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ICSE

SOLVED PAPER 2018

CLASS 10

CHEMISTRY

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LATEST SYLLABUS

Chemistry

CLASS 10

*There will be **one** paper of **two** hours duration of 80 marks and Internal Assessment of practical work carrying 20 marks.*

*The paper will be divided into **two** sections, Section I (40 marks) and Section II (40 marks).*

***Section I** (compulsory) will contain short answer questions on the entire syllabus.*

***Section II** will contain **six** questions. Candidates will be required to answer any **four** of these six questions.*

***Note :** All chemical process/reactions should be studied with reference to the reactants, products, conditions, observation, the (balanced) equation and diagram.*

1. Periodic Properties and variations of Properties – Physical and Chemical.

(i) Periodic properties and their variations in groups and periods.

Definitions of following periodic properties and trends in these properties in groups and periods should be studied:

- *atomic size,*
- *metallic character*
- *non-metallic character*
- *ionisation potential*
- *electron affinity*
- *electronegativity*

(ii) Periodicity on the basis of atomic number for elements.

Relation between atomic number for light elements (proton number) and atomic mass for light elements; the modern periodic table up to period 3 (students to be exposed to the complete modern periodic table but no questions will be asked on elements beyond period 3 – Argon); periodicity and other related properties to be described in terms of shells (not orbitals); special reference to the alkali metals and halogen groups.

2. Chemical Bonding

Electrovalent, covalent and co-ordinate bonding, structures of various compounds – orbit structure and electron dot structure.

Definition of Electrovalent Bond.

Structure of Electrovalent compounds NaCl, $MgCl_2$, CaO; Characteristic properties of electrovalent compounds – state of existence, melting and boiling points, conductivity (heat and electricity), ionisation in solution, dissociation in solution and in molten state to be linked with electrolysis.

Covalent Bond – definition and examples, structure of Covalent molecules on the basis of duplet and octet of electrons (example : hydrogen, chlorine, nitrogen, water, ammonia, carbon tetrachloride, methane.)

Characteristic properties of Covalent compounds – state of existence, melting and boiling points, conductivity (heat and electricity), ionisation in solution.

Comparison of Electrovalent and Covalent compounds.

Definition of Coordinate Bond: The lone pair effect of the oxygen atom of the water molecule and the nitrogen atom of the ammonia molecule to explain the formation of H_3O^+ and OH^- ions in water and NH_4^+ ion. The meaning of lone pair; the formation of hydronium ion and ammonium ion must be explained with help of electron dot diagrams.

3. Study of Acids, Bases and Salts

(i) Simple definitions in terms of the molecules and their characteristic properties.

Self-explanatory.

(ii) Ions present in mineral acids, alkalis and salts and their solutions; use of litmus and pH paper to test for acidity and alkalinity.

Examples with equation for the ionisation/dissociation of ions of acids, bases and salts: acids form hydronium ions (only positive ions) which turn blue litmus red, alkalis form hydroxyl ions (only negative ions) with water which turns red litmus blue. Salts are formed by partial or complete replacement of the hydrogen ion of an acid by a metal should be explained with suitable examples. Introduction to pH scale to test for acidity, neutrality and alkalinity by using pH paper or Universal indicator.

(iii) Definition of salt; types of salts :

Types of salts: normal salts, acid salt, basic salt, definition and examples.

(iv) General properties of salts :

- *Deliquescence, efflorescence, water of crystallization.*

Definition and example of each of the above.

- *Decomposition of hydrogen carbonates, carbonates, chlorides and nitrates by appropriate acids with heating if necessary. (relevant laboratory work must be done).*

Action of dilute acids on carbonates, hydrogen carbonates and action of concentrated acid. Equations of formation of Acid rain. (Sulphuric acid) on chlorides and nitrates, to obtain carbon dioxide, hydrogen

chloride and nitric acid, respectively should be taught. This will assist the students in their practical work.

(v) Preparation: laboratory preparation of salts (normal and acid salts) – relevant laboratory work is essential (no apparatus details are required).

Laboratory preparation of salts (normal and acid salts): Direct combination; decomposition; displacement; double decomposition; neutralization.

4. Analytical Chemistry – Use of Ammonium Hydroxide and Sodium Hydroxide

(i) On solution of salts: colour of salt and its solution; formation and colour of hydroxide precipitated for solutions of salts of Ca, Fe, Cu, Zn and Pb; special action of ammonium hydroxide on solutions of copper salt and sodium hydroxide on ammonium salts.

On solution of salts:

- *Colour of salt and its solution.*
- *Action on addition of Sodium Hydroxide to solution of Ca, Fe, Cu, Zn, and Pb salts drop by drop in excess. Formation and colour of hydroxide precipitated to be highlighted. with the help of equations.*
- *Action on addition of Ammonium Hydroxide to solution of Ca, Fe, Cu, Zn, and Pb salts drop by drop in excess. Formation and colour of hydroxide precipitated to be highlighted with the help of equations.*
- *Special action of Ammonium Hydroxide on solutions of copper salts and sodium hydroxide on ammonium salts.*

(ii) On certain metals and their oxides (relevant laboratory work is essential).

