

**MJD Govt. College Taranagar (Churu)**  
**Department of Chemistry**  
**B.Sc.-I (Syllabus)**  
**ORGANIC CHEMISTRY**  
**PAPER-II**

**Unit-I**

**(a) Structure and Bonding:**

Hybridization, bond lengths and bond angles. Bond energy, localized and delocalized chemical bond, vander waals interactions, inclusion compounds, clatherates, charge transfer complexes, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.

**(b) Mechanisms of Organic Reactions :**

Curved arrow notation, drawing electron movements with arrows, half headed and double headed arrows, homolytic and heterolytic bond breaking. Types of reagents- electrophiles and nucleophiles. Type of organic reactions, energy considerations. Reactive intermediates- carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples) Assigning, formal charges on intermediates and other ionic species. Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects. Kinetic and stereochemical studies).

**Unit-II**

**Stereochemistry of Organic Compounds**-Concept of isomerism, types of isomerism. Optical isomerism- elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute, configuration, sequence rules, D & L and R & S systems of nomenclature. Geometric isomerism- Determination of configuration of geometric isomers E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds. Conformational isomerism- conformational analysis of ethane and n-butane. Conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane

derivatives, Newman projection and sawhorse formulae, Fischer and flying wedge formulae.

Difference between configuration and conformation.

### **Unit-III**

#### **Alkanes and Cycloalkanes**

IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of

carbon atoms in alkanes. Isomerism in alkanes, sources, methods of formation (With special

reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of

carboxylic acids). physical properties and chemical reactions of alkanes.

Mechanism of free radical halogenation of alkanes : orientation, reactivity and selectivity.

Cycloalkanes - nomenclature, methods of formation, chemical reactions. Baeyer's strain theory and its limitations, ring strains in small rings (cyclopropane and cyclobutane),

Theory of

strainless rings, the case of cyclopropane ring : banana bonds.

### **Unit-IV**

#### **Alkenes, Cycloalkenes, Dienes and Alkynes**

Nomenclature of alkenes, methods of formation. Mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regio selectivity in alcohol dehydration. The Saytzeff

rule, Hofmann elimination, physical properties and relative stabilities of alkenes.

Chemical reactions of alkenes- mechanism involved in hydrogenation, electrophilic and free

radical additions, Markownikoff's rule, hydroboration-oxidation, oxymercuration-reduction,

epoxidation, ozonolysis, hydration, dehydroxylation and oxidation with  $\text{KMnO}_4$ , Polymerization

of alkenes, Substitution of the allylic and vinylic positions of alkenes. Industrial applications of

ethylene and propene.

Methods of formation, confirmation and chemical reactions of cycloalkenes.

Nomenclature and classification of Dienes : Isolated, conjugated and cumulated dienes.

Structure of allenes and butadiene, methods of formation, polymerization . Chemical reactions- 1,2 and 1,4 additions, Diels- Alder reaction.

Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reaction

of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions,

hydroboration-oxidation, metal ammonia reductions, oxidation and polymerizations.

## Unit-V

### **Arenes and aromaticity**

Nomenclature of benzene derivatives. The aryl group. Aromatic nucleus and side chain,

structure of benzene : molecular formula and Kekule structure, stability and carbon-carbon

bond lengths of benzene, resonance structure, MO picture, Aromaticity : The Huckel rule,

aromatic ions.

Aromatic electrophilic substitution- general pattern of the mechanism, role of sigma(s) and

pi( $\delta$ ) complexes. Mechanism of nitration, halogenation sulphonation, mercuration and Friedel-Craft's reactions, energy profile diagrams. Activating & deactivating substituents,

orientation and ortho / para ratio, side chain reactions of benzene derivatives. Birch reduction.

Methods of formation and chemical reactions of alkyl benzenes, alkynyl benzenes and biphenyl.

### **Alkyl and Aryl Halides**

Nomenclature and classes of alkyl halides, methods of formation, chemical reactions.

