

4. STUDENTS LEARNING OUTCOMES FOR GRADES IX-X

LEARNING OUTCOMES FOR GRADE IX

Part 1 Basic Concept

Time Allocation: 20 days

Weightage: 14%

Unit 1

FUNDAMENTALS OF CHEMISTRY

Contents	Students Learning Outcomes						
	Students will be able to:	Cognitive Level					
		R	U	Ap	An	E	C
1.1 Branches of Chemistry 1.1.1 Physical Chemistry 1.1.2 Inorganic Chemistry 1.1.3 Organic Chemistry 1.1.4 BioChemistry 1.1.5 Analytical Chemistry 1.1.6 Industrial Chemistry 1.1.7 Nuclear Chemistry 1.1.8 Environmental Chemistry 1.1.9 Green Chemistry 1.2 Basic Definitions 1.2.1 Elements, Compounds and Mixtures 1.2.2 Atomic Number 1.2.3 Relative Atomic Mass and Atomic Mass Unit 1.2.4 Calculation of Relative Atomic Mass 1.2.5 Percentage Composition 1.2.6 Empirical Formula and Molecular Formula 1.2.7 Molecular Mass and Formula Mass	<ul style="list-style-type: none"> Describe different branches of Chemistry with examples. Identify examples to explain the inter-linkage and differences between various branches of Chemistry. Differentiate between matter and energy. Distinguish among elements, atom, molecule, ion, compounds and mixtures. Define atomic number, mass number, relative atomic mass and atomic mass unit. Justify why C-12 is taken as standard. Formulate empirical and molecular formula of various compounds. Differentiate between empirical and molecular formula. <p>SKILLS:</p> <ul style="list-style-type: none"> Calculate the percentage composition of various compounds. Calculate the empirical and molecular formula from given %age composition. Deduce the number of electrons, protons and neutrons in an atom/ion from atomic number and mass number. <p>SOCIETY, TECHNOLOGY AND SCIENCE:</p> <ul style="list-style-type: none"> Explain how Science developed through observations and experiments rather than by speculation alone. 		✓	✓	✓	✓	✓

UNIT-2

Time Allocation: 12 days

Weightage: 8%

AVOGADRO'S NUMBER AND MOLE

Contents	Students Learning Outcomes						
	Students will be able to:			Cognitive Level			
		R	U	Ap	An	E	C
<p>2.1 Avogadro's Number and Mole 2.1.1 Molar Mass</p> <p>2.2 Chemical Calculations 2.2.1 Mole-Mass Calculations 2.2.2 Mole-Particle Calculations</p>	<ul style="list-style-type: none"> Distinguish among the terms gram atomic mass, gram molecular mass and gram formula mass. Convert atomic mass, molecular mass and formula mass into gram atomic mass, gram molecular mass and gram formula mass. Define Avogadro's number and mole. Relate gram atomic mass, gram molecular mass and gram formula mass to mole. Describe how Avogadro's number is related to a mole of any substance. <p>SKILLS:</p> <ul style="list-style-type: none"> Calculate the mass of one mole of any substance. Calculate the number of moles in a given mass of a substance. Calculate the number of moles in a given number of representative particles of any substance. Calculate the number of representative particles in a given number of moles of any substance. <p>SOCIETY, TECHNOLOGY AND SCIENCE:</p> <ul style="list-style-type: none"> Create an analogy to explain the size of a mole. 				✓		
		✓		✓			
			✓				
				✓			
					✓		
							✓

