygen forming carbon dioxide and water.
- (iii) This is **not** an alloy of copper:
- (A) Brass
  - (B) Bronze
  - (C) Solder
  - (D) Duralumin.
- (iv) Bonding in this molecule can be understood to involve coordinate bonding.
- (A) Carbon tetrachloride
  - (B) Hydrogen
  - (C) Hydrogen chloride
  - (D) Ammonium chloride
- (v) Which of the following would weigh the least?
- (A) 2 gram atoms of Nitrogen.
  - (B) 1mole of Silver
  - (C) 22.4 litres of oxygen gas at 1atmospheric pressure and 273K
  - (D)  $6.02 \times 10^{23}$  atoms of carbon.

[Atomic masses: Ag=108, N=14, O=16, C=12]

[5]

- (c) Complete the following calculations. Show working for complete credit:

- (i) Calculate the mass of Calcium that will contain the same number of atoms as are present in 3.2 gm of Sulphur.

[Atomic masses: S=32, Ca=40]

[2]

- (ii) If 6 litres of hydrogen and 4 litres of chlorine are mixed and exploded and if water is added to the gases formed, find the volume of the residual gas.

[2]

- (iii) If the empirical formula of a compound is CH and it has a vapour density of 13, find the molecular formula of the compound.

[1]

- (d) State **one relevant observation** for each of the following:

- (i) When crystals of copper nitrate are heated in a test tube.

- (ii) When the gaseous product obtained by dehydration of ethyl alcohol is passed through bromine water.
- (iii) When hydrogen sulphide gas is passed through lead acetate solution.
- (iv) When ammonia gas is burnt in an atmosphere of excess oxygen.
- (v) At the Anode when aqueous copper sulphate solution is electrolysed using copper electrodes. [5]
- (e) Identify *the acid* which matches the following description (i) to (v):
- (i) The acid which is used in the preparation of a non-volatile acid.
- (ii) The acid which produces sugar charcoal from sugar.
- (iii) The acid which is prepared by catalytic oxidation of ammonia.
- (iv) The acid on mixing with lead nitrate solution produces a white precipitate which is insoluble even on heating.
- (v) The acid on mixing with silver nitrate solution produces a white precipitate which is soluble in excess ammonium hydroxide. [5]
- (f) Give *appropriate scientific reasons* for the following statements:
- (i) Zinc oxide can be reduced to zinc by using carbon monoxide, but aluminium oxide cannot be reduced by a reducing agent.
- (ii) Carbon tetrachloride does not conduct electricity.
- (iii) During electrolysis of molten lead bromide graphite anode is preferred to other electrodes.
- (iv) The electrical conductivity of acetic acid is less in comparison to the electrical conductivity of dilute sulphuric acid at a given concentration.
- (v) Electrolysis of molten lead bromide is considered to be a redox reaction. [5]
- (g) (i) Give *balanced chemical equations* for the following conversions A, B and C:
- $$\text{Fe} \xrightarrow{\text{A}} \text{FeCl}_3 \xrightarrow{\text{B}} \text{FeCO}_3 \xrightarrow{\text{C}} \text{Fe(NO}_3)_2$$
- [3]
- (ii) Differentiate between the terms *strong electrolyte and weak electrolyte*. [2]  
(stating any two differences)
- (h) Answer the following questions:
- (i) Explain the bonding in methane molecule using electron dot structure. [2]

- (ii) The metals of Group 2 from top to bottom are Be, Mg, Ca, Sr, and Ba.
- (1) Which one of these elements will form ions most readily and why?
  - (2) State the common feature in the electronic configuration of all these elements.

[3]

## SECTION II (40 Marks)

*Attempt any four questions from this Section*

### Question 2

- (a) Arrange the following as per the *instructions* given in the brackets:
- (i) Cs, Na, Li, K, Rb (increasing order of metallic character).
  - (ii) Mg, Cl, Na, S, Si (decreasing order of atomic size).
  - (iii) Na, K, Cl, S, Si (increasing order of ionization energy)
  - (iv) Cl, F, Br, I (increasing order of electron affinity)
- (b) Choose the most appropriate answer from the following list of oxides which fit the *description*. Each answer may be used only once:

[SO<sub>2</sub>, SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, MgO, CO, Na<sub>2</sub>O]

- (i) A basic oxide.
  - (ii) An oxide which dissolves in water forming an acid.
  - (iii) An amphoteric oxide.
  - (iv) A covalent oxide of a metalloid.
- (c) Element X is a metal with a valency 2, Y is a non-metal with a valency 3.
- (i) Write an equation to show how Y forms an ion.
  - (ii) If Y is a diatomic gas, write an equation for the direct combination of X and Y to form a compound.

[4]

[4]

[2]

### Question 3

- (a) Give balanced *chemical equations* for the following *conversions*:
- (i) Ethanoic acid to ethyl ethanoate.
  - (ii) Calcium carbide to ethyne.
  - (iii) Sodium ethanoate to methane.

