



آغا خان یونیورسٹی ایگزامینیشن بورڈ

AGA KHAN UNIVERSITY EXAMINATION BOARD

**Secondary School Certificate
Examination Syllabus**

**GENERAL SCIENCE
CLASSES IX-X**

(based on National Curriculum 2002)

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**Secondary School Certificate
Examination Syllabus**

**GENERAL SCIENCE
CLASSES IX-X**

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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 to take effect in 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 new National Curriculum 2006.

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 (2002)¹

1.1 General Objectives

General objectives for the General Science Curriculum given in the National Curriculum document (2002) are as follows:

- 1.1.1 “To acquaint the students with activities of scientists with a view to elaborate the scientific attitude.
- 1.1.2 To help the students to understand how scientific knowledge is applied in solving problems in making intelligent decisions in day to day life.
- 1.1.3 To develop in the students an objective scientific attitude toward problems falling in the domain of science.
- 1.1.4 To inculcate in the students the habits of scientific observation, logical thinking and drawing correct conclusion about various facts related to our physical environment.
- 1.1.5 To develop an understanding of fundamental principles, laws and theories in science and processes involved in discovering them.
- 1.1.6 To help the students through scientific knowledge to redress their belief in superstition and wrong notions about natural phenomenon.
- 1.1.7 To develop in the students an attitude of preserving useful things in their environment and to help them to understand the dangers of unwise use of resources.
- 1.1.8 To develop in the students an attitude that the nation needs their best talents to meet the challenges facing the nation and to develop in the students the desire to continue the study of scientific literature and to keep themselves abreast of modern developments in Science and Technology.” (p.1)

1.2 Specific Objectives

1.2.1 Specific Objectives for the General Science Curriculum given in the National Curriculum document (2002) are as follows:

“A. Knowledge and Understanding:

After completing the study of General Science curriculum, the student will be able to know:

1. Importance of science and its development with special reference to Islam and the contribution made by Muslim scientists.
2. Why science was divided into different branches and the relationship between them.
3. Impact of science and technology on the development of mankind.
4. Causes of different common diseases and their preventive measures.
5. Balanced diet and the role of vitamins and enzymes for healthy growth of human body.
6. Importance of exercise to keep the body healthy.

¹ Government of Pakistan (2002), *National Curriculum; General Science Classes IX-X, Islamabad*, Ministry of Education (Curriculum Wing)

7. Problems associated with different phases of life.
8. Importance of wildlife and its conservation.
9. The use of nuclear radiations in the improvement of different crops and fruits, agriculture, medicines, industries and radiation hazards.
10. Different sources of energy, development of new energy sources, conservation of energy and its effect on environment.
11. Basic electronics, starting from simple topics of electricity to computers and information technology.
12. The working of simple modern technology, their basic principles and the applications of medical diagnostics.
13. Some important industries in Pakistan and their basic requirements.
14. Natural resources of Pakistan and their methods of extraction. The proper use of these natural resources and the effect of increased population growth rate on the consumption of these resources.

B. Process skills:

Almost all the processes of general science will be appreciated by the students through different demonstration/activities and the visits to different industrial units, health centers and agriculture processing units.

C. Attitude:

After completing the curriculum the students will be able to develop more scientific attitude towards science.”

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 according to which the total marks for the SSC examination have been increased from 850 to 1100 from the year 2008 and onwards. 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, but not necessarily the same content, to elicit evidence of these competencies in candidates' responses. The definitions of command words used in this syllabus are given in Section 8. 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 and 5.
- 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. These additional topics have been italicized in Section 3 of this syllabus.

2.2 Specific Rationale of the AKU-EB General Science Examination Syllabus

- 2.2.1 Secondary education is a crucial stage for young learners as problems of adjustment to new roles in life assume critical significance. It is also a doorway to higher education. This is the stage when students need to have opportunities to develop rational thinking and scientific attitudes.
- 2.2.2 The AKU-EB syllabus of General Science concentrates on broadening students' conceptual understanding of the scientific method through opportunities for inquiry and activities to enhance their observational and analytical skills.
- 2.2.3 The syllabus of General Science has been divided into part I and part II for class IX and class X respectively. Some topics are rearranged in part I and part II so that there is a balance in content of different branches of the sciences in both parts.