The metals must include zinc and aluminium, their oxides and their hydroxides, which react with caustic alkalis (NaOH, KOH), showing the amphoteric nature of these substances.

5. Mole Concept and Stoichiometry

(i) Gay Lussac's Law of Combining Volumes; Avogadro's Law.

Idea of mole – a number just as dozen, a gross; Avogadro's Law - statement and explanation; Gay Lussac's Law of Combining Volumes. – statement and explanation, "the mass of 22.4 litres of any gas at S.T.P. is equal to its molar mass". (Questions will not be set on formal proof but may be taught for clear understanding) – simple calculations based on the molar volume.

(ii) Refer to the atomicity of hydrogen, oxygen, nitrogen and chlorine (proof not required).

The explanation can be given using equations for the formation of HCl, NH_3, and NO.

(iii) Relative atomic masses (atomic weight) and relative molecular masses (molecular weights): either H=1 or $^{12}C=12$ will be accepted; molecular mass = 2×vapour density (formal proof not required).

Deduction of simple (empirical) and molecular formula from the percentage composition of a compound; the molar volume of a gas at S.T.P.; simple calculations based on chemical equations; both reacting weight and volumes.

Idea of relative atomic mass and relative molecular mass – standard H atom or $1/12^{th}$ of carbon 12 atom.

Relating mole and atomic mass; arriving at gram atomic mass and then gram atom; atomic mass is a number dealing with one atom; gram atomic mass is the mass of one mole of atoms.

Relating mole and molecular mass arriving at gram molecular mass and gram molecule – molecular mass is a number dealing with a molecule, gram molecular mass is the mass of one mole of molecules.

Molecular mass = 2×vapour density (questions will not be set on formal proof but may be taught for clear understanding); - simple calculations based on the formula.

Deduction of simple (empirical) and molecular formula from the percentage composition of a compound.

6. Electrolysis

(i) Electrolytes and non-electrolytes.

Definitions and examples.

(ii) Substances containing molecules only, ions only, both molecules and ions.

Substances containing molecules only, ions only, both molecules and ions. Examples; relating their composition with their behaviour as electrolyte (strong and weak), non-electrolyte.

Definition and explanation of electrolysis, electrolyte, electrode, anode, cathode, anion, cation, oxidation and reduction (on the basis of loss and gain of electrons).

(iii) An elementary study of the migration of ions, with reference to the factors influencing selective discharge of ions, illustrated by the electrolysis

of: molten lead bromide; acidified water with platinum electrodes and aqueous copper (II) sulphate with copper electrodes; electron transfer at the electrodes.

The above electrolytic processes can be studied in terms of electrolyte used, electrodes used, ionization reaction, anode reaction, cathode reaction, use of selective discharge theory wherever applicable.

(iv) Applications of electrolysis : electroplating with nickel and silver; purification of copper; choice of electrolyte for electroplating.

Reasons and conditions for electroplating; names of the electrolytes and the electrodes used should be given. Equations for the reactions at the electrodes should be given for electroplating, refining of copper.

(v) Acids, bases and salts as electrolytes : reference should be made to the activity series as indicating the tendency of metals, e.g. Na, Mg, Fe, Cu, to form ions.

7. Metallurgy

(i) Definition of Metals and Non-metals.

Self-explanatory.

(ii) Position of the metals (alkali metals and alkaline earth metals) in the Periodic table and general characteristics applied to these elements with reference to the following – occurrence, nature, bonding, action of air, action of water, action of acids.

Self-explanatory.

(iii) Comparison of Metals and Non-metals.

General properties with special reference to physical properties: state, lustre, melting point, density, ductility, malleability, brittleness, conduction of electricity (exceptions to be specifically noted - e.g. graphite, mercury); chemical properties: a metal forms at least one basic oxide; nonmetal, an acidic or neutral oxide; discharge of metallic ions at the cathode from fused metallic chlorides (link with bonding and ion formation); many metals liberate hydrogen from dilute HCl and H_2SO_4. In the physical properties of metals and non-metals, atomicity and valence electrons should also be included; suitable examples must be given for basic, acidic and neutral oxides; formation and discharge of ions at the cathode (metallic) and anode (non-metallic) should be explained with examples.

(iv) Reduction of metallic oxides; some can be reduced by hydrogen, carbon and carbon monoxide (e.g. copper oxide, lead oxide, iron (II) oxide) and some cannot (e.g. Al_2O_3, MgO) - refer to activity series).

Equations with conditions and observations should be given.

(v) Extraction of metals based on the activity series.

Extraction of metals: principle of extraction of metal from its compounds by reduction – carbon reduction, electrolytic reduction. Active metals by electrolysis e.g. sodium, aluminium (reference only).

