

LEARNING OUTCOMES FOR GRADE X

Part 3 Inorganic Chemistry

Time Allocation: 20 days

Weightage: 14%

UNIT-9 CHEMICAL BONDING

Contents	Students Learning Outcomes					
	Students will be able to:	Cognitive Level				
		R	U	Ap	An	E
9.1 Chemical Bonds 9.2 Types of Chemical Bonds 9.2.1 Ionic Bonds 9.2.2 Covalent Bonds 9.2.3 Dative Covalent Bonds 9.2.4 Polar and Non-Polar Covalent Bond 9.2.5 Metallic Bonds 9.3 Intermolecular Forces 9.3.1 Dipole-Dipole Interactions 9.3.2 Hydrogen Bonding	<ul style="list-style-type: none"> Find the number of valence electrons in an atom using the Periodic Table. State the Octet and Duplet rules. State the importance of noble gas electronic configurations in the formation of ion. Explain how elements attain stability and relate importance of energy in chemical bonding. Outline the ways in which bonds can be formed. Describe the formation of an ionic bond. Recognize the compounds having ionic bonds. Identify characteristics of ionic compounds. Justify the formation of a covalent bond between two nonmetallic elements. Propose examples of single, double and triple covalent bonds. Explain polar and nonpolar covalent bond with respect to electronegativity difference. Describe the properties of covalent compounds. Distinguish between the dipole-dipole interaction and hydrogen bonding. Describe the formation of Coordinate covalent bond. Explain the formation of metallic bond. <p>SKILLS</p> <ul style="list-style-type: none"> Deduce electron cross and dot structures for simple covalent molecules containing single (H₂), double (O₂) and triple (N) covalent bonds. Predict the nature of chemical bond through difference in electronegativity values. Perform an experiment to study the nature of 			✓		
	✓	✓			✓	
		✓	✓	✓		
		✓			✓	
				✓		
			✓			✓
		✓				✓
		✓				✓
				✓		
						✓
						✓

	ionic compound as electrolyte.								
	<u>SOCIETY, TECHNOLOGY AND SCIENCE:</u>								
	<ul style="list-style-type: none"> Explain the need for different synthetic adhesives like glues and epoxy resins. Explain how aircrafts, cars, trucks and boats are partially held together with epoxy adhesives. 						✓	✓	

UNIT-10

Time Allocation: 24 days

ACIDS, BASES AND SALTS

Weightage: 17%

Contents	Students Learning Outcomes						
	Students will be able to:	Cognitive Level					
		R	U	Ap	An	E	C
10.1 Concepts of Acids and Bases 10.1.1 Arrhenius Concept of 10.1.2 Acids and Bases 10.1.3 Bronsted Concept of Acids and Bases 10.1.4 Lewis Concept of Acids and Bases 10.2 pH Scale 10.3 Salts 10.3.1 Preparation of Salts 10.3.2 Types of Salts (Acidic, Basic and Neutral Salts)	<ul style="list-style-type: none"> Define and give examples of Arrhenius acids and bases. Make use of the Bronsted-Lowry theory to classify substances as acids or bases, or as proton donors or proton acceptors. Classify substances as Lewis acids or bases. Deduce the equation for the self-ionization of water. Explain one method for the preparation of each type of salt. <p><u>SKILLS:</u></p> <ul style="list-style-type: none"> Use litmus paper, pH paper and other indicators for measuring pH of solutions. Depending upon hydrogen ion or hydroxide ion concentration, classify a solution as neutral, acidic or basic. Complete and balance a neutralization reaction. Perform acid-base titrations and related calculations. <p><u>SOCIETY, TECHNOLOGY AND SCIENCE:</u></p> <ul style="list-style-type: none"> Identify areas of work for analytical chemists. Explain why the quantity of preservatives in food is restricted by government regulations. Explain pH-dependent foods. Explain process of etching in an industry. Explain stomach acidity. 	✓		✓	✓	✓	
			✓	✓	✓	✓	✓

