



آغا خان یونیورسٹی ایگزامینیشن بورڈ  
AGA KHAN UNIVERSITY EXAMINATION BOARD

Higher Secondary School Certificate  
Examination Syllabus

# Chemistry

Grades XI - XII

(Based on New National Curriculum 2022-2023)

# Student Learning Outcomes of AKU-EB HSSC Chemistry Syllabus

## Part I (Grade XI)

Topics and Sub-topics	Student Learning Outcomes		Cognitive Level <sup>1</sup>		
			R	U	A and beyond
<b>1. Stoichiometry</b>	Students should be able to:				
1.1 Nature of Science and Technology	1.1.1	compare the fields of STEAM, i.e., 'science', 'technology', 'engineering', 'arts' and 'mathematics' by giving examples from the physical sciences.		FA <sup>2</sup>	
1.2 Chemistry as a Quantitative Science	1.2.1	explain the significance of stoichiometry in the following areas: a. pharmaceuticals, b. food and beverage industries;		*	
1.3 Mole and Avogadro's Number	1.3.1	relate the concept of mole with Avogadro's number;		*	A  A
	1.3.2	apply the rules for rounding a number to a given number of significant figures to solve stoichiometric problems;			
	1.3.3	calculate the number of following chemical species/ particles: a. atoms, b. molecules, c. moles, d. ions, e. protons, f. neutrons, g. electrons;			

<sup>1</sup>R = Remember, U = Understand, A = Apply and beyond [Apply (A), Analyse (An), Evaluate (E), Create (C)]

<sup>2</sup>FA= Formative Assessment, not to be assessed under examination conditions

Topics and Sub-topics	Student Learning Outcomes		Cognitive Level		
			R	U	A and beyond
1.4 Reacting Masses and Volumes	1.4.1	calculate, using a balanced chemical equation, the a. interacting moles, b. representative particles, c. masses and volume of gases at STP (22.4 L) and RTP (24 L);			A
	1.4.2	solve problems based on stoichiometric relationships using mole ratios as conversion factor (up to 3 significant figures);			A
1.5 Formulae and Percentage Composition	1.5.1	calculate the percentage (by mass) of: a. elements in compounds, b. water of crystallisation in hydrated salts;			A
	1.5.2	calculate empirical and molecular formulae of compounds;			A
1.6 Excess and Limiting Reagent	1.6.1	deduce the limiting reagent in chemical reactions;			E
	1.6.2	calculate the maximum amount of product produced and the amount of any unreacted excess reagent, using the concept of the limiting reagent in a chemical reaction;			A
1.7 Theoretical, Actual and Percentage Yield	1.7.1	distinguish among theoretical yield, actual yield and percentage yield;		*	
	1.7.2	calculate the percentage yield of a product in a chemical reaction.			A

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
<b>2. Atomic Structure</b>	Students should be able to:			
2.1 Discharge Tube Experiment	2.1.1 explain the construction and working of the discharge tube with reference to the discovery of electron and proton; 2.1.2 explain the properties of: a. cathode rays, b. positive/ anode/ canal rays;		FA *	
2.2 Planck's Quantum Theory	2.2.1 explain the relationship among energy, frequency, wavelength and wave number using Planck's quantum theory;		*	
2.3 Bohr's Atomic Theory	2.3.1 explain Bohr's atomic theory and its defects; 2.3.2 calculate the radius and energy of revolving electrons in orbits with reference to Bohr's atomic theory; 2.3.3 explain spectral lines of hydrogen atom; 2.3.4 calculate wave numbers of photons of various spectral series with reference to Bohr's atomic theory;		* *	A A
2.4 X-Rays and Atomic Numbers	2.4.1 explain the production and uses of X-rays; 2.4.2 relate the X-ray frequency to the atomic number of different elements, with reference to Moseley's experiment; 2.4.3 state Moseley's law and its significance;		FA FA	
		FA		

