آغا خان یونیورسٹی ایگزامینیشن بورڈ

AGA KHAN UNIVERSITY EXAMINATION BOARD

Secondary School Certificate
Examination Syllabus

General Science

Grade IX - X

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Secondary School Certificate Examination Syllabus

GENERAL SCIENCE

GRADES IX-X

This syllabus will be examined in both Annual and Re-sit Examination sessions from Annual Examinations 2023

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For queries and feedback

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Preface

Established in 2002 through the Pakistan government's ordinance, the Aga Khan University Examination Board (AKU-EB) is country's first private autonomous qualification awarding body for secondary (SSC) and higher secondary (HSSC) school certifications. Its vision is to be a model of excellence and innovation in education in Pakistan and the developing world.

AKU-EB achieves its vision by developing examination syllabi which inculcate conceptual thinking and higher order learning and are aligned with National/ trans-provincial curricula and international standards. AKU-EB revises its syllabi periodically to support the needs of students, teachers and examiners.

The aims of the syllabus review of SSC and HSSC are to:

- Ensure continued compatibility with the goals of the trans-provincial curricula of Pakistan.
- Review the content for inclusion of new knowledge and deletion of obsolete knowledge.
- Review the content for clarity and relevance as per the changing needs of students, teachers and examiners.
- Enhance and strengthen continuation and progression of content both within and across grades IX - XII (SCC and HSSC).
- Ensure the readiness of students for higher education.

During the syllabus review, the needs of all the stakeholders were identified through a needs-assessment survey. Students and teachers of AKU-EB affiliated schools from across Pakistan participated in the survey. Thereafter, a revision panel, which consisted of examiners, teachers of affiliated and non-affiliated schools, teacher trainers and university academicians, reviewed and revised the syllabus following a planned, meticulous and standardised syllabi review process.

The syllabus is organised into topics and subtopics. Each subtopic is further divided into achievable student learning outcomes (SLOs). The SLOs of the cognitive domain are each assigned a cognitive level on which they have to be achieved. These cognitive levels are 'knowledge', 'understanding' and 'application', the latter also including other higher order skills. This is followed by the Exam Specification which gives clear guidance about the weightage of each topic and how the syllabus will be assessed.

The development of the revised syllabus has been made possible by the creativity and relentless hard work of Curriculum and Examination Development unit and the constant support provided by all the other units of AKU-EB. We are particularly thankful to Dr Sohail Qureshi for his very useful feedback on revising the syllabus review process, to Dr Naveed Yousuf for his continued guidance and support throughout the syllabus revision process and to Raabia Hirani for leading the syllabi revision. We are also thankful to all the students and teachers who took part in the needs-assessment survey and to the principals of AKU-EB affiliated schools who made this endeavour possible by facilitating and encouraging their teachers to be a part of the survey and the syllabus revision panel.

With your support and collective hard work, AKU-EB has been able to take the necessary steps to ensure effective implementation of the best international and trans-provincial standards through this syllabus. We are confident that this syllabus will continue to provide the support that is needed by students to progress to the next level of education and we wish the very best to our students and teachers in implementing this syllabus.

Dr Shehzad Jeeva
Chief Executive Officer (CEO), Aga Khan University Examination Board
Associate Professor of Practice, Faculty of Arts and Sciences, Aga Khan University

Understanding of AKU-EB Syllabi

1. The AKU-EB syllabi guide the students, teachers, parents and other stakeholders regarding the topics that will be taught and examined in each grade (IX, X, XI and XII). In each syllabus document, the content progresses from simple to complex, thereby, facilitating a gradual, conceptual learning of the content.

2. The topics of the syllabi are divided into subtopics and **student learning outcomes (SLOs)**. The subtopics and the SLOs define the depth and the breadth at which each topic will be taught, learnt and examined. The syllabi also provide enabling SLOs where needed to scaffold student learning.

3. Each SLO starts with an achievable and assessable **command word** such as describe, relate, evaluate, etc. The purpose of the command words is to direct the attention of teachers and students to specific tasks that the students are expected to undertake in the course of their studies. The examination questions are framed using the same command words or their connotations to elicit evidence of these competencies in students' responses.