UNIT-11
METALS

Time Allocation: 10 days

Weightage: 7%

Contents	Students Learning Outcomes										
	Students will be able to:					Cognitive Level					
	R	U	Ap	An	E	C					
11.1 Types of Metals 11.2 Structure of Metals 11.3 Properties of Alkali and Alkaline Earth Metals 11.4 Reactions of metals	<ul style="list-style-type: none"> Identify elements of periodic table as alkali metals, alkaline Earth metals and transition metals. Analyze the arrangement of particles in metals. Describe general properties (i.e. melting point, hardness, luster, and malleability, thermal and electrical conductivity) of alkali and alkaline earth metals. Explain how metals react with water, oxygen and hydrogen. <p>SKILLS:</p> <ul style="list-style-type: none"> Propose the reaction of given metal with water, oxygen or hydrogen. <p>SOCIETY, TECHNOLOGY AND SCIENCE:</p> <ul style="list-style-type: none"> Identify commercial value of silver, gold, iron and platinum. Discuss the environmental advantages and disadvantages of recycling metals, e.g. aluminium and copper 							✓			
		✓		✓							
		✓				✓					
			✓			✓					

UNIT-12

CHEMISTRY OF SELECTIVE NON-METALS

Time Allocation: 16 days

Weightage: 11%

Contents	Students Learning Outcomes										
	Students will be able to:					Cognitive Level					
	R	U	Ap	An	E	C					
12.1 Nitrogen 12.1.1 Preparation of ammonia and its uses 12.1.2 Role of ammonia 12.2 Sulphur	<ul style="list-style-type: none"> Describe occurrence of nitrogen in nature. Compare the preparation of ammonia in laboratory and on industry scale. Identify the role of ammonia in preparation of nitrogenous fertilizers (ammonium sulphate, ammonium nitrate and urea). 										
		✓		✓							
			✓								
		✓									

12.2.1 Extraction of Sulphur by Frasch Process	<ul style="list-style-type: none"> Describe the occurrence and extraction of Sulphur. Explain the preparation of Sulphuric acid by Contact process. Explain the properties of Sulphuric acid as oxidizing agent (reaction with C, S, H and Br). Describe uses of Sulphuric acid. Elaborate the preparation of chlorine and its reactions with H, O and C. Identify the role of chlorine as disinfectant. Explain the importance of O₂ gas. Discuss the process of extraction of O₂ gas from air. <p>SKILLS:</p> <ul style="list-style-type: none"> Understand the role of fertilizer in agriculture. <p>SOCIETY, TECHNOLOGY AND SCIENCE:</p> <ul style="list-style-type: none"> Understand role of Sulphur in treatment of skin diseases. 	✓					
12.2.2 Preparation Sulphuric Acid and its Uses		✓					
12.3 Chlorine							
12.3.1 Preparation and reactions of chlorine		✓					
12.3.2 Chlorine as disinfectant		✓					
12.4 Oxygen							
12.4.1 Importance of Oxygen		✓					✓
12.4.2 Extraction of Oxygen		✓					

UNIT-13

ENVIRONMENTAL CHEMISTRY

Time Allocation: 20 days

Weightage: 14%

Contents	Students Learning Outcomes							
	Students will be able to:	Cognitive Level						
		R	U	Ap	An	E	C	
13.1 Composition of Atmosphere 13.1.1 Layers of Atmosphere 13.1.2 Air Pollutants 13.1.3 Reactions Occurring in atmosphere (Acid Rain and its Effects, Ozone Depletion and its Effects) 13.2 Soft and Hard Water 13.2.1 Types of Hardness of Water 13.2.2 Methods of Removing Hardness 13.2.3 Disadvantages of Water Hardness 13.3 Major Water	<ul style="list-style-type: none"> Define atmosphere. Explain composition of atmosphere. Differentiate between stratosphere and troposphere. Identify the major air pollutants. Describe acid rain, ozone depletion and their effects on environment. Differentiate among soft, temporary and permanent hard water. Infer some possible disadvantages of water hardness. Propose methods for eliminating temporary and permanent hardness of water. Identify industrial wastes and household wastes as water pollutants. Deduce the effects of water pollutants on life. 	✓						
		✓						
		✓						
		✓						
		✓						
		✓						
		✓						
		✓						
		✓						
		✓						