3. Topics and Student Learning Outcomes of the Examination Syllabus

Part I (Class IX)

Topic	Student Learning Outcomes		Cognitive Level ²		
			K	U	A
1. Introduction and Role of Science	Candidates should be able to:				
1.1 Introduction to History of Science and Islamic Injunctions for the Pursuit of Knowledge with Special Reference to the Contribution by Muslim/ <i>Non-Muslim</i> and Pakistani Scientists in the Field of Science.	1.1.1	describe science;		*	
	1.1.2	describe the concept of science in Islam;		*	
	1.1.3	describe the scientific methodology;		*	
	1.1.4	describe the role of Muslim scientists in the early development of science and describe their discoveries and inventions (specially Jabar Bin Hayyan, Muhammad Bin Zikrya Razi, Ibn-ul-Haitham, Al-Bairruni, Bu-Ali Sina);		*	
	1.1.5	describe the role of Pakistani scientist in the field of science (Dr. Abdus Samar Mubarik Mand, Dr. Munir Ahmad, Dr. Ishfaq, Dr. Atta-ur-Rehman);		*	
	1.1.6	describe the contribution of non-Muslim scientists in development of science (Galileo, Newton, Lavoisier, Farady Maxwell, Edison, Marconi, Einstein and Schroedinger);		*	
1.2 Branches of Science and their Interrelationship	1.2.1	describe various branches of Science and their scope (Physics, Chemistry, Biology, Mathematics, Agriculture, Medicine, Astronomy, Geography);		*	
	1.2.2	explain the relationship between various branches of science;		*	

² K = Knowledge, U = Understanding, A= Application (for explanation see Section 8: Definition of command words used in Specific Learning Objectives and in Examination Questions).

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			K	U	A	
1.3	Role of Science and Technology and its Impact for Bringing Improvement in the Quality of Life.	1.3.1 1.3.2 1.3.3	explain the role of technology in the present world; analyse different technologies used in the fields of agriculture, medicine, pharmaceuticals and engineering; describe the application of different technologies in daily life (Agriculture, Medicine and Engineering);		*	*
1.4	Limitations	1.4.1 1.4.2	analyse the limitations of science and the kind of problems which scientists are still unable to solve; describe the scope of scientific development in future with special reference to the limitations of present science.		*	*
2. Our Life and Chemistry		Candidates should be able to:				
2.1	Basic Elements for Life (C, H ₂ , O ₂) (Photosynthesis and Respiration)	2.1.1 2.1.2	describe the occurrence, and importance of the basic building elements necessary for life (C, H ₂ and O ₂) and give examples from daily life; explain the importance of oxygen in the life processes (photosynthesis and respiration);		*	*
2.2	Carbon and Allotropic Forms of Carbon	2.2.1 2.2.2 2.2.3 2.2.4 2.2.5	define allotropy,; describe allotropic forms of carbon; identify their application in daily life; list the carbon compounds and abundance of carbon compounds in nature with examples; analyse the role of carbon in nature;	*	*	*
2.3	Water as Universal Solvent, Density of Water and Ice	2.3.1 2.3.2 2.3.3 2.3.4	describe the physical properties of water; explain water as a universal solvent; describe the consumption of water and uses of water on earth; describe sources of fresh water on earth and suggest ways to conserve it;		*	*

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			K	U	A
	2.3.5	describe the anomalous expansion of water and its effect on aquatic life;		*	
2.4 Major Constituent of Air	2.4.1	identify the percentage composition of air;	*		
	2.4.2	describe the properties and uses of the commonly found gases (oxygen, carbon dioxide, nitrogen and rare gases.);		*	
	2.4.3	describe the role of N ₂ , O ₂ , CO ₂ in nature;		*	
2.5 Other Elements Important for Life (Na, Ca, Mg, K, P, F, Cl, I, Fe)	2.5.1	identify important elements (Na, Ca, Mg, K, P, F, Cl, I, Fe) necessary for life;	*		
	2.5.2	describe their functions and applications in daily life (human body, agriculture and industry);		*	
	2.5.3	describe food resources that contain these elements.		*	
3. Biochemistry and Biotechnology	Candidates should be able to:				
3.1 Metabolism in Human Body (Carbohydrates, Fats and Proteins)	3.1.1	define the term metabolism;	*		
	3.1.2	describe its role in human body;		*	
	3.1.3	explain the need for food in living organisms;		*	
	3.1.4	state the constituents of carbohydrates, fats and proteins;	*		
3.2 <i>Human Digestive System</i>	3.2.1	identify the main regions of human gut and its associated organs;	*		
	3.2.2	describe the main functions of human gut and its associated organs;		*	
	3.2.3	describe ingestion, digestion, absorption, assimilation and excretion;		*	
	3.2.4	describe preventive measures for different disorders of the gut (diarrhea, dysentery, constipation, appendicitis);		*	
3.3 Blood and its Functions	3.3.1	identify different types of blood cells in human body (RBC, WBC and platelets);	*		
	3.3.2	describe structure and functions of each of the components of blood;		*	
	3.3.3	describe blood groups in human body and identify their importance for life;		*	

