



آغا خان یونیورسٹی ایگزامینیشن بورڈ

AGA KHAN UNIVERSITY EXAMINATION BOARD

**Secondary School Certificate  
Examination Syllabus**

**CHEMISTRY  
CLASSES IX-X**

(based on National Curriculum 2006)

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## PREFACE

In pursuance of National Education Policy (1998-2010), the Curriculum Wing of the Federal Ministry of Education has begun a process of curriculum reform to improve the quality of education through curriculum revision and textbook development (Preface, National Curriculum documents 2000 and 2002).

AKU-EB was founded in August 2003 with the same aim of improving the quality of education nationwide. As befits an examination board it seeks to reinforce the National Curriculum revision through the development of appropriate examinations for the Secondary School Certificate (SSC) and Higher Secondary School Certificate (HSSC) based on the latest National Curriculum and subject syllabus guidance.

AKU-EB has a mandate by Ordinance CXIV of 2002 to offer such examination services to English and Urdu medium candidates for SSC and HSSC from private schools anywhere in Pakistan or abroad, and from government schools with the relevant permissions. It has been accorded this mandate to introduce a choice of examination and associated educational approach for schools, thus fulfilling a key objective of the National Curriculum of Pakistan: “Autonomy will be given to the Examination Boards and Research and Development cells will be established in each Board to improve the system” (ibid. para. 6.5.3 (ii)).

AKU-EB is committed to creating continuity of educational experience and the best possible opportunities for its students. In consequence it offered HSSC for the first time in September, 2007 to coincide with the arrival of its first SSC students in college or higher secondary school. Needless to say this is not an exclusive offer. Private candidates and students joining AKU-EB affiliated schools and colleges for HSSC Part 1 are eligible to register as AKU-EB candidates even though they have not hitherto been associated with AKU-EB.

This examination syllabus exemplifies AKU-EB’s commitment to national educational goals.

- It is in large part a reproduction, with some elaboration, of the Class IX and X National Curriculum of the subject.
- It makes the National Curriculum freely available to the general public.
- The syllabus recommends a range of suitable textbooks already in print for student purchase and additional texts for the school library.
- It identifies areas where teachers should work together to generate classroom activities and materials for their students as a step towards the introduction of multiple textbooks, another of the Ministry of Education’s policy provisions for the improvement of secondary education (ibid. para. 6.3.4).

This examination syllabus brings together all those cognitive outcomes of the National Curriculum statement which can be reliably and validly assessed. While the focus is on the cognitive domain, particular emphasis is given to the application of knowledge and understanding, a fundamental activity in fostering “attitudes befitting useful and peaceful

citizens and the skills for and commitment to lifelong learning which is the cornerstone of national economic development” (Preface to National Curriculum documents 2000 and 2002).

To achieve this end AKU-EB has brought together university academics, teacher trainers, writers of learning materials and above all, experienced teachers, in regular workshops and subject panel meetings.

AKU-EB provides copies of the examination syllabus to subject teachers in affiliated schools to help them in planning their teaching. It is the syllabus, not the prescribed text book which is the basis of AKU-EB examinations. In addition, the AKU-EB examination syllabus can be used to identify the training needs of subject teachers and to develop learning support materials for students. Involving classroom teachers in these activities is an important part of the AKU-EB strategy for improving the quality of learning in schools.

The Curriculum Wing of the Federal Ministry of Education has recently released new subject specifications and schemes of study which have been implemented since September, 2008. These documents are a major step forward towards a standards-related curriculum and have been welcomed by AKU-EB. Our current SSC syllabuses have been revised to ensure conformity with the National Curriculum.

We stand committed to all students entering the SSC course as well as those who have recently embarked upon the HSSC course in facilitating their learning outcome. Our examination syllabus document ensures all possible support.



Dr. Thomas Christie  
Director,  
Aga Khan University Examination Board  
July 2009

## 1. **Aims/Objectives of the National Curriculum (2006)<sup>1</sup>**

### **Aims**

This two-year study of chemistry aims to develop in all students:

- A scientific understanding of the physical world.
- Cognitive, affective, and psychomotor abilities appropriate to the acquisition and use of chemical knowledge, understanding, attitude, and skills.
- An appreciation for the products and influences of science and technology, balanced by a concern for their appropriate application.
- An understanding of the nature and limitations of scientific activity.
- An ability to apply the understanding of chemistry to relevant problems (including those from everyday real-life) and to approach those problems in rational ways.
- Respect for evidence, rationality and intellectual honesty.
- The capacities to express themselves coherently and logically, both orally and in writing and to use appropriate modes of communication characteristic of scientific work.
- The ability to work effectively with others.

### **Objectives:**

A statement of objectives relevant to each of the general aims is listed below. The sequence is in no particular order.

#### **Understanding the Physical World:**

Students should understand the scientific concepts inherent in the theme for each chapter and be able to:

- State, exemplify, and interpret the concepts.
- Use appropriately, fundamental terms and classification related to the concepts.
- Cite, explain or interpret scientific evidence in support of the concepts.

#### **Using Appropriate Cognitive, Affective and Psychomotor Abilities:**

Students should show ability to:

- Formulate questions that can be investigated by gathering first or second – hand data.
- Find relevant published background information.
- Formulate hypotheses and make predictions from them.
- Plan an investigation and carry out the planned procedure
- Use appropriate and relevant motor skills in carrying out investigations.
- Observe phenomena and describe, measure and record these as data
- Classify, collate and display data
- Construct and or interpret visual representations of phenomena and relationships (diagrams, graphs, flowcharts, physical models)
- Analyze data and draw conclusions.
- Evaluate investigative procedures and the conclusions drawn from such investigations.

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<sup>1</sup> Government of Pakistan (2006), *National Curriculum; Chemistry Classes IX-X, Islamabad*, Ministry of Education (Curriculum Wing)

**Understanding the Nature and Limitations of Scientific Activity:**

For each facet of scientific activity selected for study, students should:

- Describe and exemplify it.
- Use appropriately any fundamental terms and classification related to it.
- Recognize that the problem-solving nature of science has limitations.
- Acknowledge that people engaged in science, a particularly human enterprise, have the characteristics of people in general.

**Appreciating Influences of Science and Technology**

Student should:

- Recognize that the technology resulting from scientific activity influences the quality of life and economic development through or by improvements in medical / health care nutrition and agricultural techniques.
- Explain that these influences may be the result of unforeseen consequences, rapid exploitation, or rapid cultural changes.
- Realize that advances in technology require judicious applications.

**Respecting Evidence, Rationality and Intellectual Honesty:**

Student should:

- Display respect for evidence, rationality and intellectual honesty given the number of emotive issues in the area of chemistry.

**Showing Capacities to Communicate:**

Students should:

- Comprehend the intention of a scientific communication, the relationship among its parts and its relationship to what they already know.
- Select and use the relevant parts of a communication.
- Translate information for communications in particular modes (spoken, written, tables, graphs flowcharts, diagrams) to other modes.
- Structure information using appropriate modes to communicate.

**Working with Others:**

Students should actively participate in group work and:

- Share the responsibility for achieving the group.
- Show concern for the fullest possible involvement of each group member.

## **2. Rationale of the AKU-EB Examination Syllabus**

### **2.1 General Rationale**

2.1.1 In 2007, the Curriculum Wing of the Federal Ministry of Education (MoE) issued a revised part-wise Scheme of Studies. All subjects are to be taught and examined in both classes IX and X. It is therefore important for teachers, students, parents and other stakeholders to know:

- (a) that the AKU-EB Scheme of Studies for its SSC examination (Annex A) derives directly from the 2007 Ministry of Education Scheme of Studies;
- (b) which topics will be examined in Class IX and in Class X;
- (c) at which cognitive level or levels (Knowledge, Understanding, Application and other higher order skills) the topics and sub-topics will be taught and examined;

2.1.2 This AKU-EB examination syllabus addresses these concerns. Without such guidance teachers and students have little option other than following a single textbook to prepare for an external examination. The result is a culture of rote memorization as the preferred method of examination preparation. The pedagogically desirable objectives of the National Curriculum which encourage “observation, creativity and other higher order thinking [skills]” are generally ignored. AKU-EB recommends that teachers and students use multiple teaching-learning resources for achieving the specific objectives of the National Curriculum reproduced in the AKU-EB examination syllabuses.

