

## SCIENCE (52)

### CHEMISTRY

#### SCIENCE Paper - 2

##### Aims:

1. To acquire the knowledge of terms, concepts, processes, techniques and principles related to the subject.
2. To develop the ability to apply the knowledge of contents and principles of chemistry in unfamiliar situations.
3. To acquire skills in proper handling of apparatus and chemicals.
4. To develop scientific temper, attitude and problem solving skills.
5. To recognize Chemical Science as having an important impact on the environment relating to cycles in nature; natural resources, pollution.

#### CLASS IX

*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 reactions should be studied with reference to the reactants, products, conditions, observations and the (balanced) equation.*

##### 1. Matter and its Composition: Law of Conservation of mass

- (i) Explanation of change of state of matter on the basis of Kinetic Theory of Matter.

*Main postulates of Kinetic Theory of Matter and explanation of change of state on the basis of. Inter-particle space and Inter-particle attraction and collision.*

- (ii) Law of Conservation of Mass

*Statement and explanation with examples.*

##### 2. Study of Gas Laws

- (i) The behaviour of gases under changes of temperature and pressure; explanation in

terms of molecular motion (particles, atoms, molecules); Boyle's Law and Charles' Law; absolute zero; gas equation; simple relevant calculations.

*The behaviour of gases under changes of temperature and pressure; explanation in terms of molecular motion (particles, atoms, molecules). Boyle's Law (statement, mathematical form, simple calculations).*

*Charles' Law; (statement, mathematical form, simple calculations). Absolute zero; Kelvin scale of temperature. Gas equation  $P_1 V_1 / T_1 = P_2 V_2 / T_2$ ; simple relevant calculations based on gas equation.*

- (ii) Relationship between Kelvin Scale and Celsius Scale of temperature; Standard temperature and pressure.

*Conversion of temperature from Celsius Scale to Kelvin scale and vice versa. Standard temperature and pressure. (simple calculations).*

##### 3. Elements, Compounds and Mixtures

- (i) General characteristics and differences between elements, compounds and mixtures.

*Reasons for considering a substance as an element, compound or mixture may be given to make the concepts clear.*

- (ii) Types of mixtures: of two solids, a solid and a liquid, two liquids, liquid and gas, two gases.

*Definition of mixture; each type of mixture should be shown to the students (including both homogeneous and heterogeneous types) – true solution, suspension and colloidal solution to make the concepts clear.*

- (iii) Separation of mixtures involving - use of a solvent, filtration, evaporation and distillation, fractional distillation, simple paper chromatography Centrifugation immiscible liquid.

*The following examples should be used to illustrate the principles of separation of mixtures by using following methods*

- (a) *use of solvent and filtration (e.g. sodium chloride + sand, (water as solvent), carbon and sulphur (Carbon tetra chloride as solvent)*
- (b) *evaporation e.g. sodium chloride from its aqueous solution*
- (c) *distillation e.g. purification of water containing dissolved solids.*
- (d) *fractional distillation involves the difference in boiling points of liquids e.g. benzene + toluene.*
- (e) *simple paper chromatography (limited to separation of colouring matter in ink);*
- (f) *Centrifugation (involving separation of cream from milk).*
- (g) *immiscible liquids (separating funnel e.g water + carbon tetra chloride).*

#### 4. The language of Chemistry

Symbol of an element; valency; formulae of radicals and formulae of compounds. Balancing of simple chemical equations.

*Symbol – definition; symbols of the elements used often.*

*Valency - definition; hydrogen combination and number of valence electrons of the metals and*

*non-metals; mono, di, tri and tetra valent elements.*

*Radicals – definition of radicals; formula and valencies of the radicals and formula of compounds.*

*Chemical equation – definition and examples of chemical equations with one reactant and two or three products, two reactants and one product, two reactants and two products and two reactants and three or four products; balancing of equations. (By partial equation method and hit and trial method)*

#### 5. Physical and Chemical Changes

- (i) Definitions and distinction between Physical and Chemical changes.

*Simple experiments like dissolution of sugar in water, burning of paper should be shown to make the concepts of physical and chemical change clear. More examples of such type may be given.*

- (ii) Conditions for chemical change.

