CHEMISTRY (862)

Aims:

1. To foster acquisition of knowledge and understanding of terms, concepts, facts, processes, techniques and principles relating to the subject of Chemistry.
2. To develop the ability to apply the knowledge of contents and principles of Chemistry in new or unfamiliar situations.
3. To develop skills in proper handling of apparatus and chemicals.
4. To develop an ability to appreciate achievements in the field of Chemistry and its role in nature and society.
5. To develop an interest in activities involving usage of the knowledge of Chemistry.
6. To develop a scientific attitude through the study of Physical Sciences.
7. To acquaint students with the emerging frontiers and interdisciplinary aspects of the subject.
8. To develop skills relevant to the discipline.
9. To apprise students with interface of Chemistry with other disciplines of Science, such as, Physics, Biology, Geology, Engineering, etc.

CLASS XI

There will be two papers in the subject.

Paper I: *Theory- 3 hours*	*... 70 marks*
Paper II: *Practical - 3 hours*	*...20 marks*
Project Work	*... 7 marks*
Practical File	*... 3 marks*

PAPER I –THEORY – 70 Marks

There will be one paper of 3 hours duration divided into 2 parts.

Part I (20 marks) *will consist of compulsory short answer questions, testing knowledge, application and skills relating to elementary/fundamental aspects of the entire syllabus.*

Part II (50 marks) *will be divided into 3 Sections, A, B and C. Candidates are required to answer* ***two*** *out of* ***three*** *questions from Section A (each carrying 10 marks),* ***two*** *out of* ***three*** *questions from Section B (each carrying 5 marks) and* ***two*** *out of* ***three*** *questions from Section C (each carrying 10 marks). Therefore, a total of* ***six*** *questions are to be answered in Part II.*

SECTION A

1. Atoms and Molecules

(i) The concept of atoms having fixed properties in explaining the laws of chemical combination.

The study about the atoms. Dalton's atomic theory:

- *Main postulates of the theory.*
- *Its limitations.*
- *Modern atomic theory.*

Laws of chemical combinations:

- *Law of conservation of mass.*
- *Law of definite proportion.*
- *Law of multiple proportion.*
- *Law of reciprocal proportion.*
- *Gay-Lussac's law of gaseous volumes.*

Statement, explanation and simple problems based on these laws.

(ii) Atomic and isotopic masses.

The atomic mass unit is one of the experimentally determined unit. It is equal to 1/12 of the mass of the carbon 12 isotope.

(iii) Chemical equivalents, volumetric calculations in terms of normality. C = 12.00 should be taken as a standard for expressing atomic masses.

Equivalent weight expresses the combining capacity of the elements with the standard elements such as H, Cl, O, Ag, etc.

Variable equivalent weight. Gram equivalent weights, relationship between gram equivalent weight, gram molecular weight and valency.

Determination of equivalent weight of acids, alkalis, salts, oxidising and reducing agents. (experimental details not required).

Terms used in volumetric calculations such as percentage (w/w and w/v), normality, molarity, molality, mole fraction, etc. should be discussed. Students are required to know the formulae.

Simple calculations on the above topics.

(iv) Relative molecular mass and mole. The following methods may be considered for the determination of relative molecular masses for the gases: the molar volume method; Victor Meyer's method (experimental details not required).

Numerical problems based on the above method and Victor Meyer's method. Mole concept, Avogadro's number and numerical problems on mole concept. Gram molecular volume.

2. Atomic Structure

(i) Electrons, Protons and Neutrons as fundamental particles, their charges and masses.

Concept of indivisibility of atom as proposed by Dalton does not exist. The atom consists of subatomic fundamental particles. Production of cathode rays and their properties. Production of anode rays and their properties.

Chadwick's experiment for the discovery of neutron and properties of neutron.

(ii) Rutherford's nuclear model based on the scattering experiment.

Rutherford's nuclear model of atom. Rutherford's scattering experiment. Discovery of nucleus. Defects of Rutherford model.

(iii) Bohr's atomic model.