2.1.3 The AKU-EB examination syllabuses use a uniform layout for all subjects to make them easier for teachers to follow. Blank sheets are provided in each syllabus for writing notes on potential lesson plans. It is expected that this arrangement will also be found helpful by teachers in developing classroom assessments as well as by question setters preparing material for the AKU-EB external examinations. The AKU-EB aims to enhance the quality of education through improved classroom practices and improved examinations.

- 2.1.4 The Student Learning Outcomes (SLOs) in Section 3 start with command words such as list, describe, relate, explain, etc. The purpose of the command words is to direct the attention of teachers and students to specific tasks that candidates following the AKU-EB examination syllabuses are expected to undertake in the course of their subject studies. The examination questions will be framed using the same command words or the connotation of the command words to elicit evidence of these competencies in candidates' responses. The definitions of command words used in this syllabus are given in Section 7. It is hoped that teachers will find these definitions useful in planning their lessons and classroom assessments.
- 2.1.5 The AKU-EB has classified SLOs under the three cognitive levels, Knowledge (K), Understanding (U) and Application of knowledge and skills (A) in order to derive multiple choice questions and constructed response questions on a rational basis from the subject syllabuses ensuring that the intentions of the National Curriculum should be met in full. The weighting of marks to the Multiple Choice and Constructed Response Papers is also derived from the SLOs, command words and cognitive levels. In effect the SLOs derived from the National Curriculum determine the structure of the AKU-EB subject examination set out in Section 4.
- 2.1.6 Some topics from the National Curriculum have been elaborated and enriched for better understanding of the subject and/or to better meet the needs of students in the twenty-first century.

## **2.2. Specific Rationale of the AKU-EB Chemistry Examination Syllabus**

- 2.2.1 The National Education Policy (1998-2010) outlines the following objectives for secondary education:
- a. To prepare the students well for the pursuit of professional and specialized education;
  - b. To make available such teaching and learning materials that will make learning rewarding and attractive;
  - c. To introduce a system of evaluation that emphasizes learning of concepts and discourages rote memorization.

2.2.2 In line with National Education Policy, the AKU-Examination Board syllabuses in science subject focus on the following:

- a. Broadening student's conceptual understanding through opportunities for enhancing their scientific skills, inquiry and experimentation.
- b. Allocating marks for each cognitive level of learning such as knowledge, understanding and application. The importance of content has been clearly elaborated as student learning outcomes.
- c. Reducing overloading and repetition. There is a need to look at the syllabus critically with due consideration to the fundamental concepts of secondary level science.

### 3. Topics and Student Learning Outcomes of the Examination Syllabus

#### Part I (Class IX)

Topic	Student Learning Outcomes		Cognitive Level <sup>2</sup>		
			K	U	A
<b>1. Fundamentals of Chemistry</b>	<b>Candidates should be able to:</b>				
1.1 Chemistry and its Branches	1.1.1	define chemistry and its various branches (organic, inorganic, physical, analytical, nuclear, biochemistry, industrial and environmental);	*		
1.2 Basic Definitions	1.2.1	define atom, atomic number, atomic mass and atomic mass unit;	*		
	1.2.2	define relative atomic mass based on C-12 scales;	*		
	1.2.3	differentiate among elements, compounds and mixtures;		*	
	1.2.4	distinguish between atoms and ions;		*	
	1.2.5	differentiate between molecules and molecular ions;		*	
	1.2.6	distinguish between ions and free radicals;		*	
	1.2.7	classify the chemical species into elements, mixtures, compounds, ions molecular ions and free radicals;		*	
	1.2.8	define valency and identify valencies of some common elements and radicals;	*		
1.3 Empirical and Molecular Formulae	1.3.1	define empirical and molecular formula;	*		
	1.3.2	calculate empirical formula from the given percentages of elements;			*
	1.3.3	calculate the molecular formula from the molecular mass and empirical formula;			*

<sup>2</sup> K = Knowledge, U = Understanding, A= Application (for explanation see Section 7: Definition of command words used in Student Learning Outcomes and in Examination Questions).

**NOTES**

				K	U	A
1.4	Avogadro's Number and Mole	1.4.1	define the terms gram atomic mass, gram molecular mass, gram formula mass, formula unit, mole and Avogadro's number;	*		
		1.4.2	relate gram atomic mass, gram molecular mass and gram formula mass to mole and Avogadro's number;		*	
1.5	Chemical Reactions and Calculations	1.5.1	define a chemical equation;	*		
		1.5.2	describe the formation and characteristics of chemical equations;		*	
		1.5.3	explain the types of chemical reactions with examples;		*	
		1.5.4	balance the chemical equations by inspection and trial and error methods;			*
		1.5.5	calculate the mass, number of moles, number of molecules and mole ratio based on balanced chemical equation by combustion analysis.			*
<b>2. Atomic Structure</b>		<b>Candidates should be able to:</b>				
2.1	Location of Proton, Neutron and Electron	2.1.1	describe the structure of an atom including the location of proton, electron and neutron;		*	
		2.1.2	calculate the number of $e^-$ , $p^+$ and n of the given atom and ions;			*
		2.1.3	draw the atomic structure of the first twenty elements and their ions;			*
2.2	Theories and Experiments Related to Atomic Structure	2.2.1	describe Rutherford's experiment and the discovery of atomic nucleus;		*	
		2.2.2	discuss the defects of Rutherford's atomic model;		*	
		2.2.3	describe Bohr's atomic model;		*	
2.3	Isotopes	2.3.1	define isotopes;	*		
		2.3.2	describe the number of protons, neutrons and electrons in different isotopes of H, C, O, Cl and U;		*	
		2.3.3	draw the structure of different isotopes of H, C,O, and Cl from their mass number and atomic number;			*
		2.3.4	discuss the importance of isotopes in various fields of life;		*	

**NOTES**

				K	U	A
2.4	Shells and Sub-shells	2.4.1	distinguish between shells and sub-shells;		*	
2.5	Electronic Configuration	2.5.1	show the electronic arrangement (K,L,M) and electronic configuration (s,p,d) of the first twenty elements in the periodic table.			*
<b>3. Periodic Table and Periodicity</b>		<b>Candidates should be able to:</b>				
3.1	Periodic Table	3.1.1	state the modern periodic law;	*		
		3.1.2	distinguish between a period and a group in the periodic table;		*	
		3.1.3	deduce the groups and periods of elements on the basis of electronic configuration;			*
		3.1.4	explain the shape of the periodic table (s, p, d, f blocks);		*	
		3.1.5	determine the location of families on the periodic table;		*	
		3.1.6	discuss the characteristics of different groups (I - VIII);		*	
3.2	Periodic Properties	3.2.1	recognize the similarity in the chemical and physical properties of elements in the same family of elements;		*	
		3.2.2	describe the periodic trend by using shielding effect, electronegativity, atomic radii, electron affinity and ionization energy within a group and a period of the periodic table.		*	