Pollutants 13.3.1 Industrial Wastes 13.3.2 Household Wastes 13.3.3 Agricultural Waste 13.4 Water Borne Diseases 13.5 Water Purification	<ul style="list-style-type: none"> Describe the various types of water borne diseases. Plan different economical ways to make water drinkable. 	✓					✓
	SKILLS: <ul style="list-style-type: none"> Perform filtration experiments in the laboratory on different water samples having suspended impurities. Test water quality by checking its colour, odour, hardness and conductivity and pH. Determine boiling point of water. Perform distillation of impure water samples. SOCIETY, TECHNOLOGY AND SCIENCE: <ul style="list-style-type: none"> Explain how hard water hampers the cleansing action of soap. Explain how and why water treatment is essential for water to make it drinkable. Explain how incineration of waste material contributes to the problem of air pollution. Debate whether the government should do more to control air pollution resulting from auto exhaust. 		✓		✓	✓	✓

Part 4 Organic Chemistry

UNIT-14

ORGANIC CHEMISTRY

Time Allocation: 18 days

Weightage: 13%

Contents	Students Learning Outcomes					
	Students will be able to:					Cognitive Level
	R	U	Ap	An	E	C
14.1 Unique Properties of Carbon 14.2 General Characteristics and Sources of Organic Compounds 14.3 Homologous Series	<ul style="list-style-type: none"> Debate on why the whole branch of Chemistry is based on carbon. Understand the concept of Organic Chemistry. Identify some general characteristics of organic compounds. Analyze coal, petroleum, natural gas and plants as a source of organic compound. 		✓	✓	✓	✓

14.3.1 Alkanes	<ul style="list-style-type: none"> Interpret the importance of organic compounds (polymers, medicine). 			✓		
14.3.2 Alkenes	<ul style="list-style-type: none"> Describe the Properties of a Homologous Series. 			✓		
14.4 Functional Groups						
14.4.1.1 Functional Groups Containing Carbon, Hydrogen and Oxygen	<ul style="list-style-type: none"> Devise a definition of Homologous Series in Organic Chemistry. Name alkanes and alkenes up to C₂ to C₄. Formulate chemical equations to show the reaction of alkanes with oxygen and chlorine. 	✓				✓
14.4.1.2 Functional Groups Containing Carbon, Hydrogen and Halogens	<ul style="list-style-type: none"> Formulate chemical equation to show the preparation of alkanes and alkenes by the dehydration of ethanol and dehydrohalogenation of alkyl halide. Formulate chemical equations to show the reaction of alkanes with hydrogen, steam, bromine, water and KMnO₄. 					✓
14.4.1.3 Double and Triple Bonds	<ul style="list-style-type: none"> Define functional group. Differentiate between different organic compounds on the basis of their functional groups. 	✓			✓	✓
14.5 Alcohols and Carboxylic Acids						
14.5.1 Preparation	<ul style="list-style-type: none"> Formulate a chemical equation to show the preparation of ethanol from ethene by fermentation. 					✓
14.5.2 Important Reactions	<ul style="list-style-type: none"> Formulate chemical equation to show laboratory preparation of Acetic Acid. 				✓	✓
14.5.3 Preparation of Ether Alcohol and Acetic Acid	<p>SKILLS:</p> <ul style="list-style-type: none"> Identify carboxylic acids, phenols, aldehydes and ketones in terms of functional groups in the laboratory. Distinguish between saturated and unsaturated compounds using iodine, bromine and potassium permanganate solutions. 				✓	✓
	<p>SOCIETY, TECHNOLOGY AND SCIENCE:</p> <ul style="list-style-type: none"> Understand how pharmaceutical chemists work towards partial and total synthesis of effective new drugs. Explain how substances produced by plants and animals can also be produced in the labs. Explain hydrocarbons as fuel and feed stock in industry. 	✓			✓	✓
	<ul style="list-style-type: none"> Explain hydrogenation of margarine. Explain the importance of vinegar. 	✓	✓			