1. Postulates of Bohr's theory – based on Planck's quantum theory.

2. Numericals on Bohr's atomic radii, velocity and energy of orbits (derivation not required).

3. Defects in the Bohr's Model.

(iv) Atomic structure: wave mechanical model- a simple mathematical treatment. Quantum numbers; shape, size and orientation of s and p orbitals only. Hund's rule of maximum multiplicity. Pauli's exclusion principle, Aufbau principle, electronic configuration of elements in terms of s, p, d, f subshells.

- *Wave mechanical model - experimental verification of wave nature of electron.*
- *de Broglie's equation. Numericals.*
- *Heisenberg's uncertainity principle. Numericals.*
- *Quantum numbers – types of quantum numbers, information obtained in terms of distance of electron from the nucleus, energy of electron, number of electrons present in an orbit and an orbital.*
- *Pauli's exclusion principle. Shape, size and orientation of the s and p subshells.*
- *Hund's rule of maximum multiplicity.*
- *Aufbau principle, (n+l) rule.*
- *Electronic configuration of elements in terms of s, p, d, f subshells.*

3. Periodic Table

(i) Atomic number (Proton number) as the basis for classification of the elements in the Periodic Table. IUPAC nomenclature for elements with Z> 100.

Mendeleev's periodic law, defects in the Mendeleev's periodic table. Advantages and disadvantages. Modern periodic law (atomic number taken as the basis of classification of the elements). Extended and long form of periodic table. General characteristics of groups and periods. Division of periodic table as s, p, d and f blocks.

(ii) Extra nuclear structure as the basis of periodicity. Some idea of the following: ionisation enthalpy, electron gain enthalpy, atomic radius, atomic volume, electronegativity, etc must be given. The periodicity of electronic structure leading to the periodicity of elements e.g the relative ease of ionisation of elements.

- *Periodic properties such as valence electrons, atomic volume, atomic and ionic radii and their variation in groups and periods.*

- *The idea of ionisation enthalpy, electron gain enthalpy and electronegativity must be given and their variation in groups and periods may be discussed.*
- *The factors (atomic number, atomic volume and shielding effect, the number of electrons in the outermost orbit) which affect these periodic properties and their variation in groups and periods.*

(iii) Periodicity of elements with reference to s, p, d and f block elements.

Classification of elements on the basis of s, p, d, f block elements and also on the basis of their complete and incomplete electron shells.

Study of the periodicity of properties mentioned in point (ii) in terms of s, p, d, f blocks and the governing factors in terms of the block characteristics.

4. Chemical Bonding

Electrovalent Bond

(i) Electrovalent or ionic bond e.g formation of NaCl, Li_2O, MgO, CaO, MgF_2, and Na_2S.

Cause of chemical combination, Octet rule, types of chemical bonds. Electrovalent formation of NaCl, Li_2O, MgO, CaO, MgF_2, and Na_2S. Properties of ionic compounds. Electron dot structure of the following ionic compounds: NaCl, Li_2O, MgO, CaO, MgF_2, and Na_2S must be taught in detail.

(ii) Factors influencing the formation of ionic bond, e.g electron gain enthalpy, ionisation enthalpy, lattice energy and electronegativity.

The conditions necessary for the formation of ionic bonds such as:

- *low ionisation enthalpy of metals.*
- *high electron gain enthalpy of non-metals.*
- *high lattice energy.*
- *electronegativity difference between the reacting atoms should be appreciable.*

All these points must be discussed in detail.

(iii) The relation between the ionic bonding and Periodic Table.

The relationship between the formation of cations and anions of the atoms and their positions in the periodic table should be discussed.

Correlate the periodic property and the position of the elements in the periodic table to show the ease of formation of anions and cations and electrovalent and covalent compounds.

(iv) Variable electrovalency and its causes.

Variable electrovalency; reasons for variable electrovalency i.e, due to inert electron pair effect, by using suitable examples.

Covalent Bond

(i) Covalent bond, e.g. formation of ammonia, nitrogen, ethene, ethyne, and carbon dioxide. Resonance.