Mechanisms, nucleophilic substitution reactions of alkyl halides, SN2 and SN1 reactions with

energy profile diagrams.

Polyhalogen compounds : Chloroform, carbon tetrachloride.

Methods of formation of aryl halides, nuclear and side chain reactions. The addition-elimination

and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions.

Relative reactivities of alkyl vs allyl, vinyl and aryl halides. Synthesis and uses of D.D.T. and B.H.C.

## **PAPER -III : PHYSICAL CHEMISTRY**

### **Unit-I**

#### **Mathematical Concepts & Computers :**

##### **(a) Mathematical Concepts**

Logarithmic relations, curve, sketching linear graphs and calculations of slopes, differentiation of functions like  $Kx$ ,  $e^x$ ,  $X^n$ ,  $\sin x$ ,  $\log x$ ; maxima and minima, partial differentiation and reciprocity relations. Integrations of some useful/relevant functions; permutations and combinations, Factorials. Probability

##### **(b) Computers**

General introduction to computers, different components of a computer, hardware and software, input and output devices; binary numbers and arithmetic, introduction to computer languages, Programming operating systems.

### **Unit-II**

**(a) Gaseous States :** Postulates of kinetic theory of gases, deviation from ideal behaviour, Vander-waals equation of state.

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**Critical Phenomena :** PV isotherms of real gases, continuity of states, the isotherms of Vander-waals equation, relationship between critical constants and Vander-waals constants,

the law of corresponding states, reduced equation of state.

**(b) Molecular Velocities :** Root mean square velocity, average and most probable velocities. Qualitative discussions of the Maxwell's distribution of molecular velocities, collision

number, mean free path and collision diameter. Liquification of gases (based on joule - thomson effect).

### **Unit-III**

#### **(a) Liquid State:**

Intermolecular forces, structure of liquids (a qualitative description). Structural differences

between solids, liquids and gases,

Liquid Crystals : Difference between liquid crystal, solid and liquid. Classification, structure

of nematic and cholestric phases.

Thermography and seven- segment cell.

#### **(b) Colloidal State:**

Definition of colloids, classification of colloids.

**Solids in liquids (sols) properties** - Kinetic, optical and electrical stability of colloids, protective action, Hardy - Schultze law, gold number.

**Liquids in liquids (emulsions) :** Type of emulsions, preparation and properties of Emulsions.

**Liquids in solids (gels) :** Classification, preparation and properties, inhibition, general applications of colloids.

### **Unit-IV**

**Solid State :** Definition of space lattice, unit cell.

Laws of crystallography- (i) Law of constancy of interfacial angles, (ii) Law of rationality of indices, (iii) Law of symmetry. Symmetry elements in crystals. X-ray diffraction by crystals. Derivation of Bragg equation. Determination of Crystal structure of NaCl, KCl and CsCl (Laue's method and powder method).

#### **Unit-V**

##### **Chemical kinetics and catalysis**

Chemical kinetics and its scope, rate of reaction, factors influencing the rate of reaction concentration, temperature, pressure, solvent, light, catalyst, concentration dependence of rates, mathematical characteristics of simple chemical reactions: zero order, first order, second order, pseudo order, half life and mean life. Determination of the order of reaction differential method, method of integration, method of half life period and isolation method. Radioactive decay as a first order phenomenon.

**Experimental methods of chemical kinetics :** Conductometric, potentiometric, optical methods, polarimetric and spectrophotometric.

**Theories of chemical kinetics:** Effect of temperature on rate of reaction, Arrhenius concept of activation energy.

Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis). Expression for the rate constant based on equilibrium constant and thermodynamic aspects.

Catalysis, characteristics of catalyzed reactions, classification of catalysis, miscellaneous examples.

#### **PRACTICAL**

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**Time : 120 Hours (4 Hours / Week)**

##### **(A) INORGANIC CHEMISTRY**

Semi micro and Macro analysis , Separation and Identification of Four radicals - two acidic

and two basic in a given mixture which may include any one interfering radical and/or combinations of radicals.