(vi) Corrosion of iron and its prevention.

Experiment to illustrate that moisture and oxygen in air are responsible for the corrosion. Reaction of corrosion. Prevention by painting and galvanization.

(vii) Metals and their alloys: common ores of iron, aluminium and zinc. Extraction of Aluminium.

Metals and their alloys: Occurrence of metals in nature - mineral and ore. Common ores of iron, aluminium and zinc. Dressing of the ore – hydrolytic method, magnetic separation, froth flotation method, chemical method by using chemical - NaOH for purifying bauxite – Baeyer's Process.

Extraction of Aluminium: the constituents in the charge, method of electrolytic extraction (flow chart to be used); structure of electrolytic cell and reason for using cryolite, electrolyte, electrodes, electrode reaction.

Description of the changes occurring, purpose of the substances used and the main reactions with their equations.

(a) Uses of iron, aluminium and zinc and their alloys.

Uses of iron, aluminium and zinc and their alloys. Composition of their alloys – steel, duralumin, brass.

(b) Other important alloys – bronze, fuse metal and solder.

Uses only.

8. Study of Compounds

■ Hydrogen Chloride

Hydrogen chloride: preparation of hydrogen chloride from sodium chloride; refer to the density and solubility of hydrogen chloride (fountain experiment); reaction with ammonia; acidic properties of its solution.

Preparation of hydrogen chloride from sodium chloride; (the laboratory method of preparation can be learnt in terms of reactants, product, condition,

equation, diagram or setting of the apparatus, procedure, observation, precaution, collection of the gas and identification).

Simple experiment to show the density of the gas (Hydrogen Chloride) –heavier than air. Solubility of hydrogen chloride (fountain experiment); (setting of the apparatus, procedure, observation, inference) – method of preparation of hydrochloric acid by dissolving the gas in water- the special arrangement and the mechanism by which the back suction is avoided should be learnt.

Reaction with ammonia

Acidic properties of its solution - (reaction with metals, their oxides, hydroxides and carbonates to give their chlorides; decomposition of carbonates, hydrogen carbonates, sulphides, sulphites, thiosulphates and nitrates).

■ Ammonia

(i) Ammonia: its laboratory preparation from ammonium chloride and collection; ammonia from nitrides like Mg_3N_2 and AlN and ammonium salts. Manufacture by Haber's Process; density and solubility of ammonia (fountain experiment); aqueous solution of ammonia; its reactions with hydrogen chloride and with hot copper (II) oxide and chlorine; the burning of ammonia in oxygen; uses of ammonia.

Laboratory preparation from ammonium chloride and collection (the preparation can be studied in terms of, setting of the apparatus and diagram, procedure, observation, collection and identification).

Manufacture of ammonia on a large scale - reference should be made to Haber Process for the manufacture of ammonia.

Ammonia from nitrides like Mg_3N_2 and AlN and ammonium salts; the reactions can be studied in terms of reactant, product, condition, equation.

Density and solubility of ammonia (fountain experiment); the property can be learnt in terms of setting of the apparatus, procedure and observation and inference.

Aqueous solution of ammonia - reaction with sulphuric acid, nitric acid, hydrochloric acid and solutions of iron (III) chloride, iron (II) sulphate, lead nitrate, zinc nitrate and copper sulphate.

Its reaction with: hydrogen chloride, hot copper (II) oxide, with chlorine in excess and ammonia in excess, burning of ammonia in oxygen; all these reactions may be studied in terms of reactants, products, condition, equation and observation; reference should be made to preparation of nitrogen from air and from ammonium nitrite.

Uses of ammonia - manufacture of fertilizers, explosives, nitric acid, refrigerant gas (Chlorofluro carbon – and its suitable alternatives which are non-ozone depleting), cleansing agents, source of hydrogen.

(ii) The catalytic oxidation of ammonia, as the source of nitric acid; (refer to Ostwald process) simple diagram for a catalytic oxidation of ammonia in the laboratory (with conditions and reactions only).

Self-explanatory.

■ Nitric Acid

Nitric Acid: one laboratory method of preparation of nitric acid from potassium nitrate or sodium nitrate. Nitric acid as an oxidizing agent.

Nitric Acid: Laboratory method of preparation of nitric acid from potassium nitrate or sodium nitrate; the laboratory method can be studied in terms of reactant, product, condition, equation, setting, diagram, precaution, collection, identification.

As an oxidising agent: its reaction with copper, carbon, sulphur.

■ Sulphuric Acid

Sulphuric Acid: its behaviour as an acid when dilute, as an oxidizing agent when concentrated - oxidation of carbon and sulphur; as a dehydrating agent - dehydration of sugar and copper (II) sulphate crystals; its non-volatile nature.

Manufacture by Contact process (reference only). Detail of the process to be avoided.

Its behaviour as an acid when dilute - reaction with metal, metal oxide, metal hydroxide, metal carbonate, metal bicarbonate, metal sulphite, metal sulphide.