4. The topics of the syllabi are grouped into themes derived from the National/ trans-provincial curricula. The connection between various themes and topics is highlighted in the '**concept map**' provided at the beginning of each syllabus. This ensures that students begin to understand the interconnectedness of knowledge, learn conceptually and think critically.

5. The SLOs are classified under three **cognitive levels**: knowledge (K), understanding (U) and application and other higher order skills (A) for effective planning during teaching and learning. Furthermore, it will help to derive multiple choice questions (MCQs), constructed response questions (CRQs) and extended response questions (ERQs) on a rational basis from the subject syllabi.

6. By focusing on the achievement of the SLOs, these syllabi aim to counter the culture of rote memorisation as the preferred method of examination preparation. While suggesting relevant, locally available textbooks for achieving these outcomes, AKU-EB recommends that teachers and students use multiple teaching and learning resources for achieving these outcomes.

7. The syllabi follow a uniform layout for all subjects to make them easier for students and teachers to follow. They act as a bridge between students, teachers and assessment specialists by providing a common framework of student learning outcomes and **exam specifications**.

8. On the whole, the AKU-EB syllabi for Secondary School Certificate (SSC) provide a framework that helps students to acquire conceptual understanding and learn to critically engage with it. This lays a solid foundation for HSSC and beyond.

Subject Rationale of AKU-EB General Science

Why study AKU-EB General Science?

General Science syllabus provides an opportunity for the students to develop an understanding of nature and different phenomena occurring in the environment. It concentrates on broadening students' conceptual understanding of the scientific method through opportunities for inquiry and activities to enhance their observational and analytical skills. Moreover, it enlightens about the contribution of science in the development of human culture and society.

The syllabus encompasses five major aspects i.e.

- History and Nature of Science
- Life science
- Physical science
- Conservation of Environment
- Science and Technology

Where will it take you?

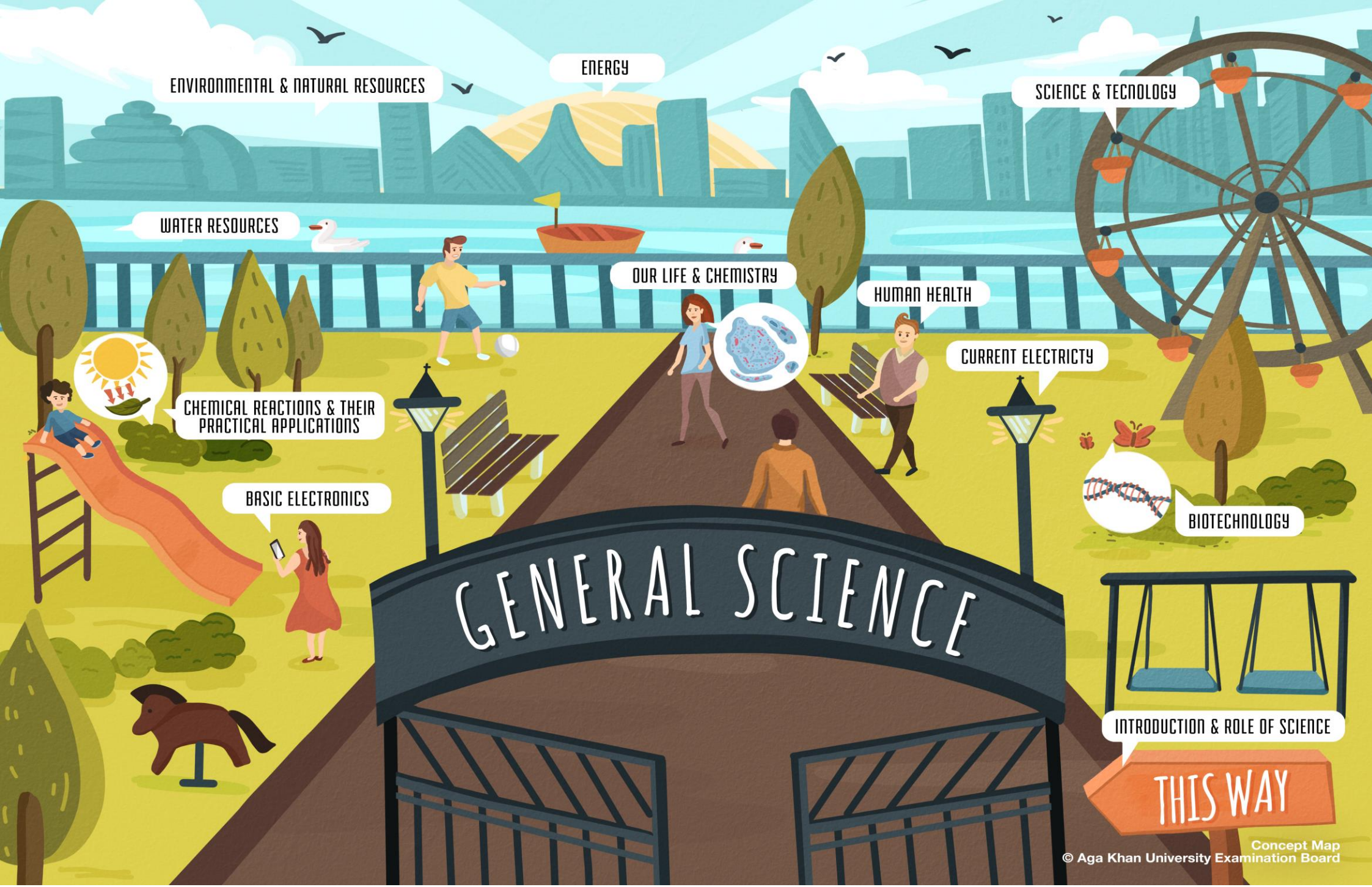
The focus of the AKU-EB General Science examination syllabus is to emphasise on conceptual understanding of the phenomena occurring in nature which prepares students appropriately for higher secondary or tertiary level studies of General Science related fields. Furthermore, it serves as a foundation in science that will creates opportunities for students to pursue progressively higher levels of study, prepare them for science related occupations, and interdisciplinary subjects such as liberal arts.