*Close contact, heat, light, electricity, pressure, catalysts with examples.*

- (iii) Types of chemical change.

*Direct combination; decomposition; displacement; double decomposition with examples.*

- (iv) Energy changes in a chemical change.

*Exothermic and endothermic reactions with examples – evolution/absorption of heat, light and electricity.*

- (v) Burning: Definition and conditions of burning.

*Definition; (Air is used for combustion) conditions for burning (combustible substance, supporter of combustion and ignition temperature); comparison of respiration and burning; burning of magnesium or candle to show that substances gain weight on burning; students to be made aware of how the balance of O<sub>2</sub> and CO<sub>2</sub> is maintained in nature. O<sub>2</sub> and CO<sub>2</sub> Cycle.*

## 6. Water

Water as a compound and as a universal solvent; its physical and chemical properties.

*Why is water considered a compound? Chief physical properties should include: density, b.p, m.p. Experiment to show that the water we drink, contains dissolved solids and dissolved gases (air); their significance. Solutions as 'mixtures' of solids in water; saturated solutions; qualitative effect of temperature on solubility (e.g. solutions of calcium sulphate, potassium nitrate, sodium chloride in water).*

Water Pollution – Causes – household, detergents, sewage, industrial waste, offshore and oil drilling.

Treatment of Water Pollution – Proper collection and disposal of domestic sewage, treatment of industrial waste to yield safe effluents.

*Chemical Properties: The action of cold water on sodium and calcium; the action of hot water on magnesium and steam on iron; reversibility of reaction between iron and steam.*

*Students can be shown the action of sodium and calcium on water in the laboratory; they must be asked to make observations (equations for the above reactions) and form reactivity series based on reactions.*

## 7. Atomic Structure

Structure of an Atom mass number and atomic number, Isotopes and Octet Rule.

*Definition of an element, definition of an atom; constituents of an atom - nucleus (protons, neutrons) with associated electrons; mass number, atomic number. Electron distribution in the orbits -  $2n^2$  rule, Octet rule. Reason for chemical activity of an atom. Definition and examples of isotopes (hydrogen, carbon, chlorine).*

## 8. The Periodic Table

Dobereiner's Triads, Newland's law of Octaves, Mendeleev's contributions; Modern Periodic Law, the Modern Periodic Table.(groups and periods)

*General idea of Dobereiner's triads, Newland's law of Octaves, Mendeleev's periodic law,*

*Discovery of Atomic Number and its use as a basis for Modern Periodic law, Modern Periodic Table (groups 1 to 18 and periods 1 to 7).*

## 9. Study of the First Element -Hydrogen

Position of the non-metal (Hydrogen) in the periodic table and general group characteristics with reference to valency electrons, burning, ion formation applied to the above mentioned element.

(i) Hydrogen from water (ii) hydrogen from dilute acids (iii) hydrogen from alkalis.

*Hydrogen from water. Cold water and metals; hot water and metals; steam and metals; steam and non-metals. Application of activity series for the above mentioned preparations. Displacement of hydrogen from dilute sulphuric acid or hydrochloric acid by zinc or iron (no reaction with copper). Displacement of hydrogen from alkalis (NaOH, KOH) by Zn, Al – unique nature of these elements.*

(ii)The preparation and collection of hydrogen by a standard laboratory method other than electrolysis.

*In the laboratory preparation, the reason for using zinc, the impurities in the gas, their removal and the precautions in the collection of the gas must be mentioned.*

*Industrial manufacture of hydrogen by Bosch process with main reactions and conditions; separation of CO<sub>2</sub> and CO from it.*

## 10. Atmospheric pollution

(a) Acid rain – composition, cause and its impact.

*Sulphur in fossil fuels giving oxides of sulphur when burnt. High temperatures in furnaces and internal combustion engines produce oxides of nitrogen. (Equations to be included). Acid rain affects soil chemistry and water bodies.*

(b) Global warming:

Greenhouse gases – their sources and ways of reducing their presence in the atmosphere.