[3]

- (b) Using their structural formulae identify the functional group by circling them:
- Dimethyl ether.
  - Propanone.
- (c) Name the following:
- Process by which ethane is obtained from ethene.
  - A hydrocarbon which contributes towards the *greenhouse* effect.
  - Distinctive reaction that takes place when ethanol is treated with acetic acid.
  - The property of elements by virtue of which atoms of the element can link to each other in the form of a long chain or ring structure.
  - Reaction when an alkyl halide is treated with alcoholic potassium hydroxide.

[2]

[5]

#### Question 4

- (a) Identify the *anion* present in each of the following compounds:
- A salt **M** on treatment with concentrated sulphuric acid produces a gas which fumes in moist air and gives dense fumes with ammonia.
  - A salt **D** on treatment with dilute sulphuric acid produces a gas which turns lime water milky but has no effect on acidified potassium dichromate solution.
  - When barium chloride solution is added to salt solution **E** a white precipitate insoluble in dilute hydrochloric acid is obtained.
- (b) The following table shows the tests a student performed on four different aqueous solutions which are **X**, **Y**, **Z** and **W**. Based on the observations provided, identify the cation present:

[3]

Chemical test	Observation	Conclusion
To solution <b>X</b> , ammonium hydroxide is added in minimum quantity first and then in excess.	A dirty white precipitate is formed which dissolves in excess to form a clear solution.	(i)

To solution <b>Y</b> ammonium hydroxide is added in minimum quantity first and then in excess.	A pale blue precipitate is formed which dissolves in excess to form a clear inky blue solution.	(ii)
To solution <b>W</b> a small quantity of sodium hydroxide solution is added and then in excess.	A white precipitate is formed which remains insoluble.	(iii)
To a salt <b>Z</b> calcium hydroxide solution is added and then heated.	A pungent smelling gas turning moist red litmus paper blue is obtained.	(iv)

[4]

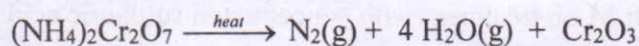
(c) Give balanced chemical equations for each of the following:

- Lab preparation of ammonia using an ammonium salt.
- Reaction of ammonia with excess chlorine.
- Reaction of ammonia with sulphuric acid.

[3]

### Question 5

(a) Consider the following reaction and based on the reaction answer the questions that follow:



Calculate:

- the quantity in moles of  $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$  if 63gm of  $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$  is heated. [1]
- the quantity in moles of nitrogen formed. [1]
- the volume in litres or  $\text{dm}^3$  of  $\text{N}_2$  evolved at S.T.P. [1]
- the mass in grams of  $\text{Cr}_2\text{O}_3$  formed at the same time. [2]

[Atomic masses: H=1, Cr= 52, N=14]

(b) (i) For each of the substance listed below, describe the role played in the extraction of aluminium.

- Cryolite
- Sodium hydroxide
- Graphite.

[3]

(ii) Explain why:

- In the electrolysis of alumina using the Hall Heroult's Process the electrolyte is covered with powdered coke.

(2) Iron sheets are coated with zinc during galvanization. [2]

### Question 6

(a) (i) Give balanced chemical equations for the action of sulphuric acid on each of the following:

(1) Potassium hydrogen carbonate.

(2) Sulphur. [2]

(ii) In the contact process for the manufacture of sulphuric acid give the equations for the conversion of sulphur trioxide to sulphuric acid. [2]

(b) (i) Copy and complete the following table:

	Anode	Electrolyte
Purification of copper		

[2]

(ii) Write the equation taking place at the anode. [1]

(c) Explain the following:

(i) Dilute nitric acid is generally considered a typical acid but not so in its reaction with metals.

(ii) Concentrated nitric acid appears yellow when it is left standing in a glass bottle.

(iii) An all glass apparatus is used in the laboratory preparation of nitric acid. [3]

### Question 7

(a) The following questions are pertaining to the laboratory preparation of hydrogen chloride gas:

(i) Write the equation for its preparation mentioning the condition required. [1]

(ii) Name the drying agent used and justify your choice. [2]

(iii) State a safety precaution you would take during the preparation of hydrochloric acid. [1]

(b) An element **L** consists of molecules.

(i) What type of bonding is present in the particles that make up **L**?

(ii) When **L** is heated with iron metal, it forms a compound **FeL**. What chemical term would you use to describe the change undergone by **L**? [2]

- (c) From the list of the following salts choose the salt that most appropriately fits the description given in the following:

[AgCl, MgCl<sub>2</sub>, NaHSO<sub>4</sub>, PbCO<sub>3</sub>, ZnCO<sub>3</sub>, KNO<sub>3</sub>, Ca(NO<sub>3</sub>)<sub>2</sub>]

- (i) A deliquescent salt.
- (ii) An insoluble chloride.
- (iii) On heating, this salt gives a yellow residue when hot and white when cold.
- (iv) On heating this salt, a brown coloured gas is evolved.

[4]