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
2.5 Heisenberg's Uncertainty Principle and Quantum Numbers	2.5.1 explain the concept of an orbital based on Heisenberg's uncertainty principle; 2.5.2 compare orbit and orbital; 2.5.3 describe the principal quantum number, Azimuthal quantum number, magnetic quantum number and spin quantum number; 2.5.4 draw the shapes of degenerate orbitals (p and d); 2.5.5 deduce the position and distribution of electrons using the concept of quantum numbers;		*	A E
2.6 Dual Nature of Electron	2.6.1 explain the dual nature of an electron with reference to de-Broglie equation;		FA	
2.7 Ionisation Energy	2.7.1 explain the variation in successive ionisation energies of an element; 2.7.2 deduce the electronic configuration and position of representative elements using successive ionisation energy data;		*	E
2.8 Energy Levels and Electronic Configuration	2.8.1 describe the rules of electronic configuration, i.e., Aufbau principle, Hund's rule, Pauli's exclusion principle; 2.8.2 explain the electronic configurations in terms of electron's energy and inter-electron repulsion; 2.8.3 determine electronic configuration of elements based on Aufbau principle, Hund's rule and Pauli's exclusion principle; 2.8.4 explain the properties of silicon, including its electronic configuration, energy band gap, and doping ability, that make it suitable for use as a semiconductor in electronic devices.		*	A

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
<b>3. Theories of Covalent Bonding and Shape of Molecules</b>	Students should be able to:			
3.1 Electronegativity and Bonding	3.1.1 relate bond energy, bond strength, and bond length to the stability of chemical bonds in molecules;		*	
	3.1.2 compare the reactivity of covalent molecules using bond length and bond energy values;		*	
	3.1.3 define the term 'electronegativity';	*		
	3.1.4 explain the factors influencing the electronegativities of elements in terms of nuclear charge, atomic radius and shielding effect;		*	
	3.1.5 explain the change in bond length of heteronuclear molecules due to the difference in electronegativity values of bonded atoms;		*	
	3.1.6 predict the nature of bonding based on the electronegativity difference of bonded atoms using Linus Pauling scale;			E
3.2 Effect of Bonding on Physical and Chemical Properties	3.2.1 explain the ionic character of covalent bond;		*	
	3.2.2 explain the solubility of ionic and covalent compounds on the basis of the nature of bonding;		*	
	3.2.3 explain the chemical properties of ionic and covalent compounds;		*	
	3.2.4 compare the directional and non-directional nature of ionic and covalent bonds;		*	

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
3.3 Shape of Molecules using VSEPR Theory	3.3.1		*	A
	3.3.2			
	3.3.3		FA	
3.4 Covalent Bonding, VBT, MOT and Hybridisation	3.4.1		*	A
	3.4.2		*	
	3.4.3		*	
	3.4.4			
	3.4.5		*	
	3.4.6			
3.5 Dipole Moment	3.5.1		*	E
	3.5.2			

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
<b>4. States of Matter: Gases, Liquids and Solids</b>	Students should be able to:			
4.1 Kinetic Molecular Interpretation of Gases, Liquids and Solids	4.1.1 compare the following physical properties of gases, liquids and solids with reference to kinetic molecular theory: <ul style="list-style-type: none"> <li>a. diffusion,</li> <li>b. compression,</li> <li>c. expansion,</li> <li>d. motion of molecules,</li> <li>e. intermolecular forces,</li> <li>f. kinetic energy;</li> </ul>		*	
4.2 Gas laws, Ideal Gas Equation and Deviation from Ideal Behaviour	4.2.1 explain the following gas laws: <ul style="list-style-type: none"> <li>a. Dalton's law of partial pressure,</li> <li>b. Graham's law of diffusion/ effusion;</li> </ul> 4.2.2 explain Boyle's law, Charles's law and Avogadro's law; 4.2.3 derive ideal gas equation using Boyle's, Charles's and Avogadro's law; 4.2.4 calculate the values of ideal gas constant if <ul style="list-style-type: none"> <li>a. pressure is measured in atm and volume in dm<sup>3</sup>,</li> <li>b. pressure is measured in mm of Hg or torr and volume in cm<sup>3</sup>,</li> <li>c. pressure is measured in Nm<sup>-2</sup> and volume in m<sup>3</sup>;</li> </ul> 4.2.5 calculate mass, pressure, volume, temperature and density of a gas using the ideal gas equation; 4.2.6 calculate the molar mass of a gas from density measurement of gases at STP; 4.2.7 explain the deviation of gases from their ideal behaviour;		* FA	A A A A

