

weak acid of same concentration.

- Study the pH change in the titration of a strong base using universal indicator.
- (b) Study of pH change by common ion effect in case of weak acids and bases.

#### F. Quantitative estimation

- Using a chemical balance.
- Preparation of standard solution of oxalic acid.
- Determination of strength of a given solution of sodium hydroxide by titrating it against standard solution of oxalic acid.
- Preparation of standard solution of sodium carbonate.
- Determination of strength of a given solution of hydrochloric acid by titrating it against standard sodium carbonate solution.

#### G. Qualitative analysis

Determination of one cation and one anion in a given salt:

Cations –  $\text{Pb}^{2+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Al}^{3+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Co}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Sr}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{NH}_4^+$

Anions –  $\text{CO}_3^{2-}$ ,  $\text{SO}_3^{2-}$ ,  $\text{SO}_4^{2-}$ ,  $\text{NO}_2^-$ ,  $\text{NO}_3^-$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$ ,  $\text{PO}_4^{3-}$ ,  $\text{C}_2\text{O}_4^{2-}$ ,  $\text{CH}_3\text{COO}^-$

(Note: Insoluble salts excluded)

#### H. Detection of nitrogen, sulphur, chlorine, bromine and iodine in an organic compound.

#### PROJECT

Scientific investigations involving laboratory testing and collecting information from other sources.

A few suggested Projects

- 1 Checking the bacterial contamination in drinking water by testing sulphide ion.
- 2 Study of the methods of purification of water.
- 3 Testing the hardness, presence of iron,

fluoride, chloride etc. depending upon the regional variation in drinking water and the study of causes of presence of these ions above permissible limit (if any).

- 4 Investigation of the foaming capacity of different washing soaps and the effect of addition of sodium carbonate on them.
- 5 Study of the acidity of different samples of the tea leaves.
- 6 Determination of the rate of evaporation of different liquids.
- 7 Study of the effect of acids and bases on the tensile strength of fibers.
- 8 Analysis of fruit and vegetable juices for their acidity.

#### Note:

Any other investigatory project can be chosen with the approval of the teacher.

### Std. XII (Theory)

#### Unit 1: Solid State

Classification of solids based on different forces; molecular, ionic, covalent and metallic solids, amorphous and crystalline solids (elementary idea), unit cell in two dimensional and three dimensional lattices, calculation of density of unit cell, packing in solids, voids, number of atoms per unit cell in a cubic unit cell, point defects, electrical and magnetic properties, **Band theory of metals, conductors and semiconductors and insulators and n and p type semiconductors.**

#### Unit 2 : Solutions and colligative properties

Types of solutions, expression of concentration of solids in liquids, solubility of gases in liquids, solid solutions, colligative properties –relative lowering



of vapor pressure, **Raoult's law** elevation of boiling point, depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties, abnormal molecular mass. **Van't Hoff factor and calculations involving it.**

### **Unit 3 :Chemical thermodynamics and energetic**

Concepts of system, types of systems, surroundings. Work, heat, energy, extensive and intensive properties, state functions. First law of thermodynamics – internal energy and enthalpy, Hess' law of constant heat summation, enthalpy of bond dissociation, combustion, formation, atomization, sublimation. Phase transition, ionization and solution **and dilution** Introduction of entropy as a state function, free energy change for spontaneous and non spontaneous processes, and equilibrium constant. **Second and third law of thermodynamics**

### **Unit 4: Electrochemistry**

Redox reactions, conductance in electrolytic solutions, specific and molar conductivity, variations of conductivity with concentration, Kohlrausch's Law, electrolysis and laws of electrolysis (elementary idea), dry cell –electrolytic and galvanic cells; lead accumulator, EMF of a cell, standard electrode potential, Nernst equation and its application to chemical cells, fuel cells; corrosion. **Relation between Gibb's energy change and emf of a cell.**

### **Unit 5: Chemical kinetics**

Rate of reaction (average and instantaneous), factors affecting rate of

reaction; concentration, temperature, catalyst; order and molecularity of a reaction; rate law and specific rate constant, integrated rate equations and half life (only for zero and first order reactions); concept of collision theory (elementary idea, no mathematical treatment). **Activation energy, Arrhenius equation.**

### **Unit 6 :General principles and processes of isolation of elements**

Principles and methods of extraction – concentration, oxidation, reduction electrolytic method and refining; occurrence and principle of extraction of aluminium, copper, zinc and iron

### **Unit 7: p-Block elements**

#### **Group 15 elements:**

General introduction, electronic configuration, occurrence, oxidation states, trends in physical and chemical properties; nitrogen – preparation, properties and uses; compounds of nitrogen; preparation and properties of ammonia and nitric acid, oxides of nitrogen (structure only); Phosphorous-allotropic forms; compounds of phosphorous; preparation and properties of phosphine, halides ( $\text{PCl}_3, \text{PCl}_5$ ) and oxoacids (elementary idea only).