UNIT-15
MACROMOLECULES

Time Allocation: 14 days

Weightage: 10%

Contents	Students Learning Outcomes						
	Students will be able to:	Cognitive Level					
		R	U	Ap	An	E	C
15.1 Polymers 15.1.1 Lipids 15.1.2 Natural Polymers 15.1.3 Synthetic Polymers	<ul style="list-style-type: none"> Define the terms: Macromolecules, Monomer, Polymer Identify the types of Polymers: natural polymers and synthetic polymers. Explain lipids with reference to fats and oils. Describe carbohydrate as a macromolecule. Distinguish between monosaccharide and disaccharide. Explain proteins are polymers made from reactions between amino acid monomers. Examine preparation and uses of Polyethylene, PVC, Polystyrene, Polyester, Nylon and Teflon. <p>SKILLS:</p> <ul style="list-style-type: none"> Evaluate the relative solubility in water of starch and sugar. <p>SOCIETY, TECHNOLOGY AND SCIENCE:</p> <ul style="list-style-type: none"> Explain why agricultural and nutritional sciences are vital. Explain the use of natural products in the preparation of flavors, fragrances, resins and pharmaceuticals. Explain the use of dextrose in drips. 		✓	✓		✓	
			✓		✓		
			✓			✓	
			✓				
			✓				
			✓				

Part 5

Industrial Chemistry

UNIT-16

Time Allocation: 18 days

CHEMICAL INDUSTRIES

Weightage: 13%

Contents	Students Learning Outcomes						
	Students will be able to:	Cognitive Level					
		R	U	Ap	An	E	C
16.1 Applied Chemistry 16.2 Urea 16.3 Basic Metallurgical Operations 16.4 Iron Industry 16.5 Domestic Chemical Industries	<ul style="list-style-type: none"> Understand the introduction to applied Chemistry. Describe the composition of urea. Develop a flow sheet diagram for the manufacture of urea. List the uses of urea. Identify some metallurgical operations. Name the ores of iron. Sketch the manufacturing process of iron. List the uses of Iron. <p>SKILLS:</p> <ul style="list-style-type: none"> Explain how stains are removed. Prepare ink, polish, soap, detergent and liquid soap. <p>SOCIETY, TECHNOLOGY AND SCIENCE:</p> <ul style="list-style-type: none"> Relate the study of Chemistry with the careers in industry. Describe how different types of fire (caused by wood, oil, electric spark) require different chemical ways to put them out. Explain how technology affects the production of common chemicals. Debate the use of synthetic fertilizers versus organic / natural fertilizers. 		✓				
			✓				✓
		✓					
		✓	✓				
		✓		✓			
			✓				✓
			✓				
				✓			
					✓		

LIST OF CHEMISTRY PRACTICALS

Grade-IX

Practical	Equipment	Chemicals
UNIT-1 Fundamentals of Chemistry 1. Separate the given mixture by physical method.	Glass plate, spatula, magnet, test tube, beaker, gas burner, matches, and safety goggles.	Iron filings, sand or any other soluble mix.
UNIT-2 Avogadro's Number and Mole None	None	None
UNIT -3 Periodic Table and Periodicity of Properties None	None	None
UNIT-4 Structure of Atoms None	None	None
UNIT-5 Physical States of Matter 1. Determine the Melting Point of Naphthalene and Biphenyl.	Beaker, thermometer, Bunsen burner, tripod stand, wire gauze, glass stirrer, capillary tube and iron stand.	Water, naphthalene and biphenyl.
2. Determine the Boiling Point of Acetone and Ethyl Alcohol.	Beaker, thermometer, Bunsen burner, tripod stand, wire gauze, glass stirrer, fusion tube, iron stand and capillary tube.	Water, acetone and ethyl alcohol.
3. Separate naphthalene from the given mixture of NaCl or NH_4Cl and naphthalene / NH_4Cl by sublimation.	China dish or watch glass, tripod stand, funnel, burner, NaCl bath and cotton.	Mixture of NaCl , naphthalene / NH_4Cl .