How to approach the syllabus?

The concept map of the syllabus gives an overview of the entire syllabus. After this, the topics and student learning outcomes (SLOs) will tell you the details about what you have to achieve. And finally, the Exam Specification will tell you what to expect in your examination.

What is the concept map telling you?

A public park is used as an analogy to represent the AKUEB-SSC General Science syllabus. A park is mapped to represent the different science disciplines such as Physics, Chemistry, Biology and Information Technology. The topics presented in the concept map are applications of each discipline of General Science and is represented by the different sections of park which symbolises its application in daily life. For example, the ferris wheel utilizes science and technology to spin. The use of such analogy is to enable the students to relate and understand the applications of science in everyday life.


ENVIRONMENTAL & NATURAL RESOURCES
ENERGY
SCIENCE & TECNOLOGY
WATER RESOURCES
OUR LIFE & CHEMISTRY
HUMAN HEALTH
CURRENT ELECTRICTY
CHEMICAL REACTIONS & THEIR PRACTICAL APPLICATIONS
BASIC ELECTRONICS
BIOTECHNOLOGY
GENERAL SCIENCE
INTRODUCTION & ROLE OF SCIENCE
THIS WAY
Concept Map
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Student Learning Outcomes of AKU-EB SSC General Science

Part I (Grade IX)

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level[1]		
				K	U	A
1. History and Nature of Science		Students should be able to:				
1.1	Introduction to History of Science, Concept of Science in Islam and Contribution of Scientists in the Field of Science.	1.1.1	define the term 'science';	*		
		1.1.2	describe the concept of science in Islam;		*	
		1.1.3	explain the scientific methodology as a technique for investigating phenomena;		*	
		1.1.4	recognise the role of Muslim scientists in the early development of science with reference to their discoveries and inventions (specially Jabar Bin Hayyan, Muhammad Bin Zikrya Razi, Ibn-ul-Haitham, Al-Bairruni, Bu-Ali Sina);		*	
		1.1.5	recognise 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 the various branches of science and their scope (Physics, Chemistry, Biology, Mathematics, Agriculture, Medicine, Astronomy, Geography);		*	
		1.2.2	explain the relationship among the various branches of science;		*	
		1.2.3	differentiate between pure and applied science;		*	
1.3	Role of Science and Technology and its Impact for Bringing Improvement in the Quality of Life	1.3.1	identify different technologies used in the fields of agriculture, diagnostics, pharmaceutics and engineering;		*	
		1.3.2	describe the impact of science and technology on the quality of human life;		*	