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level			
		R	U	A and beyond	
4.3 Intermolecular Forces and Their Impact on the Physical Properties of Liquids	4.3.1 describe the types of intermolecular forces;		FA		
	4.3.2 compare the strength and applications of Van der Waals forces (London dispersion forces and dipole-dipole interactions) and hydrogen bonding;		*		
	4.3.3 explain the following physical properties of liquids: a. evaporation, b. vapour pressure, c. boiling point, d. viscosity, e. surface tension;		*		
	4.3.4 analyse the anomalous behaviour of H <sub>2</sub> O (ice and water) using the concept of hydrogen bonding, including the following specific properties: a. surface tension, b. specific heat, c. vapour pressure, d. heat of vaporisation, e. melting and boiling points, f. density of solid ice compared with liquid water;				An
	4.3.5 compare the volatility of different liquids at the same temperature based on intermolecular forces;			*	
4.4 Energetics of Phase Changes	4.4.1 define the following terms: a. molar heat of fusion, b. heat of vaporisation, c. molar heat of sublimation;	*			
	4.4.2 explain the importance of the heat of fusion in studying glaciers and ice sheets, particularly in the context of polar ice caps;		*		

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
4.5 Liquid Crystals	4.5.1 describe the formation of liquid crystals; 4.5.2 differentiate liquid crystals from pure liquids and crystalline solids; 4.5.3 explain the various applications of liquid crystals, including temperature sensors, thermometers, skin thermography, electrical circuits, chromatographic separations, calculator screens and display screens;		*	
4.6 Types and Properties of Solids	4.6.1 explain the following characteristics of crystalline solids: a. symmetry, b. melting point, c. anisotropy, d. cleavage plane, e. crystal growth, f. geometrical shape, g. habit of crystals; 4.6.2 distinguish between crystalline and amorphous solids; 4.6.3 differentiate between isomorphism and polymorphism; 4.6.4 relate polymorphism with allotropy; 4.6.5 exemplify transition temperature;		*	
4.7 Types of Crystalline Solid	4.7.1 differentiate among the following types of crystalline solids: a. ionic, b. molecular, c. metallic, d. covalent; 4.7.2 exemplify the use of crystalline and amorphous solids in daily life.		*	

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
<b>5. Chemical Equilibrium</b>	Candidates should be able to:			
5.1 Reversible Reaction and Dynamic Equilibrium	5.1.1 describe 'dynamic equilibrium' in terms of reversible reaction;		FA	
	5.1.2 explain the necessary conditions for equilibrium and the ways through which equilibrium can be recognised;		FA	
	5.1.3 explain dynamic equilibrium between different physical states of matter;		*	
	5.1.4 differentiate between microscopic and macroscopic events in a reversible reaction with examples;		*	
	5.1.5 determine the equilibrium constant expression ( $K_c$ ) for the given reactions;			A
	5.1.6 calculate the equilibrium constant expression in terms of concentration, partial pressure, number of moles and mole fraction;			A
	5.1.7 determine expression for reaction quotient of given reactions;			A
	5.1.8 predict the direction of a reaction by relating equilibrium constant with the ratio between concentration of products and reactants;			E
	5.1.9 predict the extent of chemical reaction from the given value of $K_c$ ;			E
5.2 Le-Chatelier's Principle and Its Application	5.2.1 explain Le-Chatelier's principle;		*	
	5.2.2 deduce the effect of catalyst, temperature, pressure, volume and concentration on the equilibrium state and yield of industrial products using Le-Chatelier's principle;			E

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
5.3 Solubility Product and Common Ion Effect	5.3.1		*	
	5.3.2		*	
	5.3.3			A
	5.3.4			A
	5.3.5			A
	5.3.6		*	
	5.3.7			An