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			K	U	A	
3.4	DNA-Hereditary Material	3.4.1 3.4.2 3.4.3	define chromosome, chromatid and genes; explain that chromosome contains a long molecule of DNA which can be copied and passed on to the next generation; describe that DNA sequencing for each individual is different and unique;	*	*	
3.5	Genetic Engineering	3.5.1 3.5.2	define genetic engineering; describe its application in daily life with examples (agriculture and livestock);	*	*	
3.6	Biotechnology and Agriculture	3.6.1 3.6.2 3.6.3	explain that biotechnology is enhancing the agricultural yield in Pakistan (fertilizers, insecticide and pesticide); describe different types of fertilizers and their importance for the production of crops; discuss the effect of excessive use of insecticides and pesticides on plants, animals and human beings;		*	
3.7	Antibiotics and Vaccines	3.7.1 3.7.2 3.7.3	define antibiotics and vaccines; describe the history of discovery of antibodies and vaccines; describe the role of antibiotics and vaccines for human body;	*	*	
3.8	Recycling of Waste Material	3.8.1 3.8.2	describe the concept of waste material and recycling; discuss the importance of recycling.		*	
4.	Energy	Candidates should be able to:				
4.1	Introduction of Energy and its Forms	4.1.1 4.1.2 4.1.3	define the term energy; compare different forms of energy with examples; explain with examples the conversion of energy from one form to another;	*	*	

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				K	U	A
4.2	Energy Demands and Different Methods of Acquiring Energy	4.2.1	analyse the increasing demands for energy in industry, agriculture, households;			*
		4.2.2	describe methods of producing energy, electrical, thermal, solar, nuclear, hydroelectrical;		*	
		4.2.3	describe ways to meet the increasing demand of energy in everyday life and national development;		*	
4.3	Development of New Energy Resources	4.3.1	explain conventional and non-conventional energy sources;		*	
		4.3.2	explain renewable and non-renewable sources e.g. solar, wind, tidal, geo-thermal, biomass conversion from solid waste, alternative fuels for energy;		*	
		4.3.3	describe the importance of development of new energy sources;		*	
4.4	Measurement of Different Forms of Energy by Simple Methods. Simple Conventional Units. Simple Construction and Working of Electrical and Gas Metres	4.4.1	describe the methods and units (Watt and Calorie) of measurement of different forms of energy;		*	
		4.4.2	explain construction and working of electrical metre, gas metres, analog and digital metres;		*	
4.5	Energy and the Environment, Especially with Respect to Thermal Pollution and Nuclear Fuel Hazards. Steps to Minimize them	4.5.1	analyse the use of energy and its impact on environment;			*
		4.5.2	describe nuclear fuel hazards, thermal pollution and suggest ways to minimize environmental degradation;		*	

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			K	U	A	
4.6	Energy Conservation, Conservation of Energy at Home, Schools, Industries, etc.	4.6.1 4.6.2 4.6.3	state the law of conservation of energy; relate the law of conservation of energy to the dissemination of energy; suggest ways to conserve energy in homes, schools, industries, transportation, etc., with real life examples.	*	*	*
5. Current Electricity		Candidates should be able to:				
5.1	Introduction and Description of Various Concepts relating to Current Electricity	5.1.1	define the terms: electric current, voltage, resistance, and Ohm's law;	*		
5.2	Components of Circuits, their Working and Use in Electrical Circuits	5.2.1 5.2.2 5.2.3	identify the basic components of an electrical circuit; describe the uses and working of various components of electrical circuit, switches resistors, capacitors and transformers; construct series and parallel circuits;	*	*	*
5.3	Direct and Alternating Current, Introducing their Advantages and Disadvantages	5.3.1 5.3.2	differentiate between AC and DC with examples from everyday life; identify their advantages and disadvantages;	*	*	
5.4	Process of Electric Supply for Domestic Purposes along with its Measures	5.4.1 5.4.2	describe the process of electric supply for domestic purpose along with its measurement; describe the use and importance of circuit, fuse, etc., at home with examples;		*	*

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			K	U	A
5.5 Dangers of Electricity and Precautions against them	5.5.1	identify the various hazards (electric shock, burns, fire, explosion) of electricity;	*		
	5.5.2	suggest the safety precautions for the hazards mentioned above and first aid administration in these cases;			*
5.6 Introduction to Ammeter, Voltmeter, Multimeter, Analog and Digital Meter and their Uses.	5.6.1	explain the construction and uses of ammeter, voltmeter, multimeter, analog and digital meter.		*	

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Part II (Class X)