#### **Group 16 elements:**

General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties; dioxygen; preparation, properties and uses; **Classification of oxides**, simple oxides; Ozone.

Sulphur – allotropic forms; compounds of sulphur; preparation, properties and uses of sulphur dioxide; sulphuric acid; industrial process of manufacture, properties and



uses, oxoacids of sulphur (structures only).

#### **Group 17 elements:**

General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties; compounds of halogens; preparation, properties and uses of chlorine and hydrochloric acid, interhalogen compounds, oxoacids of halogens (structure only).

#### **Group 18 elements:**

General introduction, electronic configuration. Occurrence, trends in physical and chemical properties, uses.

### **Unit 8 : d and f Block Elements**

#### **d-Block Elements -**

General introduction, electronic configuration, occurrence and characteristics of transition metals, general trends in properties of the first row transition metals – metallic character, ionization enthalpy, oxidation states, ionic radii, colour, catalytic property, magnetic properties, interstitial compounds, alloy formation preparation and properties of  $K_2Cr_2O_7$  and  $KMnO_4$ .

#### **f-Block elements-**

**Lanthanoids** – Electronic configuration, oxidation states, chemical reactivity and lanthanoid contraction **and its consequences**. **Actinoids** – Electronic configuration, oxidation states.

#### **Comparison with lanthanoids.**

### **Unit 9: Coordination compounds**

Coordination compounds – Introduction, ligands, coordination number, colour, magnetic properties and shapes, IUPAC nomenclature of mononuclear coordination compounds, bonding; **Werner's theory**,

**VBT, CFT**. isomerism, (**structural and stereo**) importance of coordination compounds (in qualitative analysis, extraction of metals and biological systems).

### **Unit 10 : Halogen derivatives of alkanes (and arenes)**

#### **Haloalkanes :**

Nomenclature, nature of C-X bond, physical and chemical properties, mechanism of substitution reactions.

#### **Stability of carbocations, R-S and d-l configuration**

#### **Haloarenes :**

Nature of C-X bond, substitution reactions (directive influence of halogen for monosubstituted compounds only) **stability of carbocations, R-S and d-l configurations**. Uses and environmental effects of – dichloromethane, trichloromethane, tetrachloromethane, iodoform, freons, DDT.

### **Unit 11 : Alcohols, phenols and ethers**

#### **Alcohols :**

Nomenclature, methods of preparation, physical and chemical properties (of primary alcohols only); identification of primary, secondary and tertiary alcohols; mechanism of dehydration, uses of methanol and ethanol.

#### **Phenols:**

Nomenclature, methods of preparation, physical and chemical properties, acidic nature of phenol, electrophilic substitution reactions, uses of phenols.

#### **Ethers :**

Nomenclature, methods of preparation, physical and chemical properties, uses.

### **Unit 12 : Aldehydes, ketones and**



**carboxylic acids****Aldehydes and ketones :**

Nomenclature, nature of carbonyl group, methods of preparation. Physical and chemical properties, mechanism of nucleophilic addition, reactivity of alpha hydrogen in aldehydes; uses.

**Carboxylic acids :**

Nomenclature, acidic nature, methods of preparation, physical and chemical properties; uses.

**Unit 13: Organic compounds containing nitrogen**

Nitro compounds-General methods of preparation and chemical reactions

**Amines :**

Nomenclature, classification, structure, methods of preparation, physical and chemical properties, uses, identification of primary, secondary and tertiary amines.

**Cyanides and isocyanides:**

Will be mentioned at relevant places in context.

**Diazonium salts:**

Preparation, chemical reactions and importance in synthetic organic chemistry.

**Unit 14: Biomolecules****Carbohydrates:**

Classification (aldoses and ketoses), monosaccharides **d-l configuration** (glucose and fructose), oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen), importance.

**Proteins:**

Elementary idea of  $\alpha$ -amino acids, peptide, linkage, polypeptides, proteins; structure of amines-primary, secondary, tertiary structure and quaternary structures (qualitative idea only), denaturation of

proteins; enzymes.

Lipids and hormones (elementary idea) excluding structure, their classification and functions.

**Vitamins:** Classification and functions.

**Nucleic acids:** DNA and RNA

**Unit 15: Polymers**

Classification - natural and synthetic, methods of polymerization (addition and condensation), copolymerization. Some important polymers; natural and synthetic like polythene, nylon, polyesters, bakelite, and rubber. **Biodegradable and non biodegradable polymers.**

**Unit 16: Chemistry in everyday life :**

- Chemicals in medicines :** analgesics, tranquilizers, antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines
- Chemicals in food :** Preservatives, artificial sweetening agents.
- Cleansing agents :** Soaps and detergents, cleansing action.