FOR ANNUAL EXAMINATION 2026 AND ONWARDS

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
<b>6. Acids, Bases and Salts</b>	Students should be able to:			
6.1 Acid-Base Titration	6.1.1 compare Arrhenius and Brønsted-Lowry's concept of acids and bases; 6.1.2 explain amphoteric compounds; 6.1.3 explain the significance of acid-base reactions in daily life (food preservation, allergic reactions, gastric acidity, curdling of milk); 6.1.4 calculate molarity, molality and strength of sample solutions based on acid-base titration; 6.1.5 determine suitable indicators for acid-base titrations based on the given data;		FA  * *	   A A
6.2 Conjugate Acids and Bases	6.2.1 define the terms 'conjugate acid' and 'conjugate base'; 6.2.2 identify conjugate acid-base pairs in the given reaction; 6.2.3 compare the strength of conjugate acids and bases;	*	 * *	
6.3 Strengths of Acids and Bases	6.3.1 derive the ionisation constant of water ( $K_w$ ); 6.3.2 calculate the pH and pOH of solutions by using the given hydrogen or hydroxide ion concentration; 6.3.3 compare the strength of acids and bases using pH and pOH; 6.3.4 derive the ionisation constants of an acid ( $K_a$ ) and a base ( $K_b$ ); 6.3.5 determine the relationship between $K_a$ and $K_b$ ; 6.3.6 calculate the $H_3O^+$ concentration using the given $K_a$ and molar concentration of the weak acid; 6.3.7 explain the 'levelling effect' with reference to the strength of acids;		  *   *	A A  A A A
6.4 Lewis Concept of Acids and Bases	6.4.1 explain 'Lewis acids' and 'Lewis bases'; 6.4.2 classify compounds as Lewis acids or bases;		* *	

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
6.5 Buffer Solution	6.5.1 describe 'buffer solution'; 6.5.2 explain the significance of buffers to maintain the pH of solutions using chemical equations, including the role of $\text{HCO}_3^-$ in controlling pH in the blood; 6.5.3 illustrate the preparation of different types of buffer; 6.5.4 calculate the pH of buffer solutions using Henderson Hasselbalch equation;		* FA	A A
6.6 Hydrolysis and Hydration	6.6.1 define the following terms: a. hydrolysis, b. hydration; 6.6.2 explain the types of salts on the basis of hydrolysis; 6.6.3 differentiate between hydrolysis and hydration;	*	* *	

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
<b>7. Chemical Kinetics</b>	Students should be able to:			
7.1 Rate and Order of Reaction	7.1.1 describe the terms: <ol style="list-style-type: none"> <li>chemical kinetics,</li> <li>rate of reaction,</li> <li>rate law,</li> <li>order of reaction,</li> <li>rate constant,</li> <li>rate-determining step;</li> </ol> 7.1.2 explain the significance of the rate-determining step on the overall rate of a multistep reaction;           7.1.3 determine the rate law for the given reactions;           7.1.4 calculate the initial rate using concentration data for given reactions;           7.1.5 deduce the rate of reaction and order of reaction using the method of initial rates;           7.1.6 determine the rate constant using the method of initial rates and the half-life method;		*	
7.2 Factors Influencing Reaction Rates and Energy Considerations in Chemical Reactions	7.2.1 relate activation energy and activated complex to the rate of reaction;           7.2.2 describe collision theory;           7.2.3 discuss the effect of concentration, temperature and surface area on the rate of reaction using collision theory;           7.2.4 interpret the effect of temperature change on the rate constant and the rate of a reaction using the Boltzmann distribution curve;		*	
7.3 Catalysis	7.3.1 explain homogeneous and heterogeneous catalysis;           7.3.2 illustrate the effect of a catalyst on the rate of a reaction using a labelled energy diagram showing the activation energy and the influence of the catalyst.		*	A