			K	U	A
6. Human Health		Candidates should be able to:			
6.1 Major Components of Food	6.1.1	list major components of food for a balanced diet and their sources;	*		
	6.1.2	explain their functions in human body (carbohydrates, proteins, fats, vitamins, minerals);		*	
6.2 Food and Energy (Energy Requirement According to Age, Sex and Body Size, Climate and Working Conditions)	6.2.1	define calorie as on energy value	*		
	6.2.2	compare the calorie requirement for different (a) ages (b) sexes (c) activities of an individual;		*	
	6.2.3	explain that energy intake should be related to age, sex and activity of an individual;		*	
	6.2.4	state the effect of malnutrition in relation to constipation, obesity and heart diseases;	*		
	6.2.5	construct caloric value charts of typical local foods and use of energy by the body;			*
6.3 Balance Diet (Babies, Young, Old, Pregnant, Feeding Mother)	6.3.1	define the balanced diet;	*		
	6.3.2	construct a balanced diet chart for babies, young, old, pregnant, feeding mothers (especially a young student aged 13+ years);			*
6.4 <i>Hormone System</i>	6.4.1	differentiate endocrine and exocrine glands in human body;		*	
	6.4.2	explain their functions;		*	
	6.4.3	relate hormonal disorders to various abnormalities;		*	
6.5 Developmental Stages	6.5.1	state various stages of development in human life (physical and cognitive);	*		
	6.5.2	relate the developmental stages of a child and significant features of behaviour at each stage;		*	

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			K	U	A
	6.5.3	explain the sensitivity of adolescence and puberty and ways to understand own behaviour and emotion with respect to the developmental stages;		*	
	6.5.4	identify various features related to the process of aging;	*		
6.6 Healthy Life	6.6.1	analyse the role of exercise for a healthy life;			*
	6.6.2	identify various activities that could change a sedentary life style;	*		
	6.6.3	describe different activities for fitness and healthy living including the offering of prayer;		*	
6.7 First Aid	6.7.1	identify the importance of first aid and its administration in daily life;	*		
	6.7.2	describe different kinds of first aids used for common accidents/emergencies (specially for dog bite, snake bite, heart attack, artificial respiration, etc.).		*	
7. Human Immune Mechanism and Diseases (Diseases and Prevention)	Candidates should be able to:				
7.1 Immunity	7.1.1	describe the immune mechanism of humans with respect to: (a) white blood cells (b) antibodies;		*	
	7.1.2	explain that vaccination creates immunity in living bodies;		*	
7.2 Diseases Caused by Germs	7.2.1	identify the causes, symptoms and preventive measures for the following diseases: (a) viral: (small pox, polio, measles, influenza, HIV/AIDS, hepatitis), (b) bacterial: (tuberculosis, whooping cough, diphtheria, tetanus, typhoid, cholera), (c) fungal: (ringworm or 'dad'), (d) protozoan: (malaria, ascariases and threadworm infection);	*		

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			K	U	A	
7.3	Spreading of Germs	7.3.1	identify sources that spread germs (air, touch, faeces, louse, animals, cuts and scratches, etc.);	*		
7.4	Protection from Germs and Diseases	7.4.1	explain preventive measures through which spread of germs can be controlled e.g. (i) sterilization, (ii) extermination, (iii) vaccination, (iv) isolation, (v) cleanliness, (vii) sewage disposal, (viii) immunization;		*	
7.5	Diseases Caused by Unhealthy Habits	7.5.1	identify various factors that cause certain diseases in humans (a) smoking, (b) use of drugs, (c) lack of exercise, (d) poor diet;	*		
		7.5.2	explain causes, symptoms and preventive measures to control the following diseases: (a) heart disease, (b) blood pressure, (c) cancer, (d) nervous breakdown, (e) respiratory diseases;		*	
7.6	Drug Abuses	7.6.1	differentiate between drugs, medicines, narcotics, sedatives, hallucinogens and painkillers;		*	
		7.6.2	evaluate the increasing use of drugs in society and suggest ways to increase awareness of the hazards of: (a) drug addiction, (b) self medication;			*
		7.6.3	identify some harmful effects of smoking;	*		
		7.6.4	list some important drugs and narcotics and their abuses;	*		
8. Environmental and Natural Resources		Candidates should be able to:				
8.1	The Atmosphere, and its Different Layers (Green House Effect)	8.1.1	describe the composition of atmosphere and its different layers with examples;		*	
		8.1.2	describe greenhouse effect, ozone protection and ozone depletion and its importance;		*	

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	8.1.3	explain the relationship between human activity, climate and weather patterns;		*	
	8.1.4	describe the energy radiation and observation in the atmosphere;		*	
8.2	Different Kinds of Pollution and their Reduction	8.2.1	describe different kinds of pollution, its various causes and ways to reduce it;	*	
8.3	Effects of Pollution on Life on Earth	8.3.1	explain the impact of pollution on human life and on the earth;	*	
8.4	Minerals and Fossil Fuels	8.4.1	identify the different kinds of minerals and fossil fuels;	*	
		8.4.2	explain the extraction of coal, gas and petroleum and their main uses in daily life;	*	
		8.4.3	identify places in Pakistan from where we get mineral resources;	*	
		8.4.4	describe the occurrence and uses of chromites, gem stones, gypsum and mica;	*	
8.5	Need for Conservation of Natural Resources	8.5.1	compare the annual production of mineral resources in Pakistan with their consumption;	*	
		8.5.2	analyse the consequences of limited mineral resources and their uncontrolled use;		*
		8.5.3	suggest ways to conserve the use of mineral resources;		*
		8.5.4	describe alternative sources of energy and techniques for their use;	*	
8.6	Crops and Fruits of Pakistan: Production Trends in Principle Crops	8.6.1	describe the different crops and fruits of Pakistan;	*	
		8.6.2	explain the production trends in the rural economy of Pakistan;	*	
		8.6.3	analyse the ways and importance of mechanized agriculture with special reference to Pakistan;		*

