آغا خان یونیورسٹی ایگزامینیشن بورڈ

AGA KHAN UNIVERSITY EXAMINATION BOARD

Secondary School Certificate
Examination Syllabus

Chemistry

Grades IX - X

(Based on New National Curriculum 2022-2023)

Student Learning Outcomes of AKU-EB SSC Chemistry Syllabus

Part I (Grade IX)

Topics and Sub-topics	Student Learning Outcomes		Cognitive Level[1]		
			R	U	A and beyond
1. Fundamentals of Chemistry	Students should be able to:				
1.1 Chemistry and its Branches	1.1.1	define 'chemistry' and its various branches: a. analytical chemistry, b. astrochemistry, c. biochemistry, d. environmental chemistry, e. geochemistry, f. industrial chemistry, g. inorganic chemistry, h. nuclear chemistry, i. organic chemistry, j. physical chemistry, k. polymer chemistry;	*		
	1.1.2	explain the significance of the branches of chemistry mentioned in SLO 1.1.1;		*	

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

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				R	U	A and beyond
1.2	History of Chemistry	1.2.1	describe the contribution of Jabir Ibn Hayyan and Al-Razi in chemistry during the Islamic Golden Age (8th to 14th centuries);		FA[2]	
		1.2.2	define the term 'scientific paradigm';	FA		
		1.2.3	explain the following examples of 'scientific paradigm' in chemistry: a. Phlogiston theory, b. Plum pudding model;		FA	
1.3	Basic Definitions, Comparisons, Valencies, and Chemical Formulae	1.3.1	define the following terms: a. atoms, b. elements, c. compounds, d. mixtures, e. molecules;	*		
		1.3.2	differentiate between: a. atoms and molecules, b. atoms and ions, c. molecules and molecular ions, d. ions and free radicals;		*	
		1.3.3	differentiate among elements, compounds and mixtures;		*	
		1.3.4	classify the chemical species into elements, mixtures, compounds, ions, molecular ions and free radicals;		*	
		1.3.5	define the term 'valency';	*		
		1.3.6	determine valencies of common elements and ions (radicals) independently or in compounds;			A
		1.3.7	determine the formula of a compound based on the valencies of elements and ions (radicals).			A

[2]FA= Formative Assessment, not to be assessed under examination conditions

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				R	U	A and beyond
2. Stoichiometry		Students should be able to:				
2.1	Avogadro's Number and Mole	2.1.1	define the following terms: a. gram atomic mass, b. gram molecular mass, c. gram formula mass, d. formula unit, e. mole, f. Avogadro's number;	*		
		2.1.2	relate gram atomic mass, gram molecular mass and gram formula mass to mole and Avogadro's number;		*	
		2.1.3	calculate the following quantities of chemical species: a. number of moles, b. number of particles (atoms, molecules and ions), c. molar mass (atomic/ molecular/ formula), d. mass;			A
2.2	Formulae and Percentage Composition	2.2.1	differentiate between empirical formula and molecular formula;		*	
		2.2.2	calculate the percentage composition by mass of an element in a compound;			A
		2.2.3	calculate the empirical formula using percentages or masses of elements;			A
		2.2.4	calculate the molecular formula using molecular mass and empirical formula;			A
2.3	Chemical Reactions and Calculations	2.3.1	describe the following terms: a. chemical reaction, b. chemical equation;		*	

Topics and Sub-topics		Student Learning Outcomes	Cognitive Level		
			R	U	A and beyond
	2.3.2	illustrate the following types of chemical reactions: a. displacement (single/ double), b. decomposition, c. addition/ synthesis/ combination, d. combustion (complete/ incomplete), e. neutralisation, f. hydrolysis;			A
	2.3.3	evaluate the effectiveness of chemical reactions based on the following characteristics: a. change of state, b. change in colour, c. evolution of gas, d. change in temperature, e. formation of a precipitate, f. occurrence of sound;			E
	2.3.4	construct chemical equations and ionic equations to show reactants forming products, including state symbols;			An
	2.3.5	balance chemical equations by inspection or trial and error method;			An
	2.3.6	solve problems based on stoichiometric relationships of substances in terms of: a. mass, b. number of moles, c. number of molecules, d. mole ratio, e. volume of gases at Room Temperature and Pressure (RTP) (24 L or dm^3 and 24000 mL or cm^3).			A