**NOTES**

			K	U	A
<b>4. Structure of Molecules</b>	<b>Candidates should be able to:</b>				
4.1 Formation of Chemical Bond	4.1.1	determine the number of valence electrons in an atom using the periodic table;		*	
	4.1.2	state the importance of noble gas electronic configuration in the formation of an ion;	*		
	4.1.3	state octet and duplet rules;	*		
	4.1.4	describe the ways in which bonds are formed;		*	
	4.1.5	describe the formation of cations from an atom of a metallic element;		*	
	4.1.6	describe the formation of anions from an atom of a non-metallic element;		*	
4.2 Ionic Bond	4.2.1	draw electronic dot and cross structure of an ionic compound (for example NaCl, MgO, K <sub>2</sub> O and CaCl <sub>2</sub> );			*
	4.2.2	describe the characteristics of ionic bonds;		*	
	4.2.3	recognize a compound as having ionic bond;		*	
	4.2.4	describe the characteristics of ionic compounds;		*	
4.3 Covalent Bond	4.3.1	describe the formation of a covalent bond between two non-metallic elements;		*	
	4.3.2	describe with example single, double and triple covalent bond;		*	
	4.3.3	draw electron cross and dot structures for simple covalent molecules containing single, double and triple bond;			*
	4.3.4	describe the characteristics of covalent compounds;		*	
	4.3.5	describe the properties of polar and non-polar compounds;		*	
4.4 Coordinate Covalent Bond	4.4.1	describe the formation of coordinate covalent bond by donation of an electron pair from one element to the other element (e.g. ammonium ion);		*	
	4.4.2	explain (a) the difference in the formation of coordinate covalent compounds and covalent compounds (b) lack of difference in chemical properties of coordinate covalent compounds and covalent compounds;		*	

**NOTES**

			K	U	A	
4.5	Metallic Bond	4.5.1	describe that (a) valence electrons of metals are loosely held by the nucleus of the atoms, (b) metallic ions are embedded in their electronic clouds, (c) for establishment of the electronic cloud, the nucleus of the positively charged metallic ions leads to the formation of a metallic bond;		*	
		4.5.2	describe the properties of metallic bonds of different metals;		*	
4.6	Dot Diagram	4.6.1	draw electronic dot diagrams of different types of chemical bonds;			*
4.7	Intermolecular Forces	4.7.1	describe weak forces of interactions such as dipole-dipole interaction and hydrogen bonding.		*	
<b>5. States of Matter</b>		<b>Candidates should be able to:</b>				
5.1	Physical States of Matter	5.1.1	describe the physical states of matter with regard to intermolecular forces present between their molecules;		*	
5.2	<u>Gaseous State</u> Typical Properties	5.2.1	explain the properties of gases (diffusion, effusion and pressure);		*	
5.3	Laws Related to Gases	5.3.1	account for pressure and volume changes in a gas using Boyle's law;		*	
		5.3.2	account for temperature and volume changes in a gas using Charles's law;		*	
5.4	<u>Liquid State</u> Typical Properties	5.4.1	summarize the properties of liquid like evaporation, vapour pressure, boiling point, freezing point, diffusion and density;		*	
		5.4.2	explain the effect of temperature and external pressure on vapour pressure and boiling point;		*	
5.5	<u>Solid State</u> Typical Properties	5.5.1	describe physical properties of solids (melting point, boiling point and sublimation);		*	
		5.5.2	differentiate between amorphous and crystalline solids;		*	

**NOTES**

				K	U	A
5.6	Types of Solid	5.6.1	define allotropes and explain allotropic forms of solid (for example carbon and sulphur).		*	
<b>6. Solutions</b>		<b>Candidates should be able to:</b>				
6.1	Solution, Aqueous Solution, Solute and Solvent	6.1.1	define the terms solution, aqueous solution, solute and solvent and give an example of each;	*		
6.2	Types of Solution	6.2.1	determine different types of solutions (gas into gas, gas into liquid, gas into solid, liquid into gas, liquid into liquid, liquid into solid, solid into liquid, solid into solid, solid into gas);		*	
6.3	Saturated, Unsaturated, Supersaturated, Dilute and Concentrated Solution	6.3.1	explain the differences among saturated, unsaturated and supersaturated solution;		*	
		6.3.2	differentiate between dilute and concentrated solution;		*	
6.4	Concentration Units and Dilution of Solutions	6.4.1	define the meaning of concentration of solution;	*		
		6.4.2	define molarity and solve problems involving the molarity of a solution;			*
		6.4.3	define percentage as unit of concentration;	*		
		6.4.4	calculate percentage composition of different solutions (% m/m, % m/v, % v/m, % v/v);			*
		6.4.5	solve numerical based on dilution of solutions from concentrated solutions of known molarity;			*

**NOTES**

			<b>K</b>	<b>U</b>	<b>A</b>	
6.5	Factors Affecting Solubility	6.5.1 6.5.2 6.5.3 6.5.4	define solubility; explain the factors which affect solubility like temperature and pressure; determine the effect of temperature on solubility of different salts in water; predict the solubility of one substance into another using the rule of 'like dissolve like';	*	*	*
6.6	Crystallization	6.6.1 6.6.2	define crystallization; describe the process of purifying an impure substance through crystallization with examples;	*	*	
6.7	Comparison of Solution, Suspension and Colloid	6.7.1	differentiate among solution, suspension and colloid.		*	
<b>7. Electrochemistry</b>		<b>Candidates should be able to:</b>				
7.1	Oxidation and Reduction Reactions	7.1.1	define oxidation and reduction in terms of loss or gain of oxygen or hydrogen or electrons;	*		
7.2	Oxidation States and Rules for Assigning Oxidation States	7.2.1 7.2.2 7.2.3	define oxidation state; state the common rules used for assigning oxidation numbers to free elements, ions (simple and complex), molecules and atoms; deduce the oxidation number of an atom of any element in a compound;	*		*
7.3	Oxidizing and Reducing Agents	7.3.1 7.3.2	define oxidizing and reducing agents in a redox reaction; investigate oxidizing and reducing agents in a redox reaction;	*		*

**NOTES**

			<b>K</b>	<b>U</b>	<b>A</b>	
7.4	Electrochemical Cells	7.4.1	define electrode potential;	*		
		7.4.2	sketch an electrolytic cell - label the cathode and the anode;			*
		7.4.3	identify the reactivity of elements using a reactivity series;	*		
		7.4.4	deduce the direction of movement of cations and anions towards respective electrodes;			*
		7.4.5	describe the nature of electrochemical processes;		*	
		7.4.6	infer which solutions conduct electricity in a given set of solutions;			*
		7.4.7	describe metal displacement reactions in an aqueous medium;		*	
		7.4.8	list the possible uses of an electrolytic cell;	*		
		7.4.9	sketch a Daniel cell, labelling the cathode, the anode and the direction of flow of electrons;			*
		7.4.10	describe how a battery produces electrical energy;		*	
		7.4.11	deduce the half-cell in which oxidation occurs and the half-cell in which reduction occurs given a voltaic cell;			*
		7.4.12	distinguish between electrolytic and voltaic (Galvanic) cells;		*	
7.5	Electrochemical Industries	7.5.1	describe the manufacturing of sodium metal from fused NaCl;		*	
		7.5.2	identify the formation of by-products in the manufacture of sodium metal from fused NaCl;	*		
		7.5.3	explain electrolytic refining of copper;		*	
7.6	Corrosion and its Prevention	7.6.1	define corrosion;	*		
		7.6.2	describe rusting of iron as an example of corrosion;		*	
		7.6.3	summarize the methods used to prevent corrosion;		*	
		7.6.4	explain electroplating of metals on iron (using examples of zinc, tin and chromium plating).		*	

**NOTES**

			K	U	A
<b>8. Chemical Reactivity</b>		<b>Candidates should be able to:</b>			
8.1	Differences Between Metals and Non-metals	8.1.1	differentiate between metals and non-metals based on physical and chemical properties;		*
8.2	Metals	8.2.1	identify elements as an alkali metal or an alkaline earth metal;	*	
		8.2.2	explain why alkali metals are not found in free state in nature;		*
		8.2.3	describe the position of sodium in the periodic table along with its physical properties, chemical properties and uses;		*
		8.2.4	describe the position of calcium and magnesium in periodic table along with their physical properties, chemical properties and uses;		*
		8.2.5	explain the differences in ionization energies of alkali and alkaline earth metals;		*
		8.2.6	differentiate between soft and hard metals (sodium, iron);		*
		8.2.7	describe the inertness of noble metals;		*
		8.2.8	identify the commercial value of silver, gold and platinum;	*	
8.3	Non-Metals	8.3.1	compile some important reactions of halogens with group I and II elements;		*
		8.3.2	name some elements which are found in uncombined state in nature.	*	