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				K	U	A
8.7	Different Dairy and Poultry Products and Methods for their Improvement	8.7.1 8.7.2 8.7.3	describe the importance of dairy and poultry farming; analyse the quality of dairy and poultry products available in Pakistan and analyse their impact on human health (milk and milk products, meat and fish products); suggest ways to increase the quality of dairy and poultry products;		*	*
8.8	Importance of Wildlife, National Parks, Conservation of Wildlife and Endangered Species	8.8.1 8.8.2 8.8.3 8.8.4 8.8.5 8.8.6	describe wildlife of Pakistan (animals and plenty); explain the factors that have contributed to the extinction of different species from the Earth; explain the importance of wildlife and suggest ways to conserve species; analyse the role of deforestation in environmental degradation and discuss its importance to life; analyse the factors contributing to environmental degradation in Pakistan; identify resources in marine life;	*	*	*
8.9	Effects of Growing Population on the Environment, Poverty and the Quality of Life	8.9.1 8.9.2	analyse the effects of growing population on the ecological balance, poverty, quality of life, destruction of land, urbanization, deforestation, migration, etc.; suggest ways to: (a) Control growth rate of population, (b) Reduce migration towards the urban areas, (c) Increase the civic amenities.			*
9. Basic Electronics		Candidates should be able to:				
9.1	Semiconductor Diode and their Basic Uses	9.1.1	describe the basic working principle and uses of semiconductor diode;		*	
9.2	Radio, Television, Cable and Satellite	9.2.1	explain the terms: radio waves, radio, television, cable and satellite television;		*	

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			K	U	A
	9.2.2	describe the working of radio and television with simple examples;		*	
9.3 Computers, Microprocessors, their Importance and Uses in Different Fields	9.3.1	describe briefly the development of computers from Babbage's calculating machine to the modern chip through valves and diodes;		*	
	9.3.2	analyse their importance and uses in different fields;			*
9.4 Information Technology and Some Communication System	9.4.1	define the term information technology with examples;	*		
	9.4.2	describe some communication systems.		*	
10. Science and Technology	Candidates should be able to:				
10.1 Advancement of Science and Technology for the Development of a Country	10.1.1	describe the advancement of science and technology for the development of a country;		*	
10.2 Functions and Uses of Lasers Optical Fiber System, Satellites and Radar	10.2.1	describe the principle and construction of lasers, optical fiber system, satellites and radar;		*	
	10.2.2	analyse the functions and application of lasers, optical fibers, satellites and radars in different fields with examples;			*
10.3 Radioactivity and its Uses in Health and Agriculture	10.3.1	explain radioactivity and its properties;		*	
	10.3.2	describe the uses of radiations emitted by radioactive substances and radioisotopes in various fields (health, agriculture, etc.);		*	

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			K	U	A
10.4 Modern Methods of Medical Diagnostics (Ultrasound, X-rays, ECG, EEG, MRI, CT-Scan and Angiography)	10.4.1	describe the use of Ultrasound, X-rays, ECG, EEG, MRI, CT-Scan, Angiography;		*	
10.5 Important Industries of Pakistan and their Impact	10.5.1 10.5.2 10.5.3	identify the important industries of Pakistan such as the production of refined sugar, steel, pharmaceuticals, synthetic fibers, textiles, leather, etc.; explain the uses of technology in these industries; analyse their impact on the economic and social progress of Pakistan.	*	*	*
11. Space and Pakistan's Nuclear Programme	Candidates should be able to:				
11.1 Space Exploration and its Benefits to Science and Technology	11.1.1 11.1.2	identify the role of space science in human progress (landing on moon); explain the principle and working mechanism of geostatic satellites and relate this with their role in daily life (communication and weather satellites, rockets and space shuttles);	*	*	
11.2 Pakistan's Space Programme (SUPARCO)	11.2.1	describe Pakistan's space programme (SUPARCO);		*	
11.3 Pakistan's Nuclear Programme	11.3.1 11.3.2 11.3.3	describe the salient features of Pakistan's nuclear programme and discuss its implications for the future of the country; describe nuclear energy usage in the world and its impact on life on Earth; describe the use of atomic energy for peace purposes.		*	*