Definition of covalent bonding, conditions for formation of covalent bonds, types of covalent bonds i.e single, double and triple bonds. Classification of covalent bonds based on electronegativity of atoms - polar and non polar covalent bond, dipole moment, formation of ammonia, nitrogen, ethyne, ethene and carbondioxide, etc and their electron dot structure or Lewis structure. Characteristics of covalent compounds. Comparison in electrovalency and covalency. Resonance in simple inorganic molecules like ozone, carbon dioxide, carbonate ion and nitrate ion.

(ii) Variable valency: chlorine exhibits the valency of 1,3,5 & 7 respectively.

Variable valency, cause of variable covalency e.g. chlorine exhibits the valency 1, 3, 5 and 7 respectively. Discuss in terms of atomic structure.

Variable covalency of phosphorus and sulphur may be discussed. Discuss in terms of atomic structure.

(iii) Deviation from Octet rule and Fajan's rules.

Definition of Octet rule.

Failure of Octet rule, due to either incomplete octet or expansion of Octet with suitable examples.

Fajan's rules: Statements. Conditions for electrovalency and covalency must be discussed. Polar and non polar bonds should be correlated with Fajan's rules.

5. The Gaseous State

(i) The gas laws, kinetic theory treated qualitatively.

Characteristics of gases, comparison between solid, liquid and gas. Properties of gases on the basis of kinetic theory of gases. Laws of gases – Boyle's Law, Charles' Law, Absolute Temperature, Pressure Temperature Law, Avogadro's Law. Simple numerical problems based on the above laws.

Postulates of Kinetic Theory must be discussed to explain gas laws.

(ii) PV = nRT or PV= (w/M)RT and the application of this equation of state.

Ideal gas equation PV = nRT; its application in calculation of relative molecular mass and in the calculation of the value of R.

(iii) Non ideal behaviour of gases and Van der Waals' equation.

Non ideal behaviour of gases i.e. deviation from gas laws may be discussed at low and at high temperature and pressure.

Van der Waals' equation $(P + a/V^2)$ *(V-b) = RT for one mole of a gas.*

The pressure correction and volume correction may be explained.

(iv) Dalton's law, the Avogadro constant, the mole, Graham's law of diffusion, simple numerical problems on the above.

- *Dalton's Law of partial pressure.*
- *Application of Dalton's Law.*
- *Numerical problems based on the above law.*
- *Avogadro's constant.*
- *Relationship between the mole and Avogadro number. Graham's Law of diffusion and its application.*
- *Simple numerical problems on the above.*

6. Colloidal Solutions

Preparation and properties of colloids, both lyophilic and lyophobic colloids. Precipitation as evidence that the colloidal particles are charged. Idea of gold number is required, but application of gold number is not required. The importance of large surface area in adsorption should also be appreciated**.**

- *Thomas Graham classified the substances as crystalloid and colloid.*
- *Classification of substances on the basis of the particle size i.e. true solution, sol and suspension.*
- *Colloidal system is heterogeneous. Lyophilic and lyophobic colloids.*
- *Classification of colloidal solutions as micro, macro and associated colloids.*
- *Preparation of lyophilic colloids. Preparation of lyophobic colloids by colloid mill, peptisation, Bredig's arc method (procedural details not required) by oxidation, reduction, double decomposition and exchange of solvent method should be discussed.*
- *Purification of colloids (dialysis, ultra filtration, and ultracentrifugation).*
- *Properties of colloidal solutions such as Brownian movement, Tyndall effect, coagulation and protection (protective colloids), should be discussed.*
- *Gold number and Hardy Schulze rule.*
- *Application of colloids in life.*
- *Electrophoresis (movement of dispersed phase).*
- *Emulsions, surfactants, micelles (only definition and examples).*

7. Chemical Kinetics

(i) Qualitative treatment of the dependence of reaction rates on: concentration of the reactants, size of the particles, temperature and presence of a catalyst. Catalyst – structure: enzymes and zeolites.

- *Scope and importance of Kinetics of the reaction.*
  - *Comparison of Chemical Kinetics with Chemical Thermodynamics.*
  - *Confirming the mechanism of the reaction.*
- *Variation in reaction rates:*
  - *Rate of the reaction.*
  - *Factors affecting rate of reaction such as concentration, temperature, nature of reactants, presence of catalyst, surface area, radiation, etc.*

(Refer to practicals for some experiments).