[1] K = Knowledge, U = Understanding, A = Application and other higher-order cognitive skills

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level[1]		
				K	U	A
1.4	Limitations of Science	1.4.1	describe the scope of scientific development in future with special reference to the limitations of present science.		*	

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				K	U	A
2. Our Life and Chemistry		Students should be able to:				
2.1	Significance of Chemistry in Daily Life	2.1.1	recognise the importance of chemistry in daily life (digestion of food, cooking, baking, construction of houses etc.);		*	
		2.1.2	define metabolism;	*		
		2.1.3	differentiate between anabolism and catabolism;		*	
		2.1.4	describe the metabolism of carbohydrates, proteins and fats in the human body;		*	
		2.1.5	define enzymes;	*		
		2.1.6	describe the characteristics of enzymes;		*	
		2.1.7	recognise the role of enzymes in our daily life;		*	
2.2	Basic Elements for Life	2.2.1	identify the basic building elements (carbon, hydrogen, phosphorous, sulphur and oxygen) necessary for life;		*	
		2.2.2	describe the importance of carbon, hydrogen and oxygen in the life processes (photosynthesis and respiration);		*	
		2.2.3	differentiate among the allotropic forms of carbon, i.e diamond, graphite and buckyballs;		*	
2.3	Elements Necessary for Human body, Agriculture and Industry	2.3.1	describe food sources and functions of sodium, calcium, phosphorous, iron and iodine in maintaining human health;		*	
		2.3.2	describe the functions of potassium, calcium, phosphorous, magnesium and iron in the maintenance of agriculture;		*	
		2.3.3	describe the use of sodium, calcium, magnesium, potassium, sulphur, copper, chlorine, iodine and iron in industries;		*	

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				K	U	A
		Students should be able to:				
2.4	Chemical Composition of Common Materials Used in Our Daily Life	2.4.1	identify the chemical composition (basic unit) of common materials such as polyester, nylon, polythene, rubber, glass, sugar, table salt and washing powder;		*	
		2.4.2	compare the physical and chemical properties of elements and compounds to assess their potential uses and associated risks (e.g., hydrogen and helium in balloons, copper and aluminum in wiring, copper versus lead in plumbing, water and alcohol in thermometers, petrol and diesel in automobiles);		*	
2.5	Impact of Chemicals on Our Lives and Environment	2.5.1	discuss the effect of aerosols, CFCs, fertilisers and pesticides on the human life and environment;		*	
2.6	Chemical Changes in the Environment That We Encounter Daily	2.6.1	explain the chemical changes that occur during the process of burning, fermentation and decomposition;		*	
2.7	Waste Material Management	2.7.1	describe the concept of 'The 3 R's principle' (reduce, reuse and recycle);		*	
		2.7.2	exemplify reduce, reuse and recycle in daily life;		*	
		2.7.3	describe the important steps involved in the recycling of plastic, rubber and glass;		*	
		2.7.4	discuss the importance of waste management in our daily life.		*	

Topics and Sub-topics	Student Learning Outcomes		Cognitive Level		
			K	U	A
3. Human Health, Diseases and Preventions	Students should be able to:				
3.1 Introduction to Human Health	3.1.1	define health, nutrition and nutrients;	*		
	3.1.2	describe the components of health triangle; a. physical health b. mental health c. social health;		*	
3.2 Major Components of Food and their Sources	3.2.1	describe the basic nutrients of food; a. carbohydrates b. proteins c. fats d. vitamins i. fat soluble vitamins (A, D, E and K) ii. water soluble vitamins (B, B1, B2, B12 and C) e. minerals f. water g. dietary fiber;		*	
	3.2.2	identify the food sources of each nutrient;		*	
	3.2.3	describe the functions of each nutrient;		*	
3.3 Health Implications of the Malnutrition of Major Components of Food	3.3.1	describe malnutrition;		*	
	3.3.2	differentiate between under-nutrition and over-nutrition;		*	
	3.3.3	describe the following health implications of malnutrition of nutrients; a. obesity b. cardiovascular diseases c. kwashiorkor d. marasmus e. constipation;		*	