Concentrated sulphuric acid as an oxidizing agent - the oxidation of carbon and sulphur.

Concentrated sulphuric acid as a dehydrating agent- (a) the dehydration of sugar (b) Copper(II) sulphate crystals.

Non-volatile nature of sulphuric acid - reaction with sodium or potassium chloride and sodium or potassium nitrate.

9. Organic Chemistry

(i) Introduction to Organic compounds.

Unique nature of Carbon atom – tetra valency, catenation, formation of single, double and triple bonds, straight chain, branched chain and cyclic compounds.

(ii) Structure and Isomerism.

Structure of compounds with single, double and triple bonds; Isomerism – structural (chain, position)

(iii) Homologous series – characteristics with examples.

Alkane, alkene, alkyne series and their gradation in properties and the relationship with the molecular mass or molecular formula.

(iv) Simple nomenclature.

Simple nomenclature - of the hydrocarbons with simple functional groups – (double bond, triple bond, alcoholic, ether, aldehydic, keto, carboxylic group) longest chain rule and smallest number for functional groups rule – trivial and IUPAC names.

(v) Hydrocarbons : alkanes, alkenes, alkynes.

Alkanes - general formula; methane (greenhouse gas) and ethane - methods of preparation from sodium ethanoate (sodium acetate), sodium propanoate (sodium propionate), from iodomethane (methyl iodide) and bromoethane (ethyl bromide). Oxidation of methane and ethane in presence of oxygen under suitable conditions, reaction of methane and ethane with chlorine through substitution.

Alkenes – (unsaturated hydrocarbons with a double bond); ethene as an example. Methods of preparation of ethene by dehydro halogenation reaction and dehydration reactions.

Alkynes -(unsaturated hydrocarbons with a triple bond); ethyne as an example of alkyne; Methods of preparation from calcium carbide and 1,2 dibromoethane ethylene dibromide). Only main properties, particularly addition products with hydrogen and halogen namely Cl, Br and I; structural formulae of hydrocarbons. Structural formula must be given for: alkanes (up to butane), alkene (C_2H_4); alkynes (C_2H_2). Uses of methane, ethane, ethene, acetylene.

(vi) Alcohols: ethanol – preparation, properties and uses.

Preparation of ethanol :

- *hydration of ethene;*
- *by hydrolysis of alkyl halide;*
- *Properties – Physical: Nature, Solubility, Density, Boiling Points. Chemical: Combustion, Oxidation with acidified Potassium dichromate, action with sodium, ester formation with acetic acid, dehydration with conc. Sulphuric acid with reference to Ethanol.*
- *Denatured alcohol:*
- *Important uses of Ethanol.*

(vii) Carboxylic acids (aliphatic - mono carboxylic acid): Acetic acid – preparation, properties and uses of acetic acid.

Preparation of acetic acid from Ethyl alcohol.

Properties of Acetic Acid: Physical properties – odour (vinegar), glacial acetic acid (effect of sufficient cooling to produce ice like crystals). Chemical properties – action with litmus, alkalis and alcohol (idea of esterification).

Uses of acetic acid.

EVALUATION

The assignments/project work are to be evaluated by the subject teacher and by an External Examiner. (The External Examiner may be a teacher nominated by the Head of the school, who could be from the faculty, **but not teaching the subject in the section/class.** For example, a teacher of Chemistry of Class VIII may be deputed to be an External Examiner for Class X Chemistry projects.)

The Internal Examiner and the External Examiner will assess the assignments independently.

Award of marks	**(20 Marks)**
Subject Teacher (Internal Examiner)	10 marks
External Examiner	10 marks

The total marks obtained out of 20 are to be sent to the Council by the Head of the school.

The Head of the school will be responsible for the entry of marks on the mark sheets provided by the Council.

NOTE : *According to the recommendation of International Union of Pure and Applied Chemistry (IUPAC), the groups are numbered from 1 to 18 replacing the older notation of groups IA ….. VIIA, VIII, IB …… VIIB and 0. However, for the examination both notations will be accepted.*

Old notation	IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIII			IB	IIB	IIIA	IVA	VA	VIA	VIIA	0
New notation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

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ICSE Solved Paper, 2018
Class-X
Chemistry

(Maximum Marks : 80)
(Time allowed : Two hours)

(i) Answers to this Paper must be written on the paper provided separately
(ii) You will not be allowed to write during the first 15 minutes
(iii) This time is to be spent in reading the Question Paper
(iv) 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 **Section 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) The salt solution which does not reach with *ammonium hydroxide* is:
A. Calcium Nitrate
B. Zinc Nitrate
C. Lead Nitrate
D. Copper Nitrate

(ii) The organic compound which undergoes *substitution reaction* is:
A. C_2H_2
B. C_2H_4
C. $C_{10}H_{18}$
D. C_2H_6

(iii) The *electrolysis of acidified water is* an example of:
A. Reduction
B. Oxidation
C. Redox reaction
D. Synthesis