*(water vapour, carbon dioxide, methane and oxides of nitrogen)*

(c) Ozone depletion

*Formation of ozone – relevant equations*

*Function in the atmosphere.*

*Destruction of the ozone layer – chemicals responsible for this to be named but reactions not required.*

### INTERNAL ASSESSMENT OF PRACTICAL WORK

Candidates will be asked to observe the effect of reagents and/or of heat on substances supplied to them. The exercises will be simple and may include the recognition and identification of certain gases listed below.

**Gases:** Hydrogen, Oxygen, Carbon dioxide, Chlorine, Hydrogen chloride, Sulphur dioxide, Hydrogen sulphide, Ammonia, Water vapour, Nitrogen dioxide.

Candidates are expected to have completed the following minimum practical work.

#### Simple experiments on:

1. Heat the given (unknown) substance, make observations, identify any products and make deductions where possible.
  - (a) copper carbonate, zinc carbonate
  - (b) washing soda, copper sulphate crystals
  - (c) zinc nitrate, copper nitrate, lead nitrate
  - (d) ammonium chloride, iodine, ammonium dichromate

2. Add dilute sulphuric acid to the unknown substance, warm if necessary, make observation, identify the product and make deductions.

- (a) a sulphide
- (b) a carbonate
- (c) a metal

3. Apply the flame test to identify the metal in the unknown substance.

- (a) a sodium salt
- (b) a potassium salt
- (c) a calcium compound

4. The percentage composition of a mixture of powdered salt and water-washed sand.

The experiment would test techniques in dissolving, filtering or decanting, washing and weighing. It may be counted out as taking too much time. The weakness could be met by supplying a given weight of the mixture; also by choosing sand of such grain size that filtering or decanting will not be slow and yet not so large that separation of salt and sand cannot be done simply by sorting out mechanically the sand from the salt. The experiment should take about 20 minutes using 10g mixture (4g sand, 6g salt).

5. Simple experiments based on hard water and soft water – identification of hardness – simple softening – by heating the temporary hard water, using washing soda and advantage of using detergents over soap in hard water.
6. Find out the sources of pollution of water bodies in the locality and determine the quality of water.

## CLASS X

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<sub>2</sub>, 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<sub>3</sub>O<sup>+</sup> and OH<sup>-</sup> ions in water and NH<sub>4</sub><sup>+</sup> 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<sub>3</sub>, 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 =  $2 \times$  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  $1/12^{\text{th}}$  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 =  $2 \times$  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; non-metal, 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<sub>2</sub>SO<sub>4</sub>. 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<sub>2</sub>O<sub>3</sub>, 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, aluminum (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 (Chlorofluoro 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.*

## 8. 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 (green house 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.*

## INTERNAL ASSESSMENT OF PRACTICAL WORK

Candidates will be asked to observe the effect of reagents and/or of heat on substances supplied to them. The exercises will be simple and may include the recognition and identification of certain gases and ions listed below. The examiners will not, however, be restricted in their choice to substances containing the listed ions.

**Gases:** Hydrogen, Oxygen, Carbon dioxide, Chlorine, Hydrogen chloride, Sulphur dioxide, Hydrogen sulphide, Ammonia, Water vapour, Nitrogen dioxide.

**Ions:** Calcium, Copper, Iron, Lead, Zinc and Ammonium, Carbonate, Chloride, Nitrate, Sulphide, Sulphite and Sulphate.

Knowledge of a formal scheme of analysis is not required. Semi-micro techniques are acceptable but candidates using such techniques may need to adapt the instructions given to suit the size of the apparatus being used.

Candidates are expected to have completed the following minimum practical work:

1. Make a solution of the unknown substance: add sodium hydroxide solution or ammonium hydroxide solution, make observations and give your deduction. Warming the mixture may be needed. Choose from substances containing  $\text{Ca}^{2+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Fe}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Pb}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{NH}_4^+$ .
2. Supply a solution of a dilute acid and alkali. Determine which is acidic and which is basic, giving two tests for each.
3. Add concentrated hydrochloric acid to each of the given substances, warm, make observations, identify any product and make deductions: (a) copper oxide (b) manganese dioxide.

4. Use of pH in soil analysis, water analysis, medical field – simple identification with universal indicator.

### 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 |