4. Separate the given mixture of alcohol and water by distillation.	Round bottom distillation flask or retort, thermometer, corks, water condenser, receiving flask, burner, iron stand, tripod stand, wire gauze, filter paper and funnel.	Mixture of water and alcohol.
UNIT-6 Solutions Preparation of Solution of Known Molarity: 1. Prepare 250cm ³ of 0.1 Hydrated Oxalic acid.	Beaker, stirrer, volumetric flask and physical balance, funnel, wash bottle.	Oxalic acid, Distilled water.
2. Prepare 250cm ³ of 0.05M of Na ₂ CO ₃ solution.	Burette, funnel, volumetric flask.	Distilled water, Na ₂ CO ₃ .
3. Prepare 100 ml of 0.05M Oxalic acid from the above solution.	Burette, funnel, volumetric flask.	Stock solution, distilled water, Oxalic acid.
4. Demonstrate that miscible liquids dissolve in each other and immiscible liquids do not.	Three small beakers, organic waste bottle, safety goggles.	Water, oil, ethanol.
5. Demonstrate that temperature affects solubility.	Test tubes, burner, matches test tube holder, test tube rack, stirring rod, safety goggles.	Sucrose, water.
UNIT-7 Oxidation and Reduction None	None	None
UNIT-8 ElectroChemistry 1. Demonstrate the conductivity of different given solutions.	Dry battery cell with holder with two electrodes, beakers, stirrer test tube holder.	Two electrodes, distilled water, sugar, NaCl, vinegar, HCl, NaOH.

2. Demonstrate a metal displacement reaction in aqueous medium.	Copper wire, bulb with bulb holder, test tube.	Copper sulphate and iron strip or nail.
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Grade-X

UNIT-9 Chemical Bonding None	None	None
UNIT-10 Acids, Bases and Salts Demonstrate that some natural substances are weak acids.	Dropper, knife, test tubes, two test tube racks, beaker, gas burner, wire gauze, matches, dropper, safety goggles.	Citrus fruits, pH paper.
Standardize the given HCl solution volumetrically.	Pipette, burette, funnel, conical flask, beaker, iron stand.	Standard solution of HCl, solution of NaOH, phenolphthalein.
Determine the exact Molarity of the HCl solution volumetrically.	Pipette, burette, funnel, conical flask, beaker, iron stand.	Standard solution of Na ₂ CO ₃ , solution HCl, methyl orange.
Determine the exact Molarity of a solution of oxalic acid volumetrically.	Pipette, burette, funnel, conical flask, beaker.	Standard solution of oxalic acid, phenolphthalein, solution of NaOH.
Classify substances as acidic, basic or neutral.	Six 100 cm ³ beakers, red and blue litmus papers, safety goggles	Red and blue litmus paper, 0.1% bromothymol blue, 0.1% solutions of various acids (HCl, H ₂ SO ₄ and acetic acid) Bases: (Sodium carbonate, hydroxide of sodium, potassium, calcium and magnesium) Natural Substances: Methanol, ethanol,

		sodium chloride and water.
Identify saturated and unsaturated organic compounds by $KMnO_4$.	Test tubes, test tube holder, test tube rack, dropper.	Cinnamic acid solution, $KMnO_4$ solution, distilled water.
UNIT-11 Metals Identify sodium, strontium, barium, copper, potassium radicals by flame test.	Platinum wire, HCl , spatula, watch, glass, burner, and match sticks.	Salt of each of sodium, strontium, barium, copper, potassium, concentrated HCl .
Testing for metal ions: Al^{3+} , Zn^{2+} , Ca^{2+} , Fe^{2+} , Fe^{3+} , Cu^{2+}	Test tubes, test tube rack, safety goggles.	$NaOH$, NH_4OH .
UNIT-12 Chemistry of some selective non-metals Reaction of sulphuric acid with zinc.	Wolf bottle, delivery tube, gas jar	Zinc granules, dil. H_2SO_4
UNIT-13 Environmental Chemistry None	None	None
UNIT-14 Organic Chemistry None	None	None
UNIT-15 Macromolecules Demonstrate that sugar decomposes into elements or other compounds.	China dish, burner, tripod, stand, wire gauze, matches, spatula, safety goggles.	Sugar.
UNIT-16 Chemical Industries Preparation of shoe polish	Beaker, stirrer	Wax, turpentine oil, black dye