**NOTES**

**Part-II (Class X)**

Topic	Student Learning Outcomes		Cognitive Level		
			K	U	A
<b>9. Chemical Equilibrium</b>	<b>Candidates should be able to:</b>				
9.1 Reversible Reactions and Dynamic Equilibrium	9.1.1 9.1.2 9.1.3	define chemical equilibrium in terms of a reversible reaction; show both forward and reverse reactions using chemical equations; describe the macroscopic characteristics of both forward and reverse reactions;	*	*	*
9.2 Law of Mass Action and Thermal Reactions	9.2.1 9.2.2	define law of mass action; explain exothermic and endothermic reactions with examples;	*	*	
9.3 Expression for the Equilibrium Constant	9.3.1 9.3.2 9.3.3 9.3.4	derive an expression for the equilibrium constant and its units; show the equilibrium constant expression of a reaction and its unit; state the necessary conditions for equilibrium and the ways through which equilibrium can be recognized; describe the effect of catalyst, temperature, pressure and concentration on a reversible reaction at equilibrium.	*	*	*
<b>10. Acids, Bases and Salts</b>	<b>Candidates should be able to:</b>				
10.1 Concepts of Acids and Bases	10.1.1 10.1.2 10.1.3 10.1.4 10.1.5 10.1.6	define and give examples of Arrhenius acids and bases; state Bronsted Lowry theory; classify substances as acids or bases or as proton donors or proton acceptors using Bronsted Lowry theory; state Lewis concepts of acids and bases; classify substances as Lewis acids or bases; state the equation for the self-ionization of water;	*	*	
10.2 Properties of Acids and Bases	10.2.1	describe the physical and chemical properties of acids and bases;		*	

**NOTES**

			<b>K</b>	<b>U</b>	<b>A</b>	
10.3	Strengths of Acids and Bases	10.3.1	define acidity of bases and basicity of acids;	*		
		10.3.2	define strong and weak acids and bases with examples;	*		
10.4	Applications of Acids and Bases	10.4.1	list the uses of acids and bases in daily life;	*		
		10.4.2	explain the process of etching in art and industry;		*	
10.5	pH Scale	10.5.1	define pH and explain its measurement with pH paper using examples from daily life (pH of body fluids, secretions and fruit juices);		*	
		10.5.2	classify a solution as neutral, acidic or basic based on the given hydrogen ion or hydroxide ion concentration;		*	
		10.5.3	calculate the pH and pOH of solutions by using the given hydrogen or hydroxide ion concentration;			*
10.6	Acid Base Titration	10.6.1	perform acid base titrations and related calculations;			*
		10.6.2	complete and balance a neutralization reaction.			*
10.7	Salts	10.7.1	define salts;	*		
		10.7.2	describe the properties of a salt;		*	
		10.7.3	describe the methods of preparing soluble and insoluble salts;		*	
		10.7.4	list the uses of salts in daily life;	*		
10.8	Types of Salt	10.8.1	explain different types of salts.		*	

**NOTES**

<b>11. Organic Chemistry</b>		<b>Candidates should be able to:</b>		<b>K</b>	<b>U</b>	<b>A</b>
11.1 Organic Compounds	11.1.1	list general characteristics of organic compounds;	*			
	11.1.2	explain the diversity and magnitude of organic compounds;		*		
	11.1.3	list some sources of organic compounds;	*			
	11.1.4	list the uses of organic compounds;	*			
11.2 Classification of Organic Compounds	11.2.1	classify organic compounds into straight chain, branched chain and cyclic compounds;		*		
	11.2.2	recognize structural, condensed and molecular formulae of the straight chain hydrocarbons up to ten carbon atoms;		*		
11.3 Alkanes and Alkyl Radicals	11.3.1	name the alkanes up to decane;	*			
	11.3.2	convert alkanes into alkyl radicals;			*	
	11.3.3	differentiate between alkanes and alkyl radicals;		*		
11.4 Homologous Series and Isomerism	11.4.1	describe the homologous series and its characteristics;		*		
	11.4.2	describe chain isomerism with examples;		*		
	11.4.3	draw possible structures of butane;			*	
11.5 Functional Groups	11.5.1	define functional group;	*			
	11.5.2	differentiate among various organic compounds on the basis of their functional groups;		*		
	11.5.3	infer a molecule's functional group;			*	
	11.5.4	explain the detection of carboxylic acids, phenols, amines, aldehydes and ketones in terms of functional groups.		*		

**NOTES**

			K	U	A
12. Hydrocarbons		Candidates should be able to:			
12.1 Introduction	12.1.1	explain the necessity of a systematic method of naming chemical compounds and use IUPAC system in naming compounds (alkanes, alkenes and alkynes) up to 5 carbon atoms;		*	
	12.1.2	define hydrocarbons;	*		
	12.1.3	distinguish between saturated and unsaturated hydrocarbons (including test with iodine, bromine and potassium permanganate);		*	
	12.1.4	describe that alkynes are more unsaturated compounds than alkenes;		*	
12.2 Structural and Electronic Formulae	12.2.1	draw structural and electronic (cross and dot) formulae of alkanes, alkenes and alkynes up to 5 carbon atoms;			*
12.3 Uses of Hydrocarbons	12.3.1	explain hydrocarbons as fuel;		*	
	12.3.2	explain hydrocarbons as feed stock in industry;		*	
12.4 Alkanes	12.4.1	identify that in alkanes, the four bonds of each carbon atom are directed to the corners of a tetrahedron;	*		
	12.4.2	describe the preparation, physical properties, chemical properties and uses of methane;		*	
	12.4.3	describe that the combustion of alkanes provide energy for heating and cooking;		*	
	12.4.4	show the preparation of alkanes from hydrogenation of alkenes and alkynes and reduction of alkyl halides using chemical equations;			*
12.5 Alkenes	12.5.1	describe the plane and angles formed by carbon atoms;		*	
	12.5.2	describe the physical properties of ethene or ethylene;		*	
	12.5.3	show the preparation of alkenes from dehydration of alcohols and dehydrohalogenation of alkyl halides using chemical equations;			*

**NOTES**

			<b>K</b>	<b>U</b>	<b>A</b>
12.6	Alkynes	12.6.1 describe the preparation, properties and uses of ethynes or acetylene; 12.6.2 classify: (a) ethynes as acids, (b) ethynes as more energy producing through combustion; 12.6.3 show the preparation of alkynes from dehalogenations of 1,2- dihalides and tetrahalides using chemical equations;		*	*
12.7	Reactions of Alkanes, Alkenes and Alkynes	12.7.1 show halogenations of alkanes, alkenes and alkynes using chemical equations; 12.7.2 show oxidation of alkenes and alkynes with $\text{KMnO}_4$ using chemical equations.			*
<b>13. Biochemistry</b>		<b>Candidates should be able to:</b>			
13.1	Carbohydrates	13.1.1 describe the composition of carbohydrates and distinguish among mono-, di- and tri-saccharides; 13.1.2 detect the relative solubility in water of starch and sugar; 13.1.3 describe the medicinal use of dextrose such as in drips;		*	*
13.2	Proteins	13.2.1 describe the primary, secondary and tertiary structural features and bonding in a protein molecule (i.e. peptide linkage between amino acids); 13.2.2 observe and explain the denaturing of proteins;		*	*
13.3	Enzymes	13.3.1 define enzymes; 13.3.2 list and describe the commercial uses of enzymes;	*	*	
13.4	Lipids	13.4.1 differentiate between fats and oil; 13.4.2 explain hydrogenation of vegetable oil;		*	*
13.5	Nucleic Acids	13.5.1 describe the importance of nucleic acids; 13.5.2 describe the types of nucleic acids (deoxyribonucleic and ribonucleic acids);		*	*