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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.	Introduction and Role of Science	4	0	11	2	13
2.	Our Life and Chemistry	5	5	12	1	18
3.	Biochemistry and Biotechnology	8	7	17	0	23
4.	Energy	6	2	11	3	16
5.	Current Electricity	6	4	5	2	11
	Total	29	18	56	8	81
	Percentage		22	69	9	

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.	Introduction and Role of Science	4	4	0	5	9
2.	Our Life and Chemistry	5	6	4	5	15
3.	Biochemistry and Biotechnology	8	8	8	5	21
4.	Energy	6	6	9	0	15
5.	Current Electricity	6	6	9	0	15
	Total:	29	30	30	15	75

Table 3: Paper specifications

Topic No.	Topics	Marks Distribution			Total Marks
1.	Introduction and Role of Science	MCQ 4 @ 1 Mark *ERQ 1 @ 5 Marks Choose any ONE from two			09
2.	Our Life and Chemistry	MCQ 6 @ 1 Mark CRQ 1 @ 4 Marks ERQ 1 @ 5 Marks Choose any ONE from two			15
3.	Biochemistry and Biotechnology	MCQ 8 @ 1 Mark CRQ 1 @ 8 Marks ERQ 1 @ 5 Marks Choose any ONE from two			21
4.	Energy	MCQ 6 @ 1 Mark CRQ 1 @ 9 Marks			15
5.	Current Electricity	MCQ 6 @ 1 Mark CRQ 1 @ 9 Marks			15
	Total	MCQs 30	CRQs 30	ERQs 15	75

* 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	
6.	Human Health	7	8	10	3	21
7.	Human Immune Mechanism and Diseases (Diseases and prevention)	6	5	4	1	10
8.	Environmental and Natural Resources	9	3	16	9	28
9.	Basic Electronics	4	1	5	1	7
10.	Science and Technology	5	1	6	2	9
11.	Space and Pakistan's Nuclear and space Program	3	1	5	0	6
	Total	34	19	46	16	81
	Percentage		23	57	20	

**Table 5: Allocation of Marks for the Objective Test,
Constructed Response Paper and Extended Response Question**

Topic No.	Topics	No. of Sub-Topics	Marks			Total
			Multiple Choice Questions	Constructed Response Questions	Extended Response Questions	
6.	Human Health	7	6	7	0	13
7.	Human Immune Mechanism and Diseases (Diseases and prevention)	6	5	3	5	13
8.	Environmental and Natural Resources	9	8	5	5	18
9.	Basic Electronics	4	3	5	0	8
10.	Science and Technology	5	4	6	5	15
11.	Space and Pakistan's Nuclear and space Program	3	4	4	0	8
	Total:	34	30	30	15	75

Table 6: Paper specification

Topic No.	Topics	Marks Distribution			Total Marks
6.	Human Health	MCQ 6 @ 1 Mark CRQ 1 @ 7 Marks			13
7.	Human Immune Mechanism and Diseases (Diseases and prevention)	MCQ 5 @ 1 Mark CRQ 1 @ 3 Marks *ERQ 1 @ 5 Marks Choose any ONE from two			13
8.	Environmental and Natural Resources	MCQ 8 @ 1 Mark CRQ 1 @ 5 Marks ERQ 1 @ 5 Marks Choose any ONE from two			18
9.	Basic Electronics	MCQ 3 @ 1 Mark CRQ 1 @ 5 Marks			08
10.	Science and Technology	MCQ 4 @ 1 Mark CRQ 1 @ 6 Marks ERQ 1 @ 5 Marks Choose any ONE from two			15
11.	Space and Pakistan's Nuclear and space Program	MCQ 4 @ 1 Mark CRQ 1 @ 4 Marks			08
	Total	MCQs 30	CRQs 30	ERQs 15	75

* 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 (69% and 46%), Application and higher order skills (9% and 20%) 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 administered within 3 hours.
- 4.4 Paper I theory will consist of 30 compulsory, multiple choice items. These questions will involve four response options.
- 4.5 Paper II theory will carry 45 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 All constructed response questions will be in a booklet which will also serve as an answer script.

5. Teaching-Learning Approaches and Suggested Classroom Activities

Cooperative learning

Demonstration

DART method (Directed Activities Related to Text)

Hands-on minds-on activities (structured, guided & inquiry) Individual work

Pair work (think-pair-share)

Group work (discussion, hands-on minds-on activities) Field visits (factory, hospitals, etc.)

Interviews of doctors

Lecture by guest

speakers Quiz

competition

Charts and model making.

A more detailed activities and teaching strategies from the National Curriculum, General Science Classes IX and X (2002) are attached as Annex B.