- *Law of Mass Action:*
  - *Statement of Law of Mass Action.*
  - *Collision theory.*
  - *Explanation of Law of Mass Action on the basis of collision theory.*
  - *Enzyme action – Lock and key mechanism.*
  - *Zeolites – nature and action.*

(ii) The concept of energy barrier (it is suggested that some experiments may be devised which may deal with the above mentioned factors).

The concept of threshold energy, activation energy, energy of the reactant, energy of the products and the energy of the activated complex.

Exothermic and endothermic reactions and their activation energy curves.

Activated complex.

Effect of catalyst on activation energy and reaction rate.

8. Chemical Equilibria

(i) Reversible reactions and dynamic equilibrium. The concept of equilibrium constant in terms of concentration or partial pressure to indicate the composition of the equilibrium mixture. The following are the examples: the dissociation of dinitrogen tetroxide, hydrolysis of simple esters, the Contact Process for the manufacture of sulphuric acid, the synthesis of ammonia.

- *Irreversible and reversible reactions.*
- *Chemical equilibrium:*
  - *Characteristics of chemical equilibrium.*
  - *The dynamic nature.*
  - *Law of mass action.*
  - *Equilibrium constant in terms of concentration K_c.*
  - *Gaseous reactions. Equilibrium constant in terms of partial pressures K_p.*
  - *Relationship between K_p and K_c (Derivation required).*
  - *Characteristics of equilibrium constant.*
  - *Units for equilibrium constant.*
  - *Simple calculations of equilibrium constant and concentration.*

The following examples should be considered to show maximum yield of products:

- *The dissociation of dinitrogen tetra oxide.*
- *Hydrolysis of simple esters.*
- *The Contact Process for the manufacture of sulphuric acid. The synthesis of ammonia.*

(ii) Le Chatelier's Principle and its applications to chemical equilibria.

Le Chatelier's Principle. Statement and explanation.

Factors affecting chemical and physical equilibria should be discussed in the light of Le Chatelier's Principle.

- *Change of concentration.*
- *Change of temperature.*
- *Change of pressure.*
- *Effect of catalyst.*
- *Addition of inert gas.*

SECTION B

9. Study of Representative Elements: Group 1, 2, 13, 14, 15 - The following should be included:

a) Occurrence, (b) Physical State, (c) Electronic Configuration, (d) Atomic and Ionic radii, (e) Common oxidation state, (f) Electropositive / Electronegative character, (g) Ionisation enthalpy, (h) Reducing/oxidising nature, (i) Distinctive behaviour of first member of each group (namely Lithium, Beryllium, Boron, Carbon, Nitrogen),(j) Nature of oxides, hydroxides, hydrides, carbonates, nitrates, chlorides, sulphates, wherever applicable.

s-Block elements:

Group 1 – Lithium, Sodium: General characteristics in terms of physical and chemical properties.

Group 2 – Beryllium, Magnesium and Calcium: General characteristics in terms of physical and chemical properties.

p-Block elements:

Group 13 – Boron, Aluminium: General characteristics in terms of physical and chemical properties; Boron's Lewis acid character; amphoteric nature of aluminium.

Group 14 – Carbon, Silicon, Germanium, Tin and Lead: General characteristics in terms of physical and chemical properties, property of catenation; structure of diamond, graphite and fullerene; stability of +2 oxidation state down the group in terms of inert pair effect.

Group 15 – Nitrogen, Phosphorus: General trends in group; unreactive nature of nitrogen; difference in the physical state of nitrogen and phosphorus in terms of bonding; allotropes of phosphorus (white, red) - nature and uses.

10. Preparation, properties and uses of Compounds of Groups 1, 2, 13, 14, 15.

Only brief qualitative treatment is required for preparation. Main emphasis must be given to the chemistry of preparation, chemical properties and uses of the given compounds. Biological importance of magnesium, sodium, calcium and potassium.