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				R	U	A and beyond
3. Atomic Structure		Students should be able to:				
3.1	Features of an Atom	3.1.1	describe the structure of an atom with reference to the location, relative electric charges and relative masses of proton, electron and neutron;		*	
		3.1.2	define the following terms: a. atomic (proton) number, b. mass (nucleon) number, c. atomic mass, d. atomic mass unit;	*		
		3.1.3	calculate the atomic number, mass number, number of electrons and neutrons of atoms and ions;			A
		3.1.4	draw the atomic structure of the first twenty elements of the periodic table and their ions (cations and anions) using their mass number and atomic number;			A
3.2	Isotopes	3.2.1	define the following terms: a. isotopes, b. average atomic mass, c. relative atomic mass based on C-12 scale, d. radioactive isotopes, e. radioactivity;	*		
		3.2.2	determine the number of protons, neutrons and electrons in different isotopes of H, C, O, Cl and U;			A
		3.2.3	calculate the relative atomic masses of chlorine and boron by using the mass number and natural abundance of their isotopes;			A
		3.2.4	explain the role of isotopes in carbon dating (carbon), power generation (uranium) and medical imaging (iodine, sodium, technetium, thallium, arsenic, cobalt and xenon);		*	

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				R	U	A and beyond
3.3	Models to Understand the Structure of an Atom	3.3.1	explain Rutherford's experiment leading to the discovery of the atomic nucleus;		*	
		3.3.2	explain the defects of Rutherford's atomic model;		*	
		3.3.3	describe the main points (postulates) of Bohr's atomic model;		*	
3.4	Shells and Sub-shells	3.4.1	differentiate between shells and sub-shells of an atom;		*	
3.5	Electronic Configuration	3.5.1	deduce the electronic arrangement (in shells) and electronic configuration (of sub-shells) of the first twenty elements and their ions using their atomic number and charges (if any).			E

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				R	U	A and beyond
4. Periodic Table and Periodicity		Students should be able to:				
4.1	Periodic Table	4.1.1	state the modern periodic law;	*		
		4.1.2	differentiate between a period and a group in the periodic table;		*	
		4.1.3	determine the group, period and block of an element using its electronic configuration (first twenty elements);			A
		4.1.4	describe the demarcation of the periodic table into s, p, d, and f-blocks;		*	
		4.1.5	determine the location of families on the periodic table based on their characteristics and electronic configuration (representative elements);			A
4.2	Periodic Properties	4.2.1	define the following terms: a. shielding effect, b. electronegativity, c. atomic radii, d. electron affinity, e. ionisation energy (1^{st} and 2^{nd});	*		
		4.2.2	explain the periodic trend of the following within a group and a period of the periodic table: a. shielding effect, b. electronegativity, c. atomic radii, d. electron affinity, e. ionisation energy (1^{st} and 2^{nd});		*	
		4.2.3	compare the chemical reactivity and physical properties (metallic character, physical states, conductivity, density, melting and boiling points) of elements in the same family of elements (representative elements);		*	

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				R	U	A and beyond
4.3	Properties of Elements in a Group	4.3.1	determine elements as an alkali metal, an alkaline earth metal, a halogen and a noble gas based on their electronic configuration;			A
		4.3.2	compare the general properties of metals and non-metals in terms of: a. physical states, b. density, c. malleability, d. ductility, e. melting and boiling points, f. conductivity, g. sonority, h. appearance/ lustre, i. hardness/ brittleness, j. nature of oxides (basic, acidic and amphoteric);		*	
		4.3.3	explain the following properties of Group I and II elements; a. occurrence in combined state in nature, b. softness of metals, c. reaction with water, d. reaction with hydrogen, e. reaction with oxygen, f. reaction with dilute acids;		*	
		4.3.4	explain the following properties of Group VII elements: a. existence as diatomic molecules, b. appearance (colour and state), c. displacement reactions with other halogens, d. reaction with metals;		*	