6. Recommended Texts and Reference Materials

Recommended Book

1. *General Science for Classes IX and X*. Lahore: Punjab Textbook Board.

Reference Books

1. Ababio, Osei Yaw. *New School Chemistry Certificate Science Series*. FEP International Publishers.
2. Punjab Textbook Board (2003). *Chemistry for Classes IX and X*. Lahore: Punjab Textbook Board, Lahore.
3. Punjab Textbook Board (2004). *Biology for Classes IX and X*. Lahore: Punjab Textbook Board.
4. Sindh Textbook Board (2004). *Biology for Classes IX and X*. Jamshoro: Sindh Textbook Board.
5. Balochistan Textbook Board (2004). *Biology for Classes IX and X*. Quetta: Balochistan Textbook Board.
6. Sethi, Huma Naz. (2003). *The Environment of Pakistan (2nd Ed)*. Malaysia: Peak Publishing.

Additional Reference Books

1. Mian, Salma. *Exploring Biology: A Textbook for Classes IX and X*, Karachi: Oxford University Press.
2. Sindh Textbook Board (2000). *Biology for Classes IX and X*. Jamshoro: Sindh Textbook Boards (Urdu Version).
3. IUCN Pakistan (2000). *Amozish-e-Mahowl: A Manual for Environmental Education*. Karachi: Education Unit IUCN Pakistan.
4. IUCN Pakistan. *Green Club*. Karachi: Education Unit IUCN Pakistan.
5. IUCN Pakistan. *Aao Mahowl say Seekhan, A Guide for Environmental Education*. Karachi: Education Unit IUCN Pakistan.

7. Definition of Cognitive Levels and Command Words in the Student Learning Outcomes and in Examination Papers

7.1 Definition of Cognitive Levels (Knowledge, Understanding and Application)

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, describe, 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, corroborate, compare and contrast, 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:** Describe with specific examples of how a given term or concept is applied in daily life.
- List:** Requires a number of points, generally each of one word, with no elaboration. Where a given number of points is specified, this should not be exceeded.
- State:** Implies a concise answer with little or no supporting argument, e.g. a numerical answer that can be obtained by inspection.

Understanding

- Compare:** List the main characteristics of two entities clearly identifying similarities (and differences).
- Construct:** To bring together given elements in a connected or coherent whole.

Describe	To state in words (using diagrams where appropriate) the main points of the topic. It is often used with reference either to a particular phenomena or experiments. In the former instance, the term usually implies that the answer should include reference to (visual) observations associated with the phenomena.
Differentiate:	Identify those characteristics which always or sometimes differentiate between two categories.
Discuss:	To give a critical account of the points involved in the topic.
Evaluate:	To judge or assess the worth or logic to determine the unique conclusion.
Explain:	May imply reasoning or some reference to theory, depending on the context.
Relate:	Describe how things depend upon, follow from or are part of another.

Application

Analyse:	Describe with the use of graphs how information on two or more variables has impact on other variable/variables.
Suggest:	Mentioned possible ways of contributing to the national development effort or provide examples from daily life.

* Teachers would also find it useful to refer to “Assessment Objectives” given in the National Curriculum, General Science, Classes IX and X (2002) and attached with this syllabus as annex C.

SSC Scheme of Studies³

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 ^a OR History and Geography of Pakistan-I ^b	75	-	75	Urdu Urdu English
Islamiyat-I OR Ethics-I ^c	*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
Total:	*495	30	*525	

SSC Part-II (Class X) Science Group

Subjects	Marks			Medium
	Theory	Practical	Total	
English Compulsory-II	75	-	75	English
Urdu Compulsory-II OR Sindhi ^a OR History and Geography of Pakistan-II ^b	75	-	75	Urdu Sindhi English
Islamiyat-II OR Ethics-II ^c	*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
Total:	*495	30	*525	

- 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

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

SSC Part-II (Class X) Humanities Group

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

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 ^d	1. Literature in English-II ^d	75 each	English
2. Commercial Geography-I ^d	2. Commercial Geography-II ^d		English / Urdu
3. Additional Mathematics-I ^d	3. Additional Mathematics-II ^d		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 ACTIVITIES/DEMONSTRATIONS FOR CLASSES IX-X