**NOTES**

			<b>K</b>	<b>U</b>	<b>A</b>
13.6	Vitamins	13.6.1 describe vitamins and their importance; 13.6.2 list the sources, uses and diseases due to deficiency of vitamin A, B complex, C, D, E and K;	*	*	
13.7	Biologically Important Minerals	13.7.1 enlist biologically important macro and micro-minerals;	*		
13.8	Sources and Uses	13.8.1 list the sources and uses of carbohydrates, proteins, lipids and nucleic acids; 13.8.2 explain why agricultural and nutritional sciences are vital.	*	*	
<b>14. Environmental Chemistry I: Atmosphere</b>		<b>Candidates should be able to:</b>			
14.1	Environmental Spheres	14.1.1 define environmental chemistry; 14.1.2 describe environmental spheres (lithosphere, hydrosphere, biosphere and atmosphere);	*	*	
14.2	Layers of Atmosphere	14.2.1 state the composition of atmosphere; 14.2.2 differentiate between stratosphere and troposphere; 14.2.3 summarize the components of stratosphere and troposphere;	*	*	
14.3	Air Pollutants	14.3.1 list major air pollutants; 14.3.2 describe sources and explain effects of air pollutants; 14.3.3 describe how incineration of waste material contributes to the problem of air pollution giving examples from daily life; 14.3.4 suggest what the government should do more to control air pollution resulting from auto exhaust;	*	*	*

**NOTES**

			K	U	A	
14.4	Acid Rain and its Effects	14.4.1	describe acid rain and its effects;		*	
14.5	Ozone Depletion and its Effects	14.5.1 14.5.2 14.5.3 14.5.4	explain ozone formation; describe ozone depletion and its effects; list the uses of ozone; describe global warming.	*	* * *	
<b>15. Environmental Chemistry II: Water</b>		<b>Candidates should be able to:</b>				
15.1	Properties of Water	15.1.1 15.1.2	describe the occurrence of water and explain its importance in the environment including industry; describe the composition, physical and chemical properties of water;		* *	
15.2	Water as Solvent	15.2.1 15.2.2	discuss our dependence on water and the importance of maintaining its quality; describe the unique properties of water that makes it a universal solvent;		* *	
15.3	Soft and Hard Water	15.3.1 15.3.2 15.3.3	differentiate among soft, temporary and permanent hard water; describe methods for eliminating temporary and permanent hardness of water; explain the way hard water hampers the cleansing action of soap;		* * *	
15.4	Water Pollution	15.4.1 15.4.2 15.4.3 15.4.4 15.4.5	identify water pollutants (agricultural, industrial and household wastes); describe the effects of agricultural, industrial and household wastes on life; explain why water treatment is essential to make it drinkable; explain and compare the processes of modern water treatment and sewage treatment; explain how chemistry helps maintain a clean swimming pool;	*	* * * *	
15.5	Water Borne Diseases	15.5.1	describe the various types of water borne diseases.		*	

**NOTES**

			K	U	A
<b>16. Chemical Industries</b>		<b>Candidates should be able to:</b>			
16.1	Industries and Basic Metallurgical Operations	16.1.1	relate the study of chemistry to careers in industry;	*	
		16.1.2	describe some metallurgical operations;	*	
16.2	Iron	16.2.1	describe the extraction of iron;	*	
		16.2.2	differentiate between iron and steel;	*	
16.3	Copper	16.3.1	describe the extraction of copper;	*	
16.4	Aluminium	16.4.1	describe the extraction of aluminium;	*	
16.5	Alloys	16.5.1	define the term alloy;	*	
		16.5.2	describe the composition of different alloys (brass, bronze, nichrome);	*	
16.6	Solvay Process	16.6.1	list raw materials for the Solvay process;	*	
		16.6.2	describe the basic reactions of Solvay process;	*	
		16.6.3	develop a flow sheet diagram of Solvay process;		*
16.7	Urea	16.7.1	state the composition of urea;	*	
		16.7.2	develop a flow sheet diagram for the manufacture of urea;		*
		16.7.3	list the uses of urea;	*	
		16.7.4	discuss the use of synthetic fertilizers versus natural fertilizers;		*
16.8	Petroleum Industry	16.8.1	define petroleum;	*	
		16.8.2	explain the formation of petroleum and natural gas;		*
		16.8.3	state the composition of petroleum and natural gas;	*	
		16.8.4	describe the fractional distillation of petroleum;		*
		16.8.5	describe how different types of fire (wood, oil, electric) require different chemistry to put them out.		*

**NOTES**

#### 4. Scheme of Assessment

##### Class IX

**Table 1: Number of Student Learning Outcomes by Cognitive Level**

Topic No.	Topics	No. of Sub-topics	SLOs			Total
			K	U	A	
1.	Fundamentals of Chemistry	5	7	8	4	19
2.	Atomic Structure	5	1	7	4	12
3.	Periodic Table and Periodicity	2	1	6	1	08
4.	Structure of Molecules	7	2	16	3	21
5.	States of Matter	6	0	9	0	09
6.	Solutions	7	5	7	4	16
7.	Electrochemistry	6	9	9	7	25
8.	Chemical Reactivity	3	3	7	1	11
	<b>Total</b>	<b>41</b>	<b>28</b>	<b>69</b>	<b>24</b>	<b>121</b>
	<b>Percentage</b>		<b>23</b>	<b>57</b>	<b>20</b>	<b>100</b>

**Table 2: Allocation of Marks for the Multiple Choice Questions (MCQs), Constructed Response Questions (CRQs) and Extended Response Questions (ERQs)**

Topic No.	Topics	No. of Sub-topics	Marks			Total
			Multiple Choice Questions	Constructed Response Questions	Extended Response Questions	
1.	Fundamentals of Chemistry	17	9	7	8	24
2.	Atomic Structure					
4.	Structure of Molecules					
3.	Periodic Table and Periodicity	2	3	5	-	8
5.	States of Matter	19	9	9	7	25
6.	Solutions					
7.	Electrochemistry					
8.	Chemical Reactivity	3	4	4	-	8
	<b>Total</b>	<b>41</b>	<b>25</b>	<b>25</b>	<b>15</b>	<b>65</b>
	Practical (see annex B)					10
	<b>Total</b>					<b>75</b>

**Table 3: Paper Specifications**

<b>Topic No.</b>	<b>Topic</b>	<b>Marks Distribution</b>			<b>Total Marks</b>
1.	Fundamentals of Chemistry	MCQs 9 @ 1 Mark CRQ 1 @ 7 Marks *ERQ 1 @ 8 Marks Choose any ONE from TWO			24
2.	Atomic Structure				
4.	Structure of Molecules				
3.	Periodic table and Periodicity	MCQs 3 @ 1 Mark CRQ 1 @ 5 Marks			8
5.	States of Matter	MCQs 9 @ 1 Mark CRQ 1 @ 9 Marks *ERQ 1 @ 7 Marks Choose any ONE from TWO			25
6.	Solutions				
7.	Electrochemistry				
8.	Chemical Reactivity	MCQs 4 @ 1 Mark CRQ 1 @ 4 Marks			8
	<b>Total</b>	<b>MCQs</b> <b>25</b>	<b>CRQs</b> <b>25</b>	<b>ERQs</b> <b>15</b>	<b>65</b>
	<b>Practical</b>				<b>10</b>
	<b>Total Marks</b>				<b>75</b>

\* Extended response questions (ERQs) will require answers in more descriptive form. The answers will be in a paragraph rather than a word or a single sentence.