(iv) The *IUPAC* name of dimethyl ether is:
A. Ethoxy methane
B. Methoxy methane
C. Methoxy ethane
D. Ethoxy ethane

(v) The catalyst used in the *Contact Process* is:
A. Copper
B. Iron
C. Vanadium pentaoxide
D. Manganese dioxide

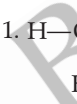
(b) Give **one word** or a **phrase** for the following statements: **[5]**

(i) The energy released when a electron is added to a neutral gaseous isolated atom to form a negatively charged ion.
(ii) Process of formation of ions from molecules which are not in ionic state.
(iii) The tendency of an element to form chains of identical atoms.
(iv) The property by which certain hydrated salts, when left exposed to atmosphere, lose their water of crystallization and crumble into powder.
(v) The process by which sulphide ore is concentrated.

(c) Write a *balanced chemical equation* for each of the following: **[5]**

(i) Action of concentrated sulphuric acid on carbon.
(ii) Reaction of sodium hydroxide solution with iron (III) chloride solution.
(iii) Action of heat on aluminium hydroxide.
(iv) Reaction of zinc with potassium hydroxide solution.
(v) Action of dilute hydrochloric acid on magnesium sulphide.

(d) (i) Give the IUPAC name for each of the following: **[5]**

1.


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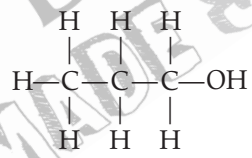

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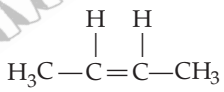


(ii) Write the structural formula of the two isomers of butane.

(e) State one *relevant observation* for each of the following: **[5]**

(i) Lead nitrate solution is treated with sodium hydroxide solution drop wise till it is in excess.
(ii) At the anode, when molten lead bromide is electrolyzed using graphite electrodes.
(iii) Lead nitrate solution is mixed with dilute hydrochloric acid and heated.
(iv) Anhydrous calcium chloride is exposed to air for some time.

(v) Barium chloride solution is slowly added to sodium sulphate solution.

(f) Give a *reason* for each of the following: **[5]**
(i) Ionic compounds have a high melting point.
(ii) Inert gases do not form ions.
(iii) Ionisation potential increases across a period, from left to right.
(iv) Alkali metals are good reducing agents.
(v) Conductivity of dilute hydrochloric acid is greater than that of acetic acid.

(g) **Name the gas** that is produced in each of the following cases: **[5]**
(i) Sulphur is oxidized by concentrated nitric acid.
(ii) Action of dilute hydrochloric acid on sodium sulphide.
(iii) Action of cold and dilute nitric acid on copper.
(iv) At the anode during the electrolysis of acidified water.
(v) Reaction of ethanol and sodium.

(h) Fill up the blanks with the correct choice given in brackets. **[5]**
(i) Ionic or electrovalent compounds do not conduct electricity in their _____ state. *(fused / solid).*
(ii) Electrolysis of aqueous sodium chloride solution will form _____ at the cathode. *(hydrogen gas / sodium metal)*
(iii) Dry hydrogen chloride gas can be collected by _____ displacement of air. *(downward / upward)*
(iv) The most common ore of iron is _____. *(calamine / haematite)*
(v) The salt prepared by the method of direct combination is _____. *(iron (II) chloride / iron (III) chloride)*

SECTION - II

(40 Marks)

Attempt any four questions from this Section.

Question 2

(a) (i) What do you understand by a lone pair of electrons? **[3]**
(ii) Draw the electron dot diagram of Hydronium. (H=1; O=8)

(b) *In Period 3 of the Periodic Table, element **B** is placed to the left of element **A**.* **[3]**
On the basis of this information, choose the correct word from the brackets to complete the following statements:
(i) The element **B** would have *(lower / higher)* metallic character than **A**.
(ii) The element **A** would probably have *(lesser / higher)* electron affinity than **B**.
(iii) The element **A** would have *(greater / smaller)* atomic size than **B**.

(c) Copy and complete the following table which refers to the conversion of ions to neutral particles. **[4]**

Conversion	Ionic Equation	Oxidation / Reduction
Chloride ion to chlorine molecule	(i) _____	(ii) _____
Lead (II) ion to lead	(iii) _____	(iv) _____

Question 3

(a) (i) Write the balanced chemical equation to prepare ammonia gas in the laboratory by using an alkali. **[3]**
(ii) State why concentrated sulphuric acid is not used for drying ammonia gas.
(iv) Why is ammonia gas not collected over water?

(b) (i) Name the acid used for the preparation of hydrogen chloride gas in the laboratory. Why is this particular acid preferred to other acids? **[3]**
(ii) Write the balanced chemical equation for the laboratory preparation of hydrogen chloride gas.

(c) For the preparation of hydrochloric acid in the laboratory.
(i) Why is direct absorption of hydrogen chloride gas in water not feasible?
(ii) What arrangement is done to dissolve hydrogen chloride gas in water?