1. Discussion about brief history of science and contribution of scientists in the development of Science to be made with the help of charts.
2. Study impact of Science and Technology on the development of mankind with the help of charts.
3. Describe different allotropic forms of carbon e.g. coal, graphite, diamond and some simple organic molecules with the help of models and samples.
4. Demonstrate the solvent properties of water by heating water in a flask fitted with a water filled burette through delivery tube.
5. Experiments depicting different properties of air, e.g. to estimate the proportion of oxygen in air by volume.
6. Make a chart depicting the importance of the elements in our body.
7. Describe the structure of DNA with the help of double helix DNA model (beads)
8. Study of some common plant diseases through field tours.
9. Enlist some waste materials, which can be recycled.
10. Demonstrate tests on potato, cooking oil, sugar, albumen to indicate starch, fat, glucose and protein.
11. With the help of food calorimeter measure the energy value of food (chart)
12. To discover the effect of exercise on your muscles.
13. Using smoke machine to show what goes inside the lungs when person smokes (model).
14. Using a blood pressure (B.P) apparatus how we measure the B.P. of a normal person.
15. Arrange a field trip to show greenhouse effect.
16. Demonstration of different types of pollution.
17. Ask the student to drop a brick/book from height and describe them how Potential Energy converts into Kinetic Energy.
18. Describe the increasing demands of energy in industry and agriculture.
19. Describe different sources of energy with the help of charts.\
20. Charts on photosynthesis and carbon reduction cycle.
21. Activity with the help of simple circuit, voltmeter and ammeter to prove Ohm's Law.
22. Show different electrical components e.g. resistor, switch, capacitors, etc., and discuss their functions.
23. Describe some dangers of electricity and their safety precautions.
24. Demonstrate the working and uses of some measuring instrument e.g. voltmeters, ammeter, etc.
25. Field visit to some latest industry.
26. Demonstration about computers and their comprehensive presentation.”

“LIST OF CHARTS/MODEL/APPARATUS REQUIRED FOR ACTIVITIES

1. Charts of Muslim and Non-Muslim Scientists.
2. Charts showing impact of Science on mankind.
3. Models of allotropic forms of carbon.
4. Charts showing importance of elements in our body.
5. Key block model to study the mode of action of enzymes.
6. DNA model.
7. Charts showing different sources of energy.
8. Flask
9. Burette
10. Delivery tube
11. Stand
12. Test tubes
13. Potato
14. Spirit lamp
15. Iodine solution
16. Benedict’s solution
17. Sugar
18. Albumen
19. NaOH (dil)
20. CuSo₄
21. Cooking Oil
22. Ethanol
23. Food Calorimeter
24. Thermometer, Tri pod Stand
25. Copper Coil, Stirrer, Electrical Coil, Heatproof Platform, Metallic Crucible
26. Conical flask
27. U-Shape glass tube
28. Glass tubes
29. Cork
30. Rubber tubing
31. Delivery tube, Cigarette, Cotton wool
32. B.P. Apparatus
33. Ammeter, Voltmeter, Multimeter, Analogue and Digital meter, Bulb, Battery.
34. Two standard resistance, connecting wires, rheostat, key.

Note: Most of the apparatus is available in Physics, Chemistry and Biology laboratories.”

“TEACHING STRATEGIES/APPROACHES

The curriculum aims to encourage skills of observation, curiosity, creativity, questioning application, etc. So the teaching methodology should be adopted in a way that it promotes the higher order skills. To achieve the purpose, the following steps in teaching learning process should be kept in view.

The teacher should plan their lesson keeping in view the objectives of the National Curriculum. The active involvement of students is the key for successful delivery of the curriculum so the purposeful learning groups for discussion and assignment should be organized.

The use of audio-visual aids should be organized properly. It should be the part and parcel of classroom activities.

The National Curriculum is activity oriented. It demands that the teachers should consider the curriculum and other reference materials keeping in view the following teaching strategies:

1. Investigative approach
2. Activity-oriented approach
3. Student-centered approach
4. Question/answer approach
5. Group discussions
6. Seminar
7. Role play
8. Speeches/Debates”

“ASSESSMENT OBJECTIVES

The assessment objective listed below reflect those parts of the aims, which will be assessed in the examination.

A. Knowledge with understanding

Students should be able to demonstrate knowledge and understanding in relation to:

1. Scientific phenomena, facts, laws, definitions, concepts, theories.
2. Scientific vocabulary, terminology, conventions.
3. Scientific and technological applications with their social, economic and environment implications.

The syllabus content defines the factual knowledge that candidates may be required to recall and explain. Question testing these objectives will often begin with one of the following words: define, state, describe, or explain.

B. Processing, applying and evaluating information

Students should be able to in words or by using written, symbolic, graphical and numerical forms of presentation:

1. Locate, select, organize and present information from a variety of sources;
2. Translate information from one form to another;
3. Present reasoned explanations for phenomena, pattern and relationships;
3. Evaluate information and hypotheses
4. Organize and present information, ideas, descriptions and arguments clearly and logically, using appropriate spelling, punctuation and grammar.

These assessment objectives can not be precisely specified in the syllabus content because questions testing such skills may be based on information, which is unfamiliar to the students. In answering such questions, students are required to use principles and concepts, which are within the syllabus and apply them in a logical, reasoned or deductive manner to a novel situation. Questions testing these objectives will often begin with one of the following words: predict, suggest, deduce, calculate or determine.”