**Class X**

**Table 4: Number of Student Learning Outcomes by Cognitive Level**

Topic No.	Topics	No. of Sub-topics	SLOs			Total
			K	U	A	
9.	Chemical Equilibrium	3	3	4	2	9
10.	Acids, Bases and Salts	8	9	9	3	21
11.	Organic Chemistry	5	5	8	3	16
12.	Hydrocarbons	7	2	11	6	19
13.	Biochemistry	8	4	10	2	16
14.	Environmental Chemistry I: Atmosphere	5	4	9	1	14
15.	Environmental Chemistry II: Water	5	1	12	0	13
16.	Chemical Industries	8	6	12	2	20
	<b>Total</b>	<b>49</b>	<b>34</b>	<b>75</b>	<b>19</b>	<b>128</b>
	<b>Percentage</b>		<b>26</b>	<b>59</b>	<b>15</b>	<b>100</b>

**Table 5: Allocation of Marks for the Multiple Choice Questions (MCQs), Constructed Response Questions (CRQs) and Extended Response Questions (ERQs)**

Topic No.	Topics	No. of Sub-topics	Marks			Total
			Multiple Choice Questions	Constructed Response Questions	Extended Response Questions	
9.	Chemical Equilibrium	3	3	6	-	9
10.	Acids, Bases and Salts	20	9	6	8	23
11.	Organic Chemistry					
12.	Hydrocarbons	8	4	6	-	10
13.	Biochemistry					
14.	Environmental Chemistry I: Atmosphere	18	9	7	7	23
15.	Environmental Chemistry II: Water					
16.	Chemical Industries					
	<b>Total</b>	<b>49</b>	<b>25</b>	<b>25</b>	<b>15</b>	<b>65</b>
	Practical (see annex B)					10
	<b>Total</b>					<b>75</b>

**Table 6: Paper Specifications**

<b>Topic No.</b>	<b>Topic</b>	<b>Marks Distribution</b>			<b>Total Marks</b>
9.	Chemical Equilibrium	MCQs 3 @ 1 Mark CRQ 1 @ 6 Marks			9
10.	Acids, Bases and Salts	MCQs 9 @ 1 Mark CRQ 1 @ 6 Marks *ERQ 1 @ 8 Marks Choose any ONE from TWO			23
11.	Organic Chemistry				
12.	Hydrocarbons				
13.	Biochemistry	MCQs 4 @ 1 Mark CRQ 1 @ 6 Marks			10
14.	Environmental Chemistry I: Atmosphere	MCQs 9 @ 1 Mark CRQ 1 @ 7 Marks *ERQ 1 @ 7 Marks Choose any ONE from TWO			23
15.	Environmental Chemistry II: Water				
16.	Chemical Industries				
	<b>Total</b>	<b>MCQs</b> <b>25</b>	<b>CRQs</b> <b>25</b>	<b>ERQs</b> <b>15</b>	<b>65</b>
	Practical				10
	<b>Total Marks</b>				<b>75</b>

\* Extended response questions (ERQs) will require answers in more descriptive form. The answers will be in a paragraph rather than a word or a single sentence.

- 4.1 Tables 1 and 4 summarize the number and nature of SLOs in each topic in classes IX and X. This will serve as a guide in the construction of the examination paper. It also indicates that more emphasis has been given to Understanding (57% and 59%), Application and higher order skills (20% and 15%) to discourage rote memorization. Tables 1 and 4 however do not translate directly into marks.
- 4.2 There will be two examinations, one at the end of Class IX and one at the end of Class X.
- 4.3 In each class, the theory paper will be in two parts: paper I and paper II. Both papers will be of duration of 3 hours.
- 4.4 Paper I theory will consist of 25 compulsory, multiple choice items. These questions will involve four response options.
- 4.5 Paper II theory will carry 40 marks and consist of a number of compulsory, structured questions and a number of extended response questions. Each extended response question will be presented in an either/or form.

- 4.6 Practical examination will be conducted separate from the theory paper. It will be based on the list of practical activities listed in the examination syllabus.
- 4.7 All constructed response questions will be in a booklet which will also serve as an answer script.
- 4.8 Practical exams to assess performance skills will carry 10 marks in class IX and 10 marks in class X.
- 4.9 It is essential for each school to equip its laboratories with chemicals, instruments, apparatus, specimens etc. according to the requirements of the practicals. Each school will be responsible to make sure that each student is provided the opportunity to do the practicals.

List of practical activities is attached as annex B.

## 5. Teaching-Learning Approaches and Classroom Activities

To promote effective teaching and learning a teacher has to play an effective and vital role as a facilitator, guide, supervisor, advisor etc. Work plan to be worked out beforehand for the speculated period. Lesson should be pre-planned keeping in view the set objectives. Theoretical concepts must be augmented by relevant practical activities. Teaching aids should be developed and tested beforehand. Classroom environment must be conducive, absorbing and friendly. Evaluation, assessment and measurement must be a regular feature for the scheme of work. Lesson evaluation should be formative and summative and to be done beforehand. Field trips to be pre-planned. Short-term projects to be designed with perfection, and should be executed effectively. Lab should be properly equipped to cater to the needs of given set of practical.

Learning approaches could encompass:

- Group and individual projects/ models
- Home assignments
- Science exhibitions / quizzes / declamation contest
- Collaborative learning (group assignments / peer work/ think-pair-share)
- Gathering information from the internet / library/ documentary / field visits (seashore, science museum, botanical gardens, industries)

## 6. Recommended Text and Reference Material

### Recommended Text Books

1. *Chemistry 9* (2012), Caravan Book House, Lahore.
2. *Chemistry 10* (2012), Caravan Book House, Lahore.
3. Mushtaq Ahmed Sheikh, (2011). *Chemistry Practical Notebook for Class IX*: Star Publishers.
4. Mushtaq Ahmed Sheikh, (2011). *Chemistry Practical Notebook for Class X*: Star Publishers.

## Reference Books

1. Rose Marie Gallagher and Paul Ingram, *Complete Chemistry*, Oxford University Press.
2. Morris Jane, *Chemistry: Collins GCSE Sciences*, Collins Publishers.
3. Mushtaq Ahmed Sheikh, (2007). *Chemistry Practical Notebook for Class XII*: Star Publishers.
4. *Chemistry for Class IX* (2010). Punjab Textbook Board, Lahore.
5. *Chemistry for Class X* (2010). Punjab Textbook Board, Lahore.
6. *Chemistry for Class XI* (2010). Punjab Textbook Board, Lahore.
7. *Chemistry for Class XII* (2010). Punjab Textbook Board, Lahore.

## Websites:

<http://www.learningsupport.akueb.edu.pk/>

<http://www.s-cool.co.uk/>

<http://www.bbc.co.uk/schools/gcsebitesize/science/aqa/>

<http://www.chem4kids.com/>

<http://www.internet4classrooms.com/chemistry.htm>

<http://101science.com/Chemistry.htm>

<http://www.usetute.com.au/index.html>

## 7. Definition of Cognitive Levels and Command Words

### 7.1 Definition of Cognitive Levels

#### Knowledge

This requires knowing and remembering facts and figures, vocabulary and contexts, and the ability to recall key ideas, concepts, trends, sequences, categories, etc. It can be taught and evaluated through questions based on: who, when, where, what, list, define, identify, label, tabulate, quote, name, state, etc.

#### Understanding

This requires understanding information, grasping meaning, interpreting facts, comparing, contrasting, grouping, inferring causes/reasons, seeing patterns, organizing parts, making links, summarizing, solving, identifying motives, finding evidence, etc. It can be taught and evaluated through questions based on: why, how, show, demonstrate, paraphrase, interpret, summarize, explain, prove, identify the main idea/theme, predict, compare, differentiate, discuss, chart the course/direction, report, solve, etc.

## Application

This requires using information or concepts in new situations, solving problems, organizing information and ideas, using old ideas to create new ones, generalizing from given facts, analyzing relationships, relating knowledge from several areas, drawing conclusions, evaluating worth, etc. It can be taught and evaluated through questions based on: differentiate, analyze, show relationship, propose an alternative, prioritize, give reasons for, categorize, illustrate, compare and contrast, suggest, create, design, formulate, integrate, rearrange, reconstruct/recreate, reorganize, predict consequences, etc.