(d) For the electro-refining of copper?
(i) What is cathode made up of
(ii) Write the reaction that takes place at the anode.

Question 4

(a) The percentage composition of a gas is:
Nitrogen 82.35%, Hydrogen 17.64%
Find the empirical formula of the gas.
[N=14, H=–1]

(b) Aluminium carbide reacts with water according to the following equation: **[4]**

$$Al_4C_3 + 12H_2O \rightarrow 4Al(OH)_3 + 3CH_4$$

(i) What mass of aluminium hydroxide is formed from 12g of aluminium carbide?
(ii) What volume of methane at s.t.p, is obtained from 12g of aluminium carbide?
[Relative molecular weight of Al_4C_3 = 144; $Al(OH)_3$ = 78]

(c) (i) If 150 cc of gas A contains X molecules, how many molecules of gas B will be present in 75. cc of B? **[2]**
The gases A and B are under the same conditions of temperature and pressure.
(ii) Name the law on which the above problem is based.

(d) Name the main component of the following alloys: **[2]**
(i) Brass
(ii) Duralumin

Question 5

(a) Complete the following table which relates to the homologous, series of hydrocarbons. **[6]**

General formula	IUPAC name of the homologous series	Characteristic bond type	IUPAC name of the first member of the series
C_nH_{2n-2}	(A) _____	(B) _____	(C) _____
C_nH_{2n+2}	(D) _____	(E) _____	(F) _____

(b) (i) Name the most common ore of the metal aluminium from which the metal is extracted. Write the chemical formula of the ore. **[4]**

(ii) Name the process by which impure ore of aluminium gets purified by using concentrated solution of an alkali.

(iii) Write the equation for the formation of aluminium at the cathode. During the electrolysis of alumina.

Question 6

(a) A compound X (having vinegar like smell) when treated with ethanol in the presence of the acid Z, gives a compound Y which has a fruity smell. **[4]**

The reaction is:

$$C_2H_5OH + X \xrightarrow{Z} Y + H_2O$$

(i) Identify Y and Z.

(ii) Write-the structural formula of X.

(iii) Name the above reaction.

(b) Ethane bum in oxygen to form CO_2 and H_2O according to the equation: **[4]**

$$2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O.$$

If 1250 cc of oxygen is burnt with 300 cc of ethane.

Calculate:

(i) the volume of CO_2 formed.

(ii) the volume of unused O2.

(c) Three solutions P, Q and R have pH value of 3.5, 5.2 and 12.2 respectively. **[2]**

Which one of these is a:

(i) Weak acid?

(ii) Strong alkali?

Question 7

(a) Give a chemical test to distinguish between the following pairs of chemicals: **[4]**

(i) Lead nitrate solution and Zinc nitrate solution

(ii) Sodium chloride solution and Sodium nitrate solution

(b) Write a balanced equation for the preparation of each of the following salts: **[4]**

(i) Copper sulphate from Copper carbonate.

(ii) Zinc carbonate from Zinc sulphate.

(c) (i) What is the type of salt formed when the reactants are heated at a suitable **[2]**
Temperature for the preparation of Nitric acid?

(ii) State why for the preparation of Nitric acid, the complete apparatus is made up of glass.

(d) Which property of sulphuric acid is shown by the reaction of concentrated sulphuric acid with: **[2]**

(i) Ethanol?

(ii) Carbon?

□□

SOLUTIONS

SECTION - I

Question 1

(a) (i) (D) Copper Nitrate

(ii) (D) C_2H_6 Δ Ethane is a saturated hydrocarbon and have C – C and C – H sigma bond only.

(iii) Redox reaction

$$2H_2O \longrightarrow \underset{\text{at anode}}{O_2} + \underset{\text{at cathode}}{2H_2}$$

Oxidation and reduction of water takes place

(iv) (B) $CH_3 - O - CH_3$
Methoxy Methane

(v) (C) V_2O_5 (Vanadium Pentaoxide) is used in contact process.

(b) (i) Electron affinity or electron gain enthalpy.

(ii) ionisation

(iii) catenation

(iv) Efflorescence

(v) Froth flotation

(c) (i) $C + 2H_2SO_4 \longrightarrow CO_2 + 2SO_2 + 2H_2O$

(ii) $FeCl_3 + 3NaOH \longrightarrow \underset{\text{red ppt}}{Fe(OH)_3} + 3NaCl$
[Insoluble hydroxide]

(iii) $2Al(OH)_3 \xrightarrow[1500^\circ C]{\Delta} \underset{\text{Alumina}}{Al_2O_3} + 3H_2O$

(iv) $Zn + 2KOH \longrightarrow \underset{\text{Potassium Zincate}}{K_2ZnO_2} + H_2$

(v) $MgSO_3 + 2HCl \longrightarrow MgCl_2 + H_2O + SO_2$

(d) (i) (1) H—C = O Methanal
|
H

(2) $CH_3 - CH_2 - CH_2 - OH$ Propane – 1 – ol

(3) $CH_3 - CH = CH - CH_3$ But – 2 – ene

(ii) $CH_3 - CH_2 - CH_2 - CH_3$ $CH_3—\underset{|}{\overset{CH_3}{CH}}—CH_3$

n – butane Iso – butane

(e) (i) Ppt of lead hydro oxide is obtained.