Group 1: Sodium chloride, Sodium hydroxide, Sodium carbonate, Sodium bicarbonate, Sodium thiosulphate; Group 2: Magnesium chloride hexahydrate, Calcium oxide, Plaster of Paris; Group 13: Borax, Borax Bead Test, Alums; Group 14: Carbon monoxide, Carbon dioxide, Silicon dioxide, Silicon carbide, Silicones; Group 15: Oxides of nitrogen, Phosphorus trichloride, Phosphorus pentachloride, Oxoacids of phosphorus.

Group 1:

(i) *Sodium chloride - Isolation. Uses.*

(ii) *Sodium hydroxide - only the principle of preparation by Castner-Kellner cell.*

(iii) *Sodium carbonate - equation of Solvay's process. Uses.*

(iv) *Sodium bicarbonate - preparation from sodium carbonate. Uses.*

(v) *Sodium thiosulphate - preparation from sodium sulphite and its reaction with iodine, dilute acids and silver nitrate. Uses.*

Group 2:

(i) *Magnesium chloride hexahydrate - preparation from magnesium oxide. Effect of heat.*

(ii) *Calcium oxide - preparation from limestone; reaction with water, carbon dioxide and silica.*

(iii) *Plaster of Paris - preparation from gypsum. Uses.*

Group 13:

(i) *Borax- reaction with water and action of heat on hydrated compound (preparation not required).*

(ii) *Borax Bead Test .*

(iii) *Alums – preparation and uses.*

Group 14:

(i) *Carbon monoxide - preparation from incomplete combustion of carbon. Hazards of CO. Reducing nature of CO.*

(ii) *Carbon dioxide - preparation from limestone, carbon. Limewater test. Uses.*

(iii) *Silicon dioxide - structure, comparison with carbon dioxide. Uses.*

(iv) *Silicon carbide - preparation from Silica. Uses.*

(v) *Silicones - general method of preparation. Uses.*

Group 15:

(i) *Oxides of nitrogen - preparation, structures and uses.*

(ii) *Phosphorus trichloride - Preparation from phosphorous. Uses.*

(iii) *Phosphorus pentachloride - preparation from PCl_5. Thermal dissociation and hydrolysis. Uses.*

(iv) *Oxoacids of phosphorus (structure only).*

11. Redox Reactions

– *Concept of oxidation and reduction in terms of oxygen, hydrogen, electrons.*

– *Redox reactions – examples.*

- *Oxidation number: Rules for calculation, simple calculations of oxidation state in molecules and ions like $K_2\underline{Cr}_2O_7$, $\underline{S}_2O_3^{2-}$, etc.*
- *Oxidation and reduction in terms of change in oxidation number.*
- *Balancing of redox reactions in acidic and basic medium by oxidation number and ion-electron method.*

SECTION C

(Note: Aliphatic compounds containing upto 5 carbon atoms to be taught)

12. Introduction to Organic Chemistry

(i) The unique nature of carbon atom and catenation.

Introduction to organic chemistry:

- *Vital force theory.*
- *Reason for separate study of organic chemistry and its importance.*
- *Characteristics of carbon atoms (tetra valency).*
- *Reasons for large number of organic compounds:*
  (a) *Catenation.*
  (b) *Isomerism and multiple bonding, etc.*

(ii) Classification of organic compounds and homologous series.

Classification of organic compounds: (definition and examples)

(a) Open chain.
(b) Closed chain.
(c) Homocyclic.
(d) Hetrocyclic.
(e) Aromatic.
(f) Alicyclic compounds.
(g) Homologous series and its characteristics.
(h) Functional groups.
(i) Nomenclature of organic compounds. Simple hydrocarbons and simple compounds.
(j) IUPAC rules for naming organic compounds.

(iii) Detection of carbon, hydrogen, sulphur, nitrogen and halogen.

Analysis of organic compounds:

Detection of elements (qualitative analysis) such as carbon, hydrogen, nitrogen, halogens and sulphur should be considered by using Lassaigne's test and reactions involved in it.

(iv) Estimation of carbon, hydrogen, nitrogen, halogens, sulphur and phosphorous.