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
<b>8. Solution and Colloids</b>	Students should be able to:			
8.1 Colloids, Suspensions and Solutions	8.1.1 compare the properties of colloids, suspensions and solutions; 8.1.2 explain the types of colloids; 8.1.3 classify substances as solutions, colloids or suspensions;		*	
8.2 Concentration Units	8.2.1 solve problems involving different concentration units of solutions: a. percentage composition, b. molarity, c. molality, d. mole fraction, e. parts per million (ppm), f. parts per billion (ppb), g. parts per trillion (ppt);			A
8.3 General Properties of Solution and Solubility	8.3.1 differentiate between hydrophobic and hydrophilic molecules; 8.3.2 predict the nature of solutions in the liquid phase as miscible, immiscible and partially miscible; 8.3.3 interpret the effect of temperature on solubility using a graph;		*	E E
8.4 Raoult's Law	8.4.1 explain Raoult's law and its role in the vapour pressures of ideal solutions; 8.4.2 illustrate vapour pressure variations of ideal solutions as composition changes using a graph based on Raoult's law; 8.4.3 illustrate deviations from Raoult's law in non-ideal solutions using a graph;		*	A A

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
8.5 Colligative Properties	8.5.1 define the term 'colligative properties'; 8.5.2 explain the following colligative properties of liquids: a. lowering of vapour pressure, b. elevation of boiling point, c. depression of freezing point, d. osmotic pressure; 8.5.3 calculate molar mass of a substance using ebullioscopic and cryoscopic methods;	*	*	A
8.6 Partition Coefficient	8.6.1 define the term 'partition coefficient' ( $K_{pc}$ ); 8.6.2 explain the factors influencing the numerical value of a partition coefficient in relation to the polarities of the solute and the solvents used; 8.6.3 calculate the partition coefficient of a system where the solute is present in the same physical state in the two solvents;	*	*	A

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
<b>9. Chemical Energetics</b>	Students should be able to:			
9.1 Fundamentals of Thermodynamics and Enthalpy Calculations in Chemical Reactions	9.1.1 define the following terms: a. thermodynamics, b. system, c. surrounding, d. state function, e. heat, f. internal energy, g. work, h. enthalpy;  9.1.2 explain the energy transfer that occurs in breaking and making chemical bonds during a chemical reaction; 9.1.3 interpret the reaction pathway diagram with respect to enthalpy change and activation energy; 9.1.4 define the following terms: a. standard conditions, b. enthalpy change of reaction ( $\Delta H_r^\circ$ ), c. enthalpy change of formation ( $\Delta H_f^\circ$ ), d. enthalpy change of combustion ( $\Delta H_c^\circ$ ), e. enthalpy change of neutralisation ( $\Delta H_{\text{neut}}^\circ$ ), f. heat capacity, g. specific heat capacity, h. molar heat capacity;  9.1.5 calculate the standard enthalpy change ( $\Delta H^\circ$ ) for the given reactions using bond energy values;	*		
			*	
				E
		*		
				A

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
9.2 First Law of Thermodynamics	9.2.1 explain the first law of thermodynamics with the help of daily life examples; 9.2.2 relate the change in internal energy of the system with thermal energy at constant volume and pressure; 9.2.3 calculate the change in internal energy and the work done by a system using the first law of thermodynamics;		*	A
9.3 Entropy and Gibbs Free Energy	9.3.1 define the term 'entropy'; 9.3.2 explain the direction of entropy changes during various processes: changes in state, temperature variations, and reactions involving changes in the number of gaseous molecules; 9.3.3 explain Gibbs free energy; 9.3.4 solve problems related to the feasibility of reactions using Gibbs free energy;	*	*	A
9.4 Hess's Law	9.4.1 explain Hess's law of heat summation; 9.4.2 construct energy cycles by using Hess's law for any given reactions; 9.4.3 calculate the standard heat of formation and the heat of reaction using Hess's law;		*	An A
9.5 Measurement of Enthalpy of a Reaction	9.5.1 explain the working of a calorimeter (glass and bomb calorimeter); 9.5.2 calculate the heat of a reaction in a calorimeter using the given experimental data;		*	A