### 7.2 Definition of Command Words

#### Knowledge

- Define:** Only a formal statement or equivalent paraphrase is required. No examples need to be given.
- Identify:** Give the name or identifying characteristics of; describe with specific examples how a given term or concept is applied in daily life.
- List / Enlist:** Requires a number of points, generally each of one word, with no elaboration. Where a given number of points are specified, this should not be exceeded.
- Name:** Mention the commonly used word for an object.
- State:** Implies concise answer with little or no supporting argument, for example a numerical answer that can be obtained by inspection.

#### Understanding

- Account for:** To give reasons, explain why something has happened.
- Compare:** List the main characteristics of two entities clearly identifying similarities or differences or both.
- Classify:** State a basis for categorization of a set of related entities and assign examples to categories.
- Describe:** State in words (using diagrams where appropriate) the main points of the topic. It is often used with reference either to particular phenomena or specific experiments. In the former instance, the term usually implies that the answer should include reference to (visual) observations associated with the phenomena.

<b>Determine:</b>	Often implies that the quantity concerned cannot be measured directly but is obtained by calculation, substituting measured or known values of other quantities into standard formula, e.g. relative molecular mass.
<b>Differentiate/ Distinguish:</b>	Identify those characteristics which always or sometimes differentiate two categories.
<b>Discuss:</b>	Give a critical and logical account of the points involved in the topic.
<b>Derive:</b>	Manipulate a mathematical relationship(s) to give a new equation or relationship.
<b>Explain:</b>	Make an idea, situation or problem clear by describing it in detail revealing relevant data or facts.
<b>Recognise:</b>	Involves looking at a given example and stating what it most probably is.
<b>Relate:</b>	Describe how things depend upon, follow from or are part of another.
<b>Summarise:</b>	Identify/review the main points, relevant factors and/or arguments so that these are explained in a clear and concise manner.

## **Application**

<b>Balance:</b>	Equalise the number of atoms on the reactant side to the number of atoms on the product side.
<b>Calculate / Solve:</b>	Used when a numerical answer is required. In general, working should be shown, especially where two or more steps are involved.
<b>Convert:</b>	Change or adapt from one system or units to another.
<b>Compile:</b>	Put together or compose from materials gathered from several sources.
<b>Complete:</b>	Bring to a finish by providing missing information in the given context.
<b>Draw / Sketch / Construct:</b>	Make a simple freehand sketch or diagram. Care should be taken with proportions and the clear labelling of parts.

<b>Deduce:</b>	By recall but by making a logical connection between other pieces of information. Such information may be wholly given in the question or may depend on answer extracted in an early part of the question.
<b>Demonstrate / Show:</b>	Show how a thing is related to another, usually it is reference to theory but sometimes it is by physical manipulation or experiment.
<b>Develop:</b>	Expand or elaborate on an idea or argument with supporting reasons.
<b>Infer:</b>	To conclude by reasoning with the help of evidences.
<b>Investigate / detect:</b>	Examine systematically a situation or a problem in order to come to a rational conclusion.
<b>Measure:</b>	To determine extent, quantity, amount or degree of something by measurement or calculation.
<b>Observe:</b>	Pay attention to details which characterize a specimen, reaction or change taking place; to examine and note scientifically;
<b>Perform:</b>	Carry out an action, undertaking, or procedure, often with great skill or care.
<b>Predict:</b>	Implies that the candidates are not expected to produce the required answer.
<b>Prepare:</b>	To bring something into existence such as making up of various objects in the laboratory.
<b>Suggest:</b>	Make a judgement and give some support or reason for your suggestion.
<b>Separate:</b>	To divide into components or parts.
<b>Standardize:</b>	To determine unknown concentration of a given solution by titrating it against a solution of known molarity.

SSC Scheme of Studies<sup>3</sup>

AKU-EB as a national board offers qualifications for both English and Urdu medium schools. The revised SSC Scheme of Studies issued by the Curriculum Wing was implemented from September 2007. Accordingly, each SSC subject will be taught across both the classes IX and X. The Science and Humanities group subjects are offered at SSC level. The marks allocated to subjects in the revised National Scheme of Studies of September 2007 have been followed.

## SSC I and II (Class IX and X) subjects on offer for examination

## SSC Part-I (Class IX) Science Group

Subjects	Marks			Medium
	Theory	Practical	Total	
English Compulsory-I	75	-	75	English
Urdu Compulsory-I OR Urdu Aasan <sup>a</sup> OR History and Geography of Pakistan-I <sup>b</sup>	75	-	75	Urdu Urdu English
Islamiyat-I OR Ethics-I <sup>c</sup>	*30	-	*30	English / Urdu
Pakistan Studies-I	*45	-	*45	English / Urdu
Mathematics-I	75	-	75	English / Urdu
Physics-I	65	10	75	English / Urdu
Chemistry-I	65	10	75	English / Urdu
Biology-I OR Computer Science-I	65	10	75	English / Urdu English
<b>Total:</b>	<b>*495</b>	<b>30</b>	<b>*525</b>	

## SSC Part-II (Class X) Science Group

Subjects	Marks			Medium
	Theory	Practical	Total	
English Compulsory-II	75	-	75	English
Urdu Compulsory-II OR Sindhi <sup>a</sup> OR History and Geography of Pakistan-II <sup>b</sup>	75	-	75	Urdu Sindhi English
Islamiyat-II OR Ethics-II <sup>c</sup>	*45	-	*45	English / Urdu
Pakistan Studies-II	*30	-	*30	English / Urdu
Mathematics-II	75	-	75	English / Urdu
Physics-II	65	10	75	English / Urdu
Chemistry-II	65	10	75	English / Urdu
Biology-II OR Computer Science-II	65	10	75	English / Urdu English
<b>Total:</b>	<b>*495</b>	<b>30</b>	<b>*525</b>	

- a. Candidates from the province of Sindh may appear in "Urdu Aasan" in SSC Part I and in "Sindhi" in Part II examination.
- b. Foreign students may opt HISTORY and GEOGRAPHY OF PAKISTAN in lieu of Urdu Compulsory, subject to the Board's approval.
- c. For non-Muslim candidates only.
- \* The above will be implemented in  
SSC Part I 2013 Examinations and onwards  
SSC Part II 2014 Examinations and onwards

<sup>3</sup> Government of Pakistan September 2007. *Scheme of Studies for SSC and HSSC (Classes IX-XII)*. Islamabad: Ministry of Education, Curriculum Wing.

### SSC Part-I (Class IX) Humanities Group

Subjects	Marks	Medium
English Compulsory-I	75	English
Urdu Compulsory-I <b>OR</b> Urdu Aasan <sup>a</sup> <b>OR</b> History and Geography of Pakistan-I <sup>b</sup>	75	Urdu Urdu English
Islamiyat-I <b>OR</b> Ethics-I <sup>c</sup>	*30	English / Urdu
Pakistan Studies-I	*45	English / Urdu
General Mathematics-I	75	English / Urdu
<b>Any three of the following Elective Subjects</b>	225 (75 each)	
1. Geography-I		English / Urdu
2. General Science-I		English / Urdu
3. Computer Science-I (65+10 practical)		English
4. Economics-I		English / Urdu
5. Civics-I		English / Urdu
6. History of Pakistan-I		English / Urdu
7. Elements of Home Economics-I		English / Urdu
8. Food and Nutrition-I (65+10 practical)		English / Urdu
9. Art & Model Drawing-I		English / Urdu
10. Business Studies-I		English / Urdu
11. Environmental Studies-I		English / Urdu
<b>Total:</b>	<b>*525</b>	