Estimation of carbon and hydrogen. Estimation of nitrogen by Kjeldahl's method; halogens by Carius' method. Estimation of sulphur and phosphorous. Numericals included.

13. Types of Chemical Reactions and their Mechanisms

(i) Substitution, addition and elimination reactions.

Substitution, addition and elimination reactions – definition and examples.

(ii) Homolytic and heterolytic fission.

Homolytic and heterolytic fission – definition and examples.

(iii) Electrophiles and nucleophiles.

Electrophiles and nucleophiles – definition and examples (including neutral electrophiles and nucleophiles).

(iv) Inductive, mesomeric and electromeric effects.

Inductive, electromeric and mesomeric effect – definition, examples and their reactivities.

(v) Free radicals and polar mechanisms (in terms of fission of the bonds and formation of the new bonds) including S_N1, S_N2, E_1 and E_2 mechanisms. (S_N1 and S_N2 , E_1 and E_2 mechanisms are to be taught at this point).

Free radical: its formation due to the fission of the bonds.

- *Meaning of S.*
- *Meaning of N.*
- *Meaning of 1 and 2.*

Explain with relevant examples and conditions.

(vi) Organometallic compounds.

Organometallic compounds including Grignard reagents, preparation and their uses. Wilkinson's and Ziegler-Natta catalyst.

14. Aliphatic and Aromatic Hydrocarbons

(i) Alkanes: General methods of preparation, Properties of alkanes.

- *General formula of alkanes.*
- *Homologous series.*
- *Naming of alkanes.*
- *Isomerism of alkanes.*
- *Occurrence.*
- *Configuration.*

General methods of preparation:

- *From sodium salts of carboxylic acids (decarboxylation and Kolbe's electrolytic method).*
- *From alcohols.*
- *From alkyl halides (Wurtz reaction).*
- *From aldehydes.*

Physical and chemical properties of alkanes.

Physical properties:

- *State of existence.*
- *Freezing point.*
- *Melting point.*
- *Boiling point.*
- *Density.*

Chemical properties:

- *Combustibility.*
- *Reaction with chlorine. (Free radical mechanism).*
- *Reaction with oxygen in presence of catalyst (formation of alcohol, aldehyde, and carboxylic acid).*

Uses of alkanes.

(ii) Alkenes: general methods of preparation and properties of alkenes.

- *General formula of alkenes.*
- *Nomenclature of alkenes.*
- *General methods of preparation – dehydration of alcohols, dehydrohalogenation of alkyl halides and Kolbe's electrolytic method.*
- *Physical and Chemical properties.*
- *Markovnikov's rule with mechanism. Explain by using suitable examples.*
- *Anti Markovnikov's rule also to be discussed.*

(iii) Alkynes: methods of preparation (including manufacture), properties and uses of ethyne.

- *General formula of alkynes.*
- *Nomenclature of the alkynes.*
- *General methods of preparations of alkynes. Manufacture of ethyne by calcium carbide and from natural gas. Dehydrohalogenation and Kolbe's electrolytic method.*
- *Physical and chemical properties of alkynes – addition reactions, formation of acetylides.*
- *Uses.*

(iv) Benzene: Coal tar as an important source of aromatic compounds; preparation of benzene from sodium benzoate, properties and uses of benzene; resonance model of benzene; directive influence of substituents in the benzene ring.

- *Coal tar as an important source of aromatic compounds – a general study.*
- *Benzene: Preparation from sodium benzoate. Physical properties and uses.*

Resonance structures (Kekule's) of benzene.

Directive influence (o- , p-, and m-) of substituents in electrophilic and nucleophilic substitutions.

Chemical properties:

- *Oxidation (formation of maleic anhydride).*
- *Pyrolysis (formation of bi-phenyl).*
- *Addition reactions with hydrogen, chlorine, bromine.*
- *With ozone.*
- *Substitution reaction (halogenation, nitration and acetylation).*
- *Alkylation, acetylation.*

15. Alkyl and Aryl Halides

(i) The nomenclature of aliphatic compounds containing halogen atom.