Topics and Sub-topics	Student Learning Outcomes		Cognitive Level		
			R	U	A and beyond
	4.3.5	explain the following properties of Group VIII elements: a. existence as monoatomic gases or free state in nature, b. chemical inertness, c. importance of noble gas electronic configuration in the formation of ions;		*	
	4.3.6	explain the following properties of transition metals: a. relative hardness, b. density, c. melting and boiling points, d. variable oxidation states, e. formation of coloured compounds;		*	
	4.3.7	explain the inertness of noble metals;		FA	
	4.3.8	discuss the commercial importance of silver, gold and platinum.			FA

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				R	U	A and beyond
5. Structure of Molecules		Students should be able to:				
5.1	Formation of Chemical Bond	5.1.1	explain duplet and octet rules that help atoms achieve stable electron configurations by forming bonds;		*	
		5.1.2	define a chemical bond and its following types: a. ionic bond, b. covalent bond, c. coordinate covalent bond, d. metallic bond;	*		
		5.1.3	exemplify the formation of: a. cations from an atom of a metallic element, b. anions from an atom of a non-metallic element;		*	
		5.1.4	explain the nature of bonding based on the electronegativity difference of bonded atoms using Linus Pauling scale;		*	
5.2	Ionic Bond	5.2.1	explain the formation of an ionic bond;		*	
		5.2.2	explain the general characteristics of ionic compounds;		*	
		5.2.3	identify a compound as having ionic bond;		*	
		5.2.4	draw electron dot and cross structure of a binary ionic compound, for example, NaCl, MgO, K_2O and $CaCl_2$;			A
5.3	Covalent Bond	5.3.1	explain the formation of a covalent bond between two non-metallic elements;		*	
		5.3.2	exemplify single, double and triple covalent bonds;		*	
		5.3.3	explain the general characteristics of covalent compounds;		*	
		5.3.4	draw electron dot and cross structures for simple covalent molecules including H_2, Cl_2, O_2, N_2, H_2O, CH_4, NH_3, HCl, CO_2, HCN, C_2H_6, C_2H_4, and C_2H_2;			A
		5.3.5	explain polar and non-polar covalent compounds;		*	

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				R	U	A and beyond
		5.3.6	differentiate between ionic and covalent compounds based on characteristics and examples;		*	
5.4	Coordinate Covalent Bond	5.4.1	explain the formation of coordinate covalent bond;		*	
		5.4.2	draw electron dot and cross structure of coordinate covalent compounds, for example, ammonium ion, oxonium (hydronium) ion, aluminium tetrachloride anion, adduct (addition product) of ammonia and boron trifluoride;			A
		5.4.3	compare the formation and characteristics of coordinate covalent compounds with covalent compounds;		*	
5.5	Metallic Bond	5.5.1	explain the formation of metallic bonding (electron-sea model);		*	
		5.5.2	explain the contribution of structure of metals and the mobility of their electrons to the following properties: a. malleability, b. ductility, c. melting and boiling points, d. lustre, e. tensile strength, f. electrical and thermal conductivity;		*	
5.6	Intermolecular Forces	5.6.1	explain weak intermolecular forces, including Van der Waals forces (London dispersion forces and dipole-dipole interactions) and hydrogen bonding, with their effect on the melting and boiling points of compounds.		*	

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				R	U	A and beyond
6. States of Matter		Students should be able to:				
6.1	Kinetic Molecular Theory and Phase Changes	6.1.1	compare the physical states of matter based on the intermolecular forces present between their molecules;		*	
		6.1.2	explain phase changes (melting, freezing, vaporisation, condensation, sublimation and deposition) due to changes in temperature and pressure affecting the arrangement and motion of particles within a substance;		*	
		6.1.3	explain melting and boiling point of substances used as a criterion to check their purity;		*	
		6.1.4	interpret heating and cooling curves in terms of kinetic theory;			E
6.2	Gaseous State	6.2.1	explain the following properties of gases in terms of kinetic theory: a. diffusion, b. effusion, c. density, d. compressibility;		*	
		6.2.2	relate qualitatively the effect of the following factors to the rate of diffusion: a. molecular mass, b. temperature;		*	
6.3	Laws Related to Gases	6.3.1	relate the changes in pressure and volume of a gas using Boyle's law;		*	
		6.3.2	relate the changes in temperature and volume of a gas using Charles's law;		*	
		6.3.3	relate the changes in number of molecules and volume of a gas using Avogadro's law;		*	