### SSC Part-II (Class X) Humanities Group

Subjects	Marks	Medium
English Compulsory-II	75	English
Urdu Compulsory-II <b>OR</b> Sindhi <sup>a</sup> History and Geography of Pakistan-II <sup>b</sup> <b>OR</b>	75	Urdu Sindhi English
Islamiyat-II <b>OR</b> Ethics-II <sup>c</sup>	*45	English / Urdu
Pakistan Studies-II	*30	English / Urdu
General Mathematics-II	75	English / Urdu
<b>Any three of the following Elective Subjects</b>	225 (75 each)	
1. Geography-II		English / Urdu
2. General Science-II		English / Urdu
3. Computer Science-II (65+10 practical)		English
4. Economics-II		English / Urdu
5. Civics-II		English / Urdu
6. History of Pakistan-II		English / Urdu
7. Elements of Home Economics-II		English / Urdu
8. Food and Nutrition-II (65+10 practical)		English / Urdu
9. Art & Model Drawing-II		English / Urdu
10. Business Studies-II		English / Urdu
11. Environmental Studies-II		English / Urdu
<b>Total:</b>	<b>*525</b>	

### SSC Part-I and Part-II (Class IX-X) Humanities Group (Additional Subjects)

SSC Part I	SSC Part II	Marks	Medium
1. Literature in English-I <sup>d</sup>	1. Literature in English-II <sup>d</sup>	75 each	English
2. Commercial Geography-I <sup>d</sup>	2. Commercial Geography-II <sup>d</sup>		English / Urdu
3. Additional Mathematics-I <sup>d</sup>	3. Additional Mathematics-II <sup>d</sup>		English

- a. Candidates from the province of Sindh may appear in "Urdu Aasan" in SSC Part I and in "Sindhi" in Part II examination.
- b. Foreign students may opt HISTORY and GEOGRAPHY OF PAKISTAN in lieu of Urdu Compulsory, subject to the Board's approval.
- c. For non-Muslim candidates only.
- d. Subject will be offered as Additional Subject.
- \* The above will be implemented in  
SSC Part I 2013 Examinations and onwards  
SSC Part II 2014 Examinations and onwards

## List of Practical Activities

## Class IX

S. No.	SLO No.	Objective	Equipment	Chemical
<b>Topic 1: Fundamentals of Chemistry</b>				
1	1.2.7	Separate the mixture of iron fillings, sand and alum by physical method.	China dish, funnel, magnet, watch glass, filter paper, funnel stand, Bunsen burner or spirit lamp, glass rod, beaker, match box, tripod stand,	Fe (iron filings), alum, sand, water
<b>Topic 5: States of Matter</b>				
2	5.4.1	Determine 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
3	5.5.1	Determine the melting point of wax / naphthalene.	Beaker, iron stand, clamp, glass rod thermometer, capillary tube, tripod stand, wire gauze, match box, Bunsen burner or spirit lamp, thread	Sample of wax / naphthalene and water
4	5.5.1	Demonstrate sublimation using solid ammonium chloride.	Test tube, cotton, test tube holder, match box, Bunsen burner or spirit lamp	Ammonium chloride
<b>Topic 6: Solutions</b>				
5	6.4.2	Prepare 250 cm <sup>3</sup> / 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 <sup>3</sup> / 1 litre)	Oxalic acid, distilled water
6	6.4.5	Prepare 100cm <sup>3</sup> of 0.01M Na <sub>2</sub> CO <sub>3</sub> solution from the given 0.1M solution.	Beaker, volumetric flask, stirrer, graduated cylinder or pipette	Distilled water, 0.1M Na <sub>2</sub> CO <sub>3</sub> solution

S. No.	SLO No.	Objective	Equipment	Chemical
7	6.6.2	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
8	6.6.2	Prepare crystals of potash alum.	Beakers, funnel, filter paper, stirrer evaporating dish, Bunsen burner, tripod stand, wire gauze, match box, wash bottle, digital balance, measuring cylinder	Potassium sulphate, aluminium sulphate, concentrated sulphuric acid and water
<b>Topic 7: Electrochemistry</b>				
9	7.4.6	Demonstrate the conductivity of different solutions.	Beakers, wires, battery, electrodes, bulb crocodile clips, bulb holder, stirrer	Distilled water, sugar, NaCl, vinegar, HCl, NaOH, CuSO <sub>4</sub> solution
10	7.4.7	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
<b>Topic 8: Chemical Reactivity</b>				
11	8.1.1	Demonstrate that two elements combine to form a binary compound.	Test tube, test tube holder, Bunsen burner	Iron and sulphur
12	8.2.4	Demonstrate that compounds can be the products of a decomposition reaction.	Test tubes, mortar pestle, safety goggles, match box, Bunsen burner, test tubes holder, test tubes, one holed stopper with glass tube and rubber tubing or bent tube	Calcium carbonate, lime water (solution of calcium hydroxide)

**Class X**

S. No.	SLO No.	Objective	Equipment	Chemical
<b>Topic 10: Acids, Bases and Salts</b>				
1	10.5.2	Determine the pH of different solutions by the help of pH paper.	Beakers, pH paper, pH scale, watch glass, stirrer	Baking soda, HCl, soap solution, curd, garden soil, table salt, caustic soda, vinegar, lemon juice, etc.
2	10.6.1	Standardize the given solution of sodium hydroxide volumetrically.	Burette, iron stand, funnel, clamp, pipette, beakers, conical flasks, dropper	Sodium hydroxide solution, standard solution of hydrochloric acid, phenolphthalein
3	10.6.1	Determine the exact molarity of a solution of oxalic acid volumetrically.	Burette, iron stand, funnel, clamp, pipette, beakers, conical flasks, dropper	Standard solution of NaOH, oxalic acid solution, phenolphthalein
4	10.7.2	Identify sodium, calcium, strontium, barium, copper, potassium radicals by flame test.	Platinum wire / glass rod, match box, watch glass, Bunsen burner	Salt each of sodium, strontium, potassium, barium, copper, calcium, concentrated HCl
5	10.7.2	Identify $\text{Cl}^-$ , $\text{Br}^-$ , $\text{I}^-$ ions using $\text{AgNO}_3$ solution.	Test tube, test tube stand, stirrer	$\text{NaI}$ , $\text{NaBr}$ , $\text{NaCl}$ and $\text{AgNO}_3$ , $\text{H}_2\text{SO}_4$ , $\text{MnO}_2$ and $\text{NH}_4\text{OH}$
<b>Topic 11: Organic Chemistry</b>				
6	11.1.2	Measure the pH values of weak organic acids in given sample using pH paper.	Beakers, pH paper, pH scale	Apple juice, lemon juice, vinegar, orange juice, grape fruit juice, oxalic acid, etc.
7	11.5.4	Identify aldehydes using Fehling's and Tollen's test.	Test tubes, test tube holder, test tube stand, Bunsen burner, match box, water bath, dropper	Formaldehyde, Tollen's reagent, Fehling's solution, glucose solution
8	11.5.4	Identify carboxylic acids using sodium carbonate test (C.T lime water test for evolution of $\text{CO}_2$ ).	Test tubes, test tube holder, test tube stand, delivery tube, dropper	Lime water, carboxylic acid, solid sodium carbonate, distilled water
9	11.5.4	Identify phenol using ferric chloride test.	Test tubes, test tube holder, test tube stand, dropper	Phenol solution, freshly prepared ferric chloride solution, distilled water

S. No.	SLO No.	Objective	Equipment	Chemical
<b>Topic 12: Hydrocarbons</b>				
10	12.1.3	Identify saturated and unsaturated organic compounds by $\text{KMnO}_4$ test.	Test tubes, test tube holder, test tube stand, dropper	Cinnamic acid solution, Ghee, vegetable oil, $\text{KMnO}_4$ solution
<b>Topic 13: Biochemistry</b>				
11	13.1.1	Demonstrate that sugar decomposes into elements or other compounds.	China dish or beaker, Bunsen burner, tripod stand, wire gauze, match box, spatula, watch glass, safety goggles.	Sugar
<b>Topic 15: Environmental Chemistry II: Water</b>				
12	15.3.2	Demonstrate the softening of permanent and temporary hard water.	Beaker, test tubes, china dish, funnel, iron stand, filter paper, Bunsen burner	Water sample (beakers containing two types of hard water), lime water, small soap bar, sodium carbonate solution, sodium zeolite