Naming the halogen derivatives of alkanes by using common system and IUPAC system for mono - halo derivatives and di halo derivatives.

(ii) Preparation, properties, uses of haloalkanes.

Preparation from:

- *Alkane and halogen.*
- *Alkene and hydrohalide.*
- *Alcohols.*

General properties:

- *Combustibility.*
- *Nucleophilic substitution reactions.*

  Reaction with:

  - *sodium nitrite.*
  - *silver nitrite.*
  - *Aq. sodium hydroxide.*
  - *alcoholic potassium hydroxide.*

Uses:

Uses of halogen derivatives of alkanes in day to day life and in industry may be discussed.

(iii) Preparation, properties, and uses of the following: ethyl bromide, chloroform, iodoform, haloform reaction.

Preparation. Properties and uses of ethyl bromide, chloroform, iodoform.

Haloform reaction for the preparation of chloroform and iodoform from alcohol should be discussed.

(iv) Chlorobenzene.

Preparation from aniline.

Physical properties

Chemical properties:

- *Electrophilic substitution (chlorination and nitration).*
- *Nucleophilic substitution - replacement of chlorine with -OH, -NH_2.*
- *Reduction to benzene.*
- *Wurtz-Fittig reaction.*
- *Fittig reaction.*
- *Addition reaction with magnesium (formation of Grignard reagent).*
- *Formation of DDT.*

16. Applications of Chemicals

(i) In medicine: antipyretics, analgesics, tranquillisers, antiseptics, disinfectants, anti-microbials, anti-fertility drugs, antihistamines, antibiotics, antacids.

Definition, common examples, uses.

Structure not required. Differences between antiseptics and disinfectants to be specified.

(ii) Industry: advanced materials: carbon fibres, micro alloys. Detergents: classification, some important examples.

Carbon fibres – qualities, application as CFRC (Carbon Fibre Reinforced Carbon), CFRP (Carbon Fibre Reinforced Plastic), in aerospace, sports goods, defence sector.

Super conductors – definition, example and uses.

Micro-alloys – applications in gold (in terms of carat and the term "Hallmark"). Uses of micro alloys.

Soaps and Detergents – advantage of detergents over soaps, classification of detergents into anionic, cationic and non-ionic.

(iii) Space: rockets propellants- characteristics, chemicals used.

Rocket Propellants - solid, liquid, hybrid, composite – examples.

(iv) Food processing: preservatives, artificial sweetening agents, antioxidants and edible colours.

Preservatives – need, uses and examples.

Artificial Sweeteners – as food additives, saccharin, aspartame.

Antioxidants – as preservatives, BHT (Butylated Hydroxy Toluene), BHA (Butylated Hydroxy Anisole).

Edible colours – need, use and examples, Need of PFA (Prevention of Food Adulteration Act).

Structures not required.

PAPER II

PRACTICAL WORK- 20 Marks

1. Measurement of the rate of reaction based on the size of the particle, concentration of reactants, temperature and presence of catalyst, e.g. the study of the rate of dissolving of magnesium or zinc in dilute sulphuric or hydrochloric acid.
2. Qualitative analysis; identification of the following:

   Cations: NH_4^+, Ag^+, Pb^{2+}, Cu^{2+}, Al^{3+}, Fe^{2+}, Fe^{3+}, Zn^{2+}, Ca^{2+}, Mg^{2+}

   Anions: CO_3^{2-}, NO_2^-, S^{2-}, SO_3^{2-}, SO_4^{2-}, NO_3^-, CH_3COO^-, Cl^-, Br^-, I^-.

   Formal analytical procedure required.
3. Titration: acid-base titration involving molarity.
4. Construction of Voltaic cell and Daniel cell and measuring their emf.

PROJECT WORK AND PRACTICAL FILE - 10 Marks

Project Work – 7 Marks

The candidate is to creatively execute one project/assignment on a selected topic of Chemistry. Teachers may assign or students may choose any one project of their choice.

Practical File – 3 Marks

Teachers are required to assess students on the basis of the Chemistry Practical file maintained by them during the academic year.