UNIT-3

Time Allocation: 22 days

Weightage: 15%

PERIODIC TABLE AND PERIODICITY OF PROPERTIES

Contents	Students Learning Outcomes						
	Students will be able to:	Cognitive Level					
		R	U	Ap	An	E	C
3.1 Periodic Table 3.1.1 Periods 3.1.2 Groups 3.2 Periodicity of Properties 3.2.1 Atomic Size 3.2.2 Ionization Energy 3.2.3 Electron Affinity 3.2.4 Electro-negativity	<ul style="list-style-type: none"> Summarize the history of development of periodic table. 		✓				
	<ul style="list-style-type: none"> State Mendeleev's Periodic Law and describes its salient features. 	✓					
	<ul style="list-style-type: none"> State the modern periodic law and describe modern Periodic Table. 	✓					
	<ul style="list-style-type: none"> Distinguish between a period and a group in the Periodic Table. 				✓		
	<ul style="list-style-type: none"> Classify the elements into two categories: (groups and periods) according to the configuration of their outer most electrons. 				✓		
	<ul style="list-style-type: none"> Recognize the similarity in the chemical and physical properties of elements in the same group of elements. 		✓				
	<ul style="list-style-type: none"> Identify the relationship between electron configuration and the position of an element in the Periodic Table. 				✓		
	<ul style="list-style-type: none"> Explain how shielding effect influences periodic trends. 			✓			
	<ul style="list-style-type: none"> Define the terms Atomic size, Ionization Energy, Electron Affinity and Electro-negativity. 	✓					
	<ul style="list-style-type: none"> Describe how do atomic size, the ionization energy, electronegativity and Electro Affinity change within a group and within a period in the Periodic Table. 					✓	
	SKILLS: <ul style="list-style-type: none"> Divide Periodic Table into blocks. Locate the families on the Periodic Table. 				✓		
	SOCIETY, TECHNOLOGY AND SCIENCE: <ul style="list-style-type: none"> Describe the importance of vacant spaces in Mendeleev's Periodic Table. Explain how Mendeleev's Periodic Table helps in correcting the Atomic Masses of elements. 		✓				
				✓			

Part 2

Physical Chemistry

Time Allocation: 20 days

Weightage: 14%

UNIT-4

STRUCTURE OF ATOMS

Contents	Students Learning Outcomes								
	Students will be able to:	Cognitive Level							
		R	U	Ap	An	E	C		
<p>4.1 Theories and Experiments related to Atomic Structure</p> <p>4.1.1 Rutherford's Atomic Model (Experiment and Postulates)</p> <p>4.1.2 Bohr's Atomic Theory (Postulates)</p> <p>4.2 Electronic Configuration</p> <p>4.2.1 Concepts of s and p Sub-Shells</p> <p>4.2.2 Electronic Configurations of First 20 Elements</p> <p>4.3 Isotopes</p>	<ul style="list-style-type: none"> Evaluate the experimentation and contributions that Rutherford made for the development of the atomic theory. Describe postulates of Bohr's Atomic Theory. Explain how Bohr's Atomic Theory differs from Rutherford's Model. Elaborate the structure of an atom including the location of the proton, electron and neutron. Identify the properties of atomic particles. Identify the presence of sub shells in a shell. Interpret the electronic configurations of first 20 elements in the Periodic Table according to Aufbau principle. Define isotopes. Compare isotopes of an atom. State the uses of isotopes in various fields of life. <p>SKILLS</p> <ul style="list-style-type: none"> Formulate the structure of different isotopes from mass number and atomic number (H, C, Cl, and U). Deduce the electronic configuration in core and valence notation for given the atoms and ions from their atomic number. <p>SOCIETY, TECHNOLOGY AND SCIENCE:</p> <ul style="list-style-type: none"> Describe the importance of Uranium in generating electricity. 					✓			
					✓		✓		
						✓			✓
						✓			
						✓			
				✓					
				✓					
							✓		
								✓	
									✓
					✓				
									✓