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				R	U	A and beyond
6.4	Liquid State	6.4.1	explain the following properties of liquids and the factors that affect them: a. vapour pressure, b. boiling point, c. freezing point, d. density, e. compressibility;		*	
		6.4.2	differentiate between evaporation and boiling;		*	
		6.4.3	discuss the effects of temperature on vapour pressure and the effects of external pressure on the boiling point of liquids;			E
		6.4.4	explain the significance of diffusion rates in the context of medicine;		FA	
6.5	Solid State	6.5.1	explain the following physical properties of solids: a. melting point, b. density, c. compressibility;		*	
		6.5.2	explain the following applications of sublimation such as: a. solid air fresheners, b. dry ice (solid carbon dioxide), c. mothballs (naphthalene), d. 3D printing;		*	
6.6	Types of Solid	6.6.1	define the term ‘allotropes’;	*		
		6.6.2	explain allotropic forms of carbon (diamond, graphite, buckyballs and coal) and sulphur (rhombic, monoclinic and plastic).		*	

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				R	U	A and beyond
7. Solutions		Students should be able to:				
7.1	Introduction to Solutions	7.1.1	exemplify the following terms: a. solvent, b. solute, c. solution, d. aqueous/ non-aqueous solution, e. residue, f. filtrate;		*	
7.2	Types of Solution According to Phases	7.2.1	classify different types of solutions according to the following phases: a. gas into gas, b. gas into liquid, c. gas into solid, d. liquid into gas, e. liquid into liquid, f. liquid into solid, g. solid into gas, h. solid into liquid, i. solid into solid;		*	
7.3	Types of Solution According to Concentration	7.3.1 7.3.2	differentiate among saturated, unsaturated and supersaturated solutions; differentiate between dilute and concentrated solutions;		* *	
7.4	Comparison of Solution, Suspension and Colloid	7.4.1	compare the characteristics of solutions, suspensions and colloids with examples;		*	
7.5	Concentration Units and Dilution of Solutions	7.5.1 7.5.2	define the term ‘molarity’; solve problems based on molarity of a solution;	*		A

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				R	U	A and beyond
		7.5.3	define the term 'percentage' as a unit of concentration;	*		
		7.5.4	calculate the percentage composition of different solutions (% m/m, % m/v, % v/m, % v/v);			A
		7.5.5	solve problems based on dilution of solutions from concentrated solutions of known molarity;			A
7.6	Factors Affecting Solubility	7.6.1	define the term 'solubility';	*		
		7.6.2	explain the factors that affect solubility, i.e., temperature, pressure and nature of solute and solvent;		*	
		7.6.3	predict the solubility of one substance into another using the rule of 'like dissolves like';			E
		7.6.4	interpret the effect of temperature on the solubility of different salts (for example, KNO_3, KCl, Li_2SO_4, $Ce_2(SO_4)_3$ and NaCl) in water by referring to absorption, release, or no change in heat, based on the solubility versus temperature graphs;			E
7.7	Methods for Separating Mixtures and Purification Techniques	7.7.1	explain the following methods of separation and purification: a. evaporation, b. decantation, c. filtration, d. crystallisation, e. distillation, f. fractional distillation;		*	
		7.7.2	define the following terms: a. chromatography, b. stationary phase, c. mobile phase, d. chromatogram, e. locating agent, f. retention factor (R_f);	*		

Topics and Sub-topics	Student Learning Outcomes		Cognitive Level		
			R	U	A and beyond
	7.7.3	apply the paper chromatography technique for separating mixtures and isolating compounds;			A
	7.7.4	interpret chromatograms using the R_f equation and spotting (locating) agents to recognise components in a mixture;			E
	7.7.5	predict techniques for separating and purifying everyday mixtures.			E