$Pb(NO_3)_2 + 2NaOH \longrightarrow Pb(OH)_2 + 2NaNO_3$

(ii) Br_2 gas is released with brown fumer

(iii) White ppt of $PbCl_2$ is formed.

$Pb(NO_3)_2 + 2HCl \longrightarrow \underset{\text{White ppt}}{PbCl_2} + 2HNO_3$

(iv) Since $CaCl_2$ is deliquescent substance. So it absorbs sufficient water from air to allow it do dissolve, when exposed to air for same time.

(v) $BaCl_2 + Na_2SO_4 \longrightarrow BaSO_4 + 2\,NaCl$
White ppt

(f) (i) In ionic solids, the constituent particles are positive and negative ions. These ions are held together by strong electrostatic forces of attraction so they have high melting point.

(ii) On a account of highly stable configuration in the valency shell, these elements have no tendency either to lose, gain or share electrons with the atoms of other elements.

(iii) As we move from left to right in the periodic table atomic size decreases and effective nuclear charge increases so ionisation potential increases.

(iv) Alkali metals have low value of ionisation potential so they can lose electron easily so they act as good reducing agent.

(v) $CH_3COOH \longleftarrow CH_3COO^- + H^+$
Weak electrolyte
Poorly-dissociate)

$HCl \longrightarrow H^+ + Cl^-$
Strong electrolyte
Completely dissociate

HCl is strong electrolyte and almost completely dissociated while CH_3 COOH is weak electrolyte and very poorly dissociated so number of ions produced in case of HCl is greater as compared to CH_3COOH. Hence HCl has greater conductivity as compare to CH_3COOH.

(g) (i) SO_2
(ii) H_2S
(iii) O_2
(iv) H_2
(v) H_2

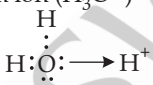
(h) (i) Solid
(ii) H_2 (hydrogen gas)
(iii) Downward
(iv) haematite
(v) Iron (III) Chloride

SECTION - II

Question 2

(a) (i) Those valence electrons which does not participate in the bond formation and remain in non bonded state are called lone pair of electrons.

(ii) Hydronium ion (H_3O^+)



(b) (i) Higher metallic character because metallic character decreases from left to right across the period. (higher)

(ii) Higher electron affinity because electron affinity increases from left to right across the period. (higher)

(iii) Smaller size because atomic size decreases from left to right across the period. (smaller)

(c)

Conversion	Ionic Equation	Oxidation / Reduction
Chloride ion to chlorine molecule	(i) $2Cl^-$ D $Cl_2 + 2e^-$	(ii) oxidation
Lead (II) ion to lead	(iii) $Pb^{+2} + 2e^{\#}\Delta$ Pb	(iv) reduction

Question 3

(a) (i) $Ca(OH)_2 + 2NH_4Cl \longrightarrow CaCl_2 + 2\,H_2O + 2NH_3\uparrow$

Slaked lime

(ii) Ammonia is basic in nature. It reacts with H_2SO_4 to form ammonium sulphate salt so conc. H_2SO_4 is not used for drying ammonia gas.

$2NH_3 + H_2SO_4 \longrightarrow (NH_4)_2\,SO_4$
ammonium sulphate

(iii) Ammonia is highly soluble in water so ammonia gas is not collected over water.

(b) (i) H_2SO_4 is used for the preparation of HCl gas in laboratory because it also acts as dehydrating agent.

(ii) $2\,NaCl(s) + H_2SO_4(aqu) \xrightarrow{Heat} Na_2SO_4(aqu) 2\,HCl(g)$

(c) (i) The reaction is highly exothermic .

(ii) As the reaction is exothermic, the installation is called HCl over burner is used. The HCl gas is absorbed in water resulting in chemically pure HCl.

(d) (i) Thin sheets of pure copper.