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
9.6 Born-Haber Cycle	9.6.1 define the following terms: a. enthalpy change of atomisation ( $\Delta H_{\text{at}}^{\circ}$ ), b. enthalpy change of sublimation ( $\Delta H_{\text{sub}}^{\circ}$ ), c. bond dissociation enthalpy ( $\Delta H_{\text{D}}^{\circ}$ ), d. lattice energy ( $\Delta H_{\text{L}}^{\circ}$ ), e. electron affinity (EA), f. ionisation energy (I);	*		
	9.6.2 explain the reaction pathway diagram in terms of enthalpy changes of reactions (for ionic compounds involving up to divalent ions) using Born-Haber cycle;		*	
	9.6.3 construct Born-Haber cycles for the given ionic solids (up to divalent cations and anions);			An
	9.6.4 calculate lattice energy and enthalpy of formation of ionic compounds from the given set of appropriate data.			A

FOR ANNUAL EXAMINATION 2024 AND 2025

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
<b>10. Electrochemistry</b>	Students should be able to:			
10.1 Oxidation – Reduction	10.1.1 define the following terms: a. reduction, b. oxidation, c. oxidation number, d. reducing agent, e. oxidising agent, f. disproportionation reaction; 10.1.2 determine the oxidation number of an atom in a substance; 10.1.3 deduce reducing and oxidising agents using the oxidation number change method; 10.1.4 balance a chemical equation using the oxidation number change method; 10.1.5 identify the oxidation and reduction half-reactions; 10.1.6 balance a chemical equation using the half-reaction method; 10.1.7 solve problems based on oxidation-reduction titrations; 10.1.8 discuss the use of redox reactions in daily life;	*		A E An An A FA
10.2 Activity Series	10.2.1 explain the concept of the activity series of metals and its relation to the ease of oxidation and reduction; 10.2.2 analyse the feasibility of redox reactions using the activity series;		*	An
10.3 Electrode Potential and Electrochemical Cells	10.3.1 define the following terms: a. standard electrode potential, b. standard cell potential; 10.3.2 explain Standard Hydrogen Electrode (SHE) and its application; 10.3.3 determine the potential of an electrochemical cell using the given standard electrode potential values of species;	*	*	A

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
10.4 Electrochemical Principles and Applications	10.4.1		*	
	10.4.2		*	
	10.4.3			A
	10.4.4			A
	10.4.5		FA	
	10.4.6		*	
	10.4.7		*	

FOR ANNUAL EXAMINATION 2026 AND ONWARDS

## Topic Wise Practical Activities

### Part I (Grade XI)

S. No.	Topic-Wise Practical Activity	Equipment	Chemical
<b>Topic 5: Chemical Equilibrium</b>			
1.	Purify a given sample of sodium chloride by passing HCl gas. (Application of common ion effect)	Beaker 500 mL, funnel, round-bottom flask, glass tubing, wire gauze, thistle funnel, burner, stirrer, graduated cylinder and physical/ digital balance	Distilled water, common salt, concentrated H <sub>2</sub> SO <sub>4</sub>
<b>Topic 6: Acids, Bases and Salts</b>			
2.	Measure the exact molarity of the given solution of H <sub>2</sub> SO <sub>4</sub> and the volume of this acid required to prepare 500 mL of 0.02 M acid by volumetric method.	Burette, pipette, funnel, conical flasks, beakers, iron stand with clamp	Phenolphthalein/ methyl orange, 0.1M NaOH/ Na <sub>2</sub> CO <sub>3</sub> , 0.2 M H <sub>2</sub> SO <sub>4</sub> distilled water
3.	Measure the percentage of NaOH in the given solution (such as a mixture of NaCl and NaOH or a sample of soap solution) by volumetric method.	Burette, pipette, funnel, conical flasks, beakers, iron stand with clamp	Phenolphthalein, 0.1M NaOH, 0.1M HCl, distilled water, solution containing 8 g of a mixture of NaCl and NaOH/ 250 mL solution of 10 g soap.
4.	Measure the percentage purity of the sample solution, containing 6 g of Na <sub>2</sub> CO <sub>3</sub> dissolved per dm <sup>3</sup> , using the volumetric method.	Burette, pipette, funnel, conical flasks, beakers, iron stand with clamp	Methyl orange, 0.1M Na <sub>2</sub> CO <sub>3</sub> , 0.1M HCl, distilled water, solution of 6 g of Na <sub>2</sub> CO <sub>3</sub> in 1L.