**Practical Syllabus - Std. XII****A. Chemical Kinetics**

(Any one of the following) :

- Effect of concentration and temperature on the rate of reaction between sodium thiosulphate and hydrochloric acid.
- Study of reaction rate of any one of the following:
  - Reaction of iodide ion with hydrogen peroxide at room temperature using different concentration of iodide ions.
  - Reaction between potassium iodate,  $\text{KIO}_3$  and sodium sulphite ( $\text{Na}_2\text{SO}_3$ )



using starch solution as indicator (clock reaction).

(c) Acid hydrolysis of ethyl acetate.

### B. Thermochemistry

Any one of the following experiments:

- i] Enthalpy of dissolution of copper sulphate or potassium nitrate.
- ii] Enthalpy of neutralization of strong acid (HCl) and strong base (NaOH).
- iii] Determination of enthalpy change during interaction (hydrogen bond formation) between acetone and chloroform.
- iv] Heat of displacement of Cu from  $\text{CuSO}_4$  by Zn.

### C. Electrochemistry

Variation of cell potential in  $\text{Zn}|\text{Zn}^{2+}||\text{Cu}^{2+}|\text{Cu}$  with change in concentration of electrolytes ( $\text{CuSO}_4$  or  $\text{ZnSO}_4$ ) at room temperature (demonstration).

### D. Chromatography (demonstration)

- (i) Separation of pigments from extracts of leaves and flowers by paper chromatography and determination of  $R_f$  values.
- (ii) Separation of constituents present in an inorganic mixture containing two cations only (constituents having large difference in  $R_f$  values to be provided).

### E. Preparation of Inorganic Compounds

- (i) Preparation of double salt of ferrous ammonium sulphate or potash alum.
- (ii) Preparation of potassium ferric oxalate.

### F. Preparation of Organic Compounds

- (i) p-Nitroacetanilide
- (ii) Aniline yellow or 2-Naphthol aniline dye.
- (iii) Iodoform
- (iv) Phthalic or succinic anhydride.
- (v) Di-benzal acetone

### G. Tests for the functional groups present in organic compounds

Unsaturation, alcoholic, phenolic, aldehydic, ketonic, carboxylic and amino (primary) groups.

### H. Characteristic tests of carbohydrates, fats and proteins in pure samples and their detection in given food stuffs.

### I. Determination of concentration/molarity of $\text{KMnO}_4$ solution by titrating it against a standard solution of:

- (i) Oxalic acid
- (ii) Ferrous ammonium sulphate (Students will be required to prepare standard solutions by weighing themselves).

### J. Qualitative analysis

- 1) Determination of two cations from a given mixture of salts.
- 2) Determination of two anions from a given mixture of salts.

**Cations** –  $\text{Pb}^{2+}$ ,  $\text{Cu}^{2+}$ ,  $\text{As}^{3+}$ ,  $\text{Al}^{3+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Co}^{2+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Sr}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{NH}_4^+$ ,

**Anions** –  $\text{CO}_3^{2-}$ ,  $\text{SO}_3^{2-}$ ,  $\text{SO}_4^{2-}$ ,  $\text{NO}_2^-$ ,  $\text{NO}_3^-$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$ ,  $\text{PO}_4^{3-}$ ,  $\text{C}_2\text{O}_4^{2-}$ ,  $\text{CH}_3\text{COO}^-$   
(Note : Insoluble salts excluded.)

### PROJECT

Scientific investigations involving laboratory testing and collecting information from other sources.

### A few suggested Projects:

- 1 Study of presence of oxalate ions in guava fruit at different stages of ripening.
- 2 Study of quantity of casein present in different samples of milk.
- 3 Preparation of soyabean milk and its comparison with the natural milk with



- respect to curd formation, effect of temperature, etc.
- 4 Study of the effect of potassium bisulphate as food preservative under various conditions (temperature, concentration, time etc).
  - 5 Study of digestion of starch by salivary amylase and, effect of pH and temperature on it.
  - 6 Comparative study of the rate of fermentation of following materials: wheat flour, gram flour, potato juice, carrot juice, etc.
  - 7 Extraction of essential oils present in Saunf (aniseed), Ajwain (carum), Illaichi (cardamom).
  - 8 Study of common food adulterants in fat, butter, sugar, turmeric powder, chilli powder and pepper.
- Note :** Any investigatory project, can be chosen with the approval of the teacher.