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				R	U	A and beyond
8. Electrochemistry		Students should be able to:				
8.1	Oxidation and Reduction (Redox) Reactions	8.1.1	differentiate between oxidation and reduction in terms of loss or gain of oxygen, hydrogen or electrons;		*	
8.2	Oxidation States and Rules for Assigning Oxidation States	8.2.1	define oxidation state;	*		
		8.2.2	explain the common rules used for assigning oxidation numbers to free elements, ions, molecules and atoms;		*	
		8.2.3	calculate the oxidation number of an atom in a compound and polyatomic ion;			A
8.3	Oxidising and Reducing Agents	8.3.1	describe oxidising and reducing agents in a redox reaction;		*	
		8.3.2	deduce oxidising and reducing agents in a redox reaction;			E
8.4	Electrochemical Cells	8.4.1	define the following terms: a. electrolyte, b. weak electrolyte, c. non-electrolyte, d. electrolysis;	*		
		8.4.2	describe an electrochemical cell and its two types;		*	
		8.4.3	distinguish between Galvanic (voltaic) cell and electrolytic cell based on their parts, working and examples;		*	
		8.4.4	deduce the direction of movement of cations and anions towards respective electrodes in an electrolytic cell;			E
		8.4.5	infer the electrical conductivity of solutions based on the dissociation of substances into ions;			An
		8.4.6	identify the reactivity of elements using the reactivity series;		*	
		8.4.7	illustrate metal displacement reactions in an aqueous medium;			A
		8.4.8	determine the half-cell in which oxidation occurs and the half-cell in which reduction occurs in a voltaic cell;			A

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				R	U	A and beyond
		8.4.9 8.4.10	deduce the direction of the flow of electrons in a voltaic cell; explain the production of electrical energy in a dry cell;		 *	E
8.5	Electrochemical Industries	8.5.1 8.5.2	explain the manufacturing of sodium metal from fused NaCl in Down cell; explain the manufacturing of sodium hydroxide from aqueous solution of NaCl in Nelson cell;		* *	
8.6	Corrosion and its Prevention	8.6.1 8.6.2 8.6.3	define the term ‘corrosion’; describe the rusting of iron as an example of corrosion; explain the following methods used to prevent corrosion: a. barrier coatings (using paint and galvanising), b. electroplating (using tin and chromium), c. sacrificial protection (using magnesium blocks).	*	 * *	

Topic Wise Practical Activities

Part I (Grade IX)

S No.	Topic-Wise Practical Activity	Equipment	Chemical
	Topic 1: Fundamentals of Chemistry		
1.	Employ appropriate physical methods to separate a mixture of iron filings, sand and alum.	China dish, funnel, magnet, watch glass, fitter paper, funnel stand, Bunsen burner or spirit lamp, glass rod, beaker, match box, tripod stand	Fe (iron filings), alum, sand and water
	Topic 2: Stoichiometry		
2.	Demonstrate that compounds can be the products of a decomposition reaction.	Test tubes, mortar pestle, safety goggles, match box, Bunsen burner or spirit lamp, test tube holder, one holed stopper with glass tube and rubber tubing or bent tube	Calcium carbonate and lime water (solution of calcium hydroxide)
	Topic 6: States of Matter		
3.	Measure the boiling point of ethyl alcohol.	Beaker, iron stand, clamp, glass rod thermometer, fusion tube, tripod stand, capillary tube, wire gauze, matchbox, Bunsen burner or spirit lamp	Sample of ethyl alcohol and water
4.	Measure the melting point of wax.	Beaker, iron stand, clamp, glass rod thermometer, capillary tube, tripod stand, wire gauze, match box, Bunsen burner or spirit lamp, thread	Sample of wax and water