##### **(B) ORGANIC CHEMISTRY**

###### **1.Laboratory techniques:**

###### **(i) Determination of melting point (0C)**

Naphthalene 80-82 0C, Benzoic acid 121.5-1330C

Urea 132.5-1330C, Succinic acid 184.5-1850C

Cinnamic acid 132.5-1330C , Salicylic acid 157.5-1580C

Acetanilide 113.5-1140C, m-Dinitrobenzene 900C

p- Dichlorobenzene 52 0C ,Aspirin 1350C

###### **(ii) Determination of boiling point**

Ethanol 780C, cyclohexane 81.40C, toluence 110.60C, Benzene 800C **(iii)Mixed**

###### **melting**

###### **point determination**

Urea-cinnamic acid mixture of various compositions(1:4,1:1,4:1)

#### **(iv) Distillation**

Simple distillation of ethanol-water using water condenser,  
Distillation of nitrobenzene and aniline using air condenser

#### **(v) Green Chemistry - Identification of Safety Symbols**

### **2. Purification Methods**

#### **(i). Crystallization**

Phthalic acid from hot water (using fluted filter paper and stemless funnel)  
Acetanilide from boiling water, Naphthalene from ethanol, Benzoic acid  
from water

#### **(ii). Decolorisation & Crystallization using charcoal**

Decolorisation of brown sugar (sucrose) with animal charcoal using gravity filtration,  
Crystallization and decolorisation of impure naphthalene (100g of naphthalene mixed  
with 0.3

g of Congo red using 1 g decolorizing carbon) from ethanol.

**(iii) Sublimation (Simple and Vacuum)** Camphor, Naphthalene,  
phthalic acid and succinic acid.

### **3. Qualitative analysis**

Identification of an organic compound through the functional group analysis,  
determination of  
melting point and preparation of suitable  
Derivatives

## **(C) PHYSICAL CHEMISTRY**

### **(i) Chemical Kinetics**

1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
2. To study the effect of acid strength on the hydrolysis of an ester.
3. To compare the strengths of HCl and H<sub>2</sub>SO<sub>4</sub> by studying the kinetics of hydrolysis of ethyl acetate.
4. To study kinetically the reaction of decomposition of iodide by H<sub>2</sub>O<sub>2</sub>.

### **(ii) Distribution Law**

1. To study the distribution of iodine between water and CCl<sub>4</sub>
2. To study the distribution of benzoic acid between benzene and water

### **(iii) Colloids**

1. To prepare arsenious sulphide sol and compare the precipitating power of mono-, bi- and trivalent anions.

### **(iv) Viscosity & Surface Tension**

1. To determine the percentage composition of given mixture (non interacting system) by viscosity method.
2. To determine the viscosity of amyl alcohol in water at different concentrations and calculate the viscosity of these compositions.
3. To determine the percentage composition of a given binary mixture by surface tension method (acetone & ethyl- ketone)

### **Spotting**

Spotting will include Safety symbols, laboratory instruments, techniques etc. During

examination in spotting there should be 5 spots related with instruments, techniques, safety etc. from the syllabus ; time of spotting is 20 minutes and a separate copy shall be used for the purpose.

**SCHEME OF EXAMINATION (B.Sc. Part-I) PRACTICAL**

**Max. Marks: 65 Min.Marks:24 Time 5 hours**

**INORGANIC CHEMISTRY**

Analysis: One Exercise **15Marks**

**ORGANIC CHEMISTRY**

1.Lab Techniques: One experiment from any one techniques- **2.5Marks**

2-Purification Methods: One experiment from any one methods- **2.5Marks**

3.Qualitative Analysis: One Compound **10Marks**

**PHYSICAL CHEMISTRY**

Any One experiment **15 Marks**

**SPOTTING 10 marks**

**(5**