Topics and Sub-topics	Student Learning Outcomes		Cognitive Level		
			K	U	A
	Students should be able to:				
3.4 Balanced Diet	3.4.1	define balanced diet;	*		
	3.4.2	describe the characteristics of balanced diet;		*	
	3.4.3	exemplify balanced diet;		*	
	3.4.4	recognise the importance of balanced diet for maintaining health;		*	
3.5 Dietary Practices and Disorders	3.5.1	define natural, processed and fast food;	*		
	3.5.2	describe the effect of processed and fast food on human health;		*	
	3.5.3	identify dietary disorders;		*	
	3.5.4	describe the causes and symptoms of dietary disorders; a. anorexia nervosa b. bulimia nervosa;		*	
3.6 Food and Energy	3.6.1	define energy and its unit of measurement, i.e. calorie or Joule;	*		
	3.6.2	identify the factors affecting energy requirement; a. age b. sex c. physiological state (pregnant, lactating woman and illness) d. physical activity;		*	
3.7 Human Blood	3.7.1	describe the main components of blood, i.e. plasma and blood cells;		*	
	3.7.2	describe the functions of blood;		*	
	3.7.3	describe the structure and functions of blood cells;		*	
	3.7.4	describe types of blood groups in humans;		*	
	3.7.5	explain ABO blood group system;		*	

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				K	U	A
		Students should be able to:				
		3.7.6	describe Rh blood group system;		*	
		3.7.7	determine the compatibility of blood transfusion;			*
3.8	Blood Diseases	3.8.1	describe the causes and symptoms of blood diseases; a. leukemia b. hemophilia c. anemia d. thalassemia;		*	
3.9	Diseases Caused by Viruses, Bacteria, Fungi and Parasites	3.9.1	describe the causes, signs and symptoms, preventions and treatment of viral diseases; a. HIV – AIDS b. smallpox c. polio myelitis d. influenza e. measles f. hepatitis (A, B and C);		*	
		3.9.2	describe the causes, signs and symptoms, preventions and treatment of bacterial diseases; a. tuberculosis b. whooping cough c. typhoid d. tetanus e. diphtheria f. cholera;		*	
		3.9.3	describe the causes, signs and symptoms, preventions and treatment of fungal infection, i.e. ring worm (Tinea Pedi);		*	
		3.9.4	describe the causes, signs and symptoms, preventions and treatment of parasitic diseases, i.e. malaria and ascariasis;		*	

Topics and Sub-topics	Student Learning Outcomes		Cognitive Level		
			K	U	A
	Students should be able to:				
3.10 Modes of Transmission of Germs	3.10.1	identify sources that spread germs (air, touch or direct contact, faeces, animals, insects, cuts and scratches and blood transfusion etc.);		*	
3.11 Preventive Measures	3.11.1	explain preventive measures through which spread of germs can be controlled; a. sterilisation b. extermination c. vaccination d. isolation e. cleanliness f. sewage disposal g. immunisation;		*	
	3.11.2	differentiate between vaccines and antibiotics;		*	
3.12 First Aid	3.12.1	define first aid;	*		
	3.12.2	recognise the significance of first aid;		*	
	3.12.3	identify different types of first aid kits and their content, i.e. a. home first aid kit b. sports first aid kit c. travel first aid kit;		*	
	3.12.4	demonstrate first aid administration in common accidents/ emergencies (specially for electric shock, fire burning, heat stroke, dog bite, snake bite, heart attack, artificial respiration, etc.);			*
3.13 Healthy Lifestyle	3.13.1	identify various activities that could change a sedentary lifestyle;		*	
	3.13.2	explain the term ‘cleanliness’ and its importance for healthy life;		*	
	3.13.3	analyse different activities for fitness and healthy living including the role of exercise, meditation, yoga and offering prayers.			*