(ii) Reaction at anode :

$Cu + SO_4^- \longrightarrow CuSO_4 + 2e^-$

Element	Symbol	Percentage of elements	At mass of limits	moles = $\frac{\text{percentage}}{\text{at mass}}$	Simplest molar ratio	Simplest whole as molar ratio
Nitrogen	N	82.35	14	$\frac{82.35}{14} = 5.88$	$\frac{5.88}{17.64} = 0.33$	1
Hydrogen	H	17.64	1	$\frac{17.64}{1} = 17.64$	$\frac{17.64}{17.64} = 1$	3

Question 4

(a) The percentage composition of a gas is
N = 82.35 %
H = 17.64%
So, the empirical formula of the gas is NH_3

(b) (i) $Al_4C_3 + 12\,H_2O \longrightarrow 4Al(OH)_3 + 3\,CH_4$
molecular weight of Al_4C_3 = 144
molecular weight of $Al(OH)_3$ = 78
From the above reaction . We conclude that
1 mole of Al_4C_3 gives 4 moles of $Al(OH)_3$
144 g of Al_4C_3 gives 4 x 78 g of $Al(OH)_3$

So 12 g of Al_4C_3 gives $\frac{4\times78\times12}{144}$ = 26 g of $Al(OH)_3$

So 26 g of $Al(OH)_3$ is obtained from 12g of Al_4C_3

(ii) From the above reaction we conclude that
$\because$ 1 mole of Al_4C_3 gives 3 moles of CH_4

So 12 g of Al_4C_3 gives $\frac{3\times22400\times12}{144}$ of CH_4 at S.T.P.

So 12 g of Al_4C_3 gives 5600 ml of CH_4 at S.T.P.

(c) (i) According to Avogadro's law equal volumes of all gases under similar conditions of temperature and pressure contain equal number of molecules. So 150 cc of B will also contain X molecule. So, 75 cc of B will contain $\frac{X}{2}$ molecule.

(ii) Avogadro's Law.

(d) (i) Brass $\longrightarrow$ Copper and Zinc

(ii) Duralumin $\longrightarrow$ Copper, Manganese and Magnesium, Aluminium

Question 5

(a)

General Formula	IUPAC name of the Homologous series	Characteristic bond type	IUPAC name of the first member of the series
C_nH_{2n-2}	(A) Alkyne	(B) – C 4 C–	(C) Ethyne
C_nH_{2n+2}	(D) Alkane	(E) 	(F) Methane

(b) (i) The most common ore of Al is bauxite chemical formula is $Al_2O_3 . 2H_2O$

(ii) Balyer's process.

(iii) $Al_2O_3 \rightleftharpoons Al^{+3} + AlO_3^{3-}$
$Al^{3+} + 3e^- \longrightarrow Al$ (At cathode)

Question 6

(a) $C_2H_5OH + CH_3COOH \xrightarrow[\text{conc.}]{H_2SO_4} CH_3COOC_2H_5$
Ethyl alcohol, acetic acid, Ethyl acetate (Ester)

(i) Y $\longrightarrow$ ester $\longrightarrow$ $CH_3COOC_2H_5$
Z $\longrightarrow$ conc. H_2SO_4

(ii) X $\longrightarrow$ CH_3COOH

(iii) Esterification

(b) $2\,C_2H_6 + 7O_2 \longrightarrow 4\,CO_2 + 6\,H_2O$

(i) 2 moles of ethane reacts with 7 moles of O_2.
2 × 22400 cc of ethane reacts with 7 × 22400 cc of oxygen.
For 1250 cc of oxygen, the ethane required 357.14 cc. So ethane is limiting reagent here.
2 × 22400 cc of ethane gives 4 × 22400 cc of CO_2
So 300 cc of ethane gives 4 × 22400 × 300 cc of CO_2
2 × 22400
So CO_2 released = 600 cc.

(ii) Volume of unused O_2 = 1250 – 1050 = 200 cc because 300 cc of ethane requires 1050 CC of O_2.

(c) (i) Q having pH 5.2 is weak acid

(ii) R having pH 12.2 is strong alkali

Question 7

(a) (i) Lead nitrate and Zinc nitrate solution can be distinguished by passing H_2S in solution. $PbNO_3$ will give black ppt of Pbs while $Zn(NO_3)_2$ does not.
$Pb(NO_3)_2 + H_2S \longrightarrow PbS\downarrow + 2\,HNO_3$
black ppt

(ii) NaCl and $NaNO_3$ solution can be distinguished simply by the addition of $AgNO_3$ solution into NaCl solution and $NaNO_3$ solution. NaCl gives white ppt of AgCl where as $NaNO_3$ will not.
$NaCl + AgNO_3 \longrightarrow AgCl\downarrow + NaNO_3$
white ppt

(b) (i) $CuCO_3 + H_2SO_4 \longrightarrow CuSO_4 + H_2O + CO_2$

(ii) $ZnSO_4 + Na_2CO_3 \longrightarrow Na_2SO_4 + ZnCO_3$

(c) (i) $2NaNO_3 + H_2SO4 \longrightarrow 2HNO_3 + Na_2SO_4$
Sulphate salts will be prepared.

(ii) Because nitric acid will not react with glass.

(d) (i) $C_2H_5OH \xrightarrow{H_2SO_4} C_2H_4 + H_2O$
Ethanol
H_2SO_4 acts as dehydrating agent.

(ii) $C + 2\,H_2SO_4 \longrightarrow CO_2 + 2SO_2 + 2H_2O$
H_2SO_4 oxidizes carbon and acts as oxidizing agent.

□□