S. No.	Topic-Wise Practical Activity	Equipment	Chemical
5.	Demonstrate sublimation using solid ammonium chloride.	Test tube, cotton, test tube holder, match box, Bunsen burner or spirit lamp	Ammonium chloride
	Topic 7: Solutions		
6.	Prepare 250 cm^3/ 1 litre of 0.1 M oxalic acid solution.	Beaker, glass rod, spatula, balance (physical/ digital), funnel, pipette, filter paper/ watch glass (for weighing), weight box, volumetric flask 250 cm^3/ 1 litre)	Oxalic acid, distilled water
7.	Prepare 100 cm^3 of 0.01 M Na_2CO_3 solution from the given 0.1 M solution.	Beaker, volumetric flask, stirrer, graduated cylinder or pipette	Distilled water, 0.1 M Na_2CO_3 solution
8.	Demonstrate that temperature affects solubility.	Beaker, glass rod, Bunsen burner or spirit lamp, tripod stand, wire gauze, match box	Sucrose and water
9.	Prepare crystals of copper sulphate.	Beaker, tripod stand, wire gauze, filter paper, china dish, funnel, filter stand, stirrer, match box, Bunsen burner or spirit lamp	Impure copper sulphate and distilled water
10.	Perform paper chromatography to separate the components of the given ink mixture.	Whatman filter paper No. 1, glass cylinder with a glass support, rubber bung, capillary tubes, lead pencil	Developing solvents (water – alcohol mixture/ n-butanol, ethanol and ammonia) and mixture of inks (blue, green, red)

S. No.	Topic-Wise Practical Activity	Equipment	Chemical
	Topic 8: Electrochemistry		
11.	Demonstrate the conductivity of different solutions.	Beakers, wires, battery, electrodes, bulb, crocodile clips, bulb holder, stirrer	Distilled water, sugar, NaCl, vinegar, HCl, NaOH and $CuSO_4$ solution
12.	Demonstrate the electroplating of copper metal on iron strip using copper sulphate solution.	Iron and copper strips, beaker, battery, wires, bulb, bulb holder, crocodile clips	Copper sulphate solution

Scheme of Assessment

Grade IX

Table 1: Exam Specification

Topic No.	Topics	Marks Distribution			Total Marks
		MCQs	CRQs	ERQs	
1.	Fundamentals of Chemistry	5	Total 3 Marks (1 CRQ)		8
2.	Stoichiometry	5		6 Marks Choose any ONE from TWO	16
5.	Structure of Molecules	5			
3.	Atomic Structure	5	Total 3 Marks (1 CRQ)		8
4.	Periodic Table and Periodicity	5	Total 4 Marks (1 CRQ)		9
6.	States of Matter	5	Total 3 Marks (1 CRQ)		8
7.	Solutions	5		6 Marks Choose any one from TWO	16
8.	Electrochemistry	5			
	Total	**40**	**13**	**12**	**65**
	Practical				**10**
	Total				**75**

Examination Structure and Practical Requirements for Grades IX and X

Theory:

- Multiple Choice Question (MCQ) requires candidates to choose one best/ correct answer from four options for each question. Each MCQ carries ONE mark.
- Constructed Response Question (CRQ) requires students to respond with a short text (few phrases/ sentences), calculations or diagrams.
- Extended Response Question (ERQ) requires students to answer in a more descriptive form. The answer should be in paragraph form, with diagrams where needed, and address all parts of the question.
- Table 1 and 2 contain the mark distribution for each topic.
- There will be two examinations, one at the end of grade IX and one at the end of grade X.
- In each grade, the theory paper will be for 3 hours and will consist of two parts: Paper I and Paper II.
- Paper I theory will consist of 40 compulsory, multiple choice items. These questions will involve four responses options. The answer sheet for Paper I will be provided separately.
- Paper II theory will carry 25 marks and consist of Constructed Response Questions (CRQs) and Extended Response Questions (ERQs). Each extended response question will be presented in an either/ or form.
- The booklet for Paper II will serve as an answer script.

Practical:

- In each grade, practical examination (Paper III) will be conducted separate from the theory paper and will consist of 10 marks.
- Practical examination (Paper III) will be based on the list of practical activities given in the examination syllabus. Schools may design their own practical manuals based on these activities for teaching and learning purpose.
- Practical journal/ portfolio should be developed by students and endorsed by a figure of authority, such as a teacher or principal, and submitted at the time of the practical examination (Paper III).
- It is essential for each school to equip its laboratories with chemicals, instruments, apparatus, specimens etc. according to the requirements of the practical activities. Each school will be responsible for ensuring that each student is provided the opportunity to do the practical activities.