UNIT-5

PHYSICAL STATES OF MATTER

Time Allocation: 18 days

Weightage: 12%

Contents	Students Learning Outcomes						
	Students will be able to:	Cognitive Level					
		R	U	Ap	An	E	C
5.1 Physical State of matter 5.2 Gaseous State 5.2.1 Typical Properties 5.2.2 Laws Related To Gases: <ul style="list-style-type: none"> • Boyle's Law • Charles's Law 5.3 Liquid State 5.3.1 Typical Properties 5.3.2 Factors Affecting the Boiling Point 5.4 Solid State 5.4.1 Typical Properties 5.5 Types of Solids 5.5.1 Amorphous 5.5.2 Crystalline State 5.5.3 Allotropy	<ul style="list-style-type: none"> • Compare the physical states of matter with regard to intermolecular forces present between them. • Explain the properties of gases (diffusion, effusion, pressure, density and compressibility). • Account for pressure-volume changes in a gas using Boyle's Law. • Account for temperature-volume changes in a gas using Charles's Law. • Explain the properties of liquids like evaporation, vapour pressure, boiling point, freezing point, diffusion and density. • Identify the Brownian's movement of liquid particles. • Analyze the effect of external pressure on boiling point. • Describe physical properties of solids (melting points, density and sublimation points). • Differentiate between amorphous and crystalline solids. • Explain the allotropic forms of elements (S and C). <p>SKILLS:</p> <ul style="list-style-type: none"> • Inspect the daily life examples of evaporation, diffusion and effusion. • Plan an experiment to show Brownian's movement of liquid. • Explain the working of pressure cooker. • Determine melting point of organic solids. • Determine boiling point of organic liquids. • Carry out sublimation. <p>SOCIETY, TECHNOLOGY, AND SCIENCE:</p> <ul style="list-style-type: none"> • Explain how ice is formed. 		✓		✓		
			✓		✓		
				✓	✓		
			✓		✓		
				✓	✓		
			✓		✓		
						✓	
							✓
		✓					

UNIT-7

Time Allocation: 16 days

Weightage: 11%

OXIDATION AND REDUCTION

Contents	Students Learning Outcomes						
	Students will be able to:	Cognitive Level					
		R	U	Ap	An	E	C
7.1 Oxidation and 7.2 Reduction 7.3 Oxidation States and 7.4 Rules for Assigning Oxidation States 7.5 Oxidizing and Reducing Agents 7.6 Oxidation-Reduction Reactions	<ul style="list-style-type: none"> Explain oxidation and reduction in terms of loss or gain of oxygen or hydrogen and loss or gain of electrons. Define oxidizing and reducing agents in a redox reaction. Identify the oxidizing and reducing agents in a redox reaction. Define oxidation state. State the common rules used for assigning oxidation numbers to free elements, ions (simple and complex), molecules and atoms. <p>SKILLS:</p> <ul style="list-style-type: none"> Calculate the oxidation number of element in a compound. Identify the species undergoing oxidation and reduction reactions. Determine the oxidation number of an atom of any element in a compound. <p>SOCIETY, TECHNOLOGY AND SCIENCE:</p> <ul style="list-style-type: none"> Understand the oxidation or reduction reactions in fruits and vegetables. 			✓			
		✓					
		✓			✓		
		✓					
				✓			
				✓		✓	
			✓				

UNIT-8
ELECTROCHEMISTRY

Time Allocation: 18 days

Weightage: 12%

Contents	Students Learning Outcomes						
	Students will be able to:	Cognitive Level					
		R	U	Ap	An	E	C
8.1 Electrolyte and its Types 8.2 Electrochemical Series and its Applications 8.3 Electrochemical Cell 8.4 Galvanic Cell 8.5 Electrolytic Cell 8.6 Electrolysis of Water 8.7 Electrochemical Industries 8.7.1 Manufacture of Na by Down Cell 8.7.2 Electroplating	<ul style="list-style-type: none"> Understand the importance and application of electroChemistry. Define ElectroChemistry. Recognize weak and strong electrolyte. Distinguish between ionization and dissociation. Compare the tendencies of metals and non-metals to be oxidized and reduced in an electrochemical series. Understand the reactions of metals with dilute acids with the help of electrochemical series. Identify components of Electrochemical Cell in terms of anode and cathode. Sketch an Electrolytic Cell and label cathode and anode. Identify the direction of cation and anion towards respective electrodes. Propose how electrolysis of acidified water would occur. Describe manufacturing of Na metal by Down Cell. Explain Electroplating of Copper. <p>SKILLS:</p> <ul style="list-style-type: none"> Perform metal displacement reactions in aqueous medium. <p>SOCIETY, TECHNOLOGY AND SCIENCE:</p> <ul style="list-style-type: none"> Understand electroplating of artificial jewelry. Explain electroplating of rims of wheels of motorbikes. 		✓				
	✓	✓		✓	✓		✓