S. No.	Topic-Wise Practical Activity	Equipment	Chemical
5.	Perform volumetric analysis to determine the value of X in the given sample of 6.3 g of $(\text{COOH})_2 \cdot X\text{H}_2\text{O}$ dissolved per L.	Burette, pipette, funnel, conical flasks, beakers, iron stand with clamp	Phenolphthalein, 0.1M NaOH, 0.1M $(\text{COOH})_2 \cdot 2\text{H}_2\text{O}$ , distilled water
6.	Demonstrate the solubility of oxalic acid at room temperature volumetrically.	Burette, pipette, funnel, conical flasks, beakers, iron stand with clamp	Phenolphthalein, 0.1M NaOH, 0.1M $(\text{COOH})_2 \cdot 2\text{H}_2\text{O}$ , distilled water
<b>Topic 9: Chemical Energetics</b>			
7.	Measure the heat of neutralisation of NaOH and HCl.	Calorimeter with stirrer, thermometer, balance (physical/ digital)	1M NaOH, 1M HCl, distilled water
<b>Topic 10: Electrochemistry</b>			
8.	Standardise the given solution of $\text{KMnO}_4$ and calculate the volume of $\text{KMnO}_4$ required for preparing 1 L of 0.01M $\text{KMnO}_4$ solution volumetrically.	Burette, pipette, funnel, conical flasks, beakers, iron stand with clamp, Bunsen burner/ spirit lamp, test tube	0.1M $\text{FeSO}_4$ solution/ 0.05M oxalic acid, 0.02M $\text{KMnO}_4$ solution, dilute $\text{H}_2\text{SO}_4$ , distilled water
9.	Measure the amount of iron in the given sample volumetrically.	Burette, pipette, funnel, conical flasks, beakers, iron stand with clamp, test tube	0.05M $\text{FeSO}_4$ solution, 0.01M $\text{KMnO}_4$ solution, dilute $\text{H}_2\text{SO}_4$ , distilled water
10.	Measure the percentage composition volumetrically of a solution mixture of $\text{K}_2\text{C}_2\text{O}_4$ and $\text{K}_2\text{SO}_4$ .	Burette, pipette, funnel, conical flasks, beakers, iron stand with clamp, test tube	Solution mixture of $\text{K}_2\text{C}_2\text{O}_4$ and $\text{K}_2\text{SO}_4$ , 0.01M $\text{KMnO}_4$ solution, dilute $\text{H}_2\text{SO}_4$ , distilled water
11.	Demonstrate the solubility of Mohr's salt at room temperature volumetrically.	Burette, pipette, funnel, conical flasks, beakers, iron stand with clamp, test tube	0.05M Mohr's salt solution, 0.01M $\text{KMnO}_4$ solution, dilute $\text{H}_2\text{SO}_4$ , distilled water

## Scheme of Assessment

Table 1: Exam Specifications

Topic No.	Topics	Marks Distribution			Total Marks
		MCQs	CRQs	ERQs	
1.	Stoichiometry	5		7 Marks Choose any ONE from TWO	16
10.	Electrochemistry	4			
2.	Atomic Structure	4	Total 4 Marks (1 CRQ)		8
3.	Theories of Covalent Bonding and Shapes of Molecules	5	Total 3 Marks (1 CRQ)		8
4.	States of Matter: Gases, Liquids and Solids	9	Total 4 Marks (1 CRQ)		13
5.	Chemical Equilibrium	4	Total 4 Marks (1 CRQ)		8
6.	Acids, Bases and Salts	5		7 Marks Choose any ONE from TWO	16
8.	Solution and Colloids	4			
7.	Chemical Kinetics	5	Total 2 Marks (1 CRQ)		7
9.	Chemical Energetics	5	Total 4 Marks (1 CRQ)		9
<b>Total</b>		<b>50</b>	<b>21</b>	<b>14</b>	<b>85</b>
<b>Practical*</b>					<b>15</b>
<b>Total</b>					<b>100</b>