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				K	U	A
4. Population and Environment		Students should be able to:				
4.1	Introduction of Population and Environment	4.1.1	define the terms population, environment and population growth;	*		
		4.1.2	relate population growth with the environment;		*	
4.2	Human Population Growth in Pakistan and Neighbouring Countries	4.2.1	define the terms birth rate, death rate and carrying capacity;	*		
		4.2.2	compare the growth rate of human population in Pakistan and neighbouring countries;		*	
		4.2.3	identify the factors which influence the human population growth rate;		*	
		4.2.4	assess how the size and rate of growth of human population are determined by birth rate, death rate, immigration, emigration, urbanisation and carrying capacity of the environment;			*
4.3	Human Impact on the Environment	4.3.1	describe that overpopulation is the major hindrance in the sustainable development of any region;		*	
		4.3.2	discuss damages to the environment and human life caused by overpopulation;		*	

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				K	U	A
5. Energy Sources		Students should be able to:				
5.1	Introduction of Energy and its Forms	5.1.1	define the term 'energy';	*		
		5.1.2	relate energy with work;		*	
		5.1.3	compare different forms of energy (kinetic, potential, mechanical, electrical, sound, light, heat, solar, nuclear, hydroelectric) with examples;		*	
5.2	Minerals and Fossil Fuels	5.2.1	identify the different kinds of minerals and fossil fuels;		*	
		5.2.2	explain the extraction of coal, gas and petroleum and their main uses in daily life;		*	
5.3	Energy Demands and Different Methods of Acquiring Energy	5.3.1	describe the increasing demands for energy in industry, agriculture and households;		*	
		5.3.2	describe methods of producing energy (electrical, thermal, solar, nuclear and hydroelectric);		*	
5.4	Development of New Energy Resources	5.4.1	explain renewable and non-renewable sources e.g. solar, wind, tidal, geothermal, biomass energy, fossil fuels: coal, petroleum, and natural gas;		*	
		5.4.2	discuss the applications of different ways to meet the increasing demand of energy in everyday life and national development (industries and infrastructure);		*	
5.5	Energy Conservation	5.5.1	state the law of conservation of energy;	*		
		5.5.2	explain the law of conversation of energy with examples;		*	
		5.5.3	relate the law of conservation of energy to the dissemination of energy;		*	
		5.5.4	analyse ways to conserve energy in homes, schools, industries, transportation, etc. with real life examples;			*

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				K	U	A
		Students should be able to:				
5.6	Measurement of Different Forms of Energy	5.6.1	describe the methods and units (Watt and Calorie) of measurement of different forms of energy;		*	
5.7	Energy and the Environment	5.7.1	describe the hazards associated with nuclear and thermal energy;		*	
		5.7.2	discuss ways to minimise environmental degradation.		*	

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				K	U	A
6. Electricity in Everyday Life		Students should be able to:				
6.1	Electric Current	6.1.1	describe the following terms with their unit and symbol: a. electric current b. voltage (potential difference) c. resistance;		*	
		6.1.2	describe conventional current;		*	
		6.1.3	state Ohm's law;	*		
		6.1.4	solve word problems related to Ohm's law by using the equation V=IR;			*
6.2	Components of Electrical Circuits, their Working and Uses	6.2.1	identify the basic components of an electrical circuit;		*	
		6.2.2	describe the uses and working of various components of electrical circuit, switches, resistors, capacitors and transformers, fuses and circuit breaker;		*	
		6.2.3	construct series and parallel electrical circuits;			*
6.3	Alternating Current (AC) and Direct Current (DC)	6.3.1	define alternating current (AC) and direct current (DC);	*		
		6.3.2	differentiate between AC and DC with examples from everyday life;		*	
		6.3.3	discuss the advantages and disadvantages of AC and DC;		*	
6.4	Electric Supply, its Measurement and Safety Methods	6.4.1	describe the process of electric supply for domestic purpose along with its measurement;		*	
		6.4.2	describe the use and importance of fuses and circuit breakers at home and schools;		*	
6.5	Dangers of Electricity and their Precautions	6.5.1	identify the various hazards (electric shock, burns, fire, explosion) of electricity;		*	
		6.5.2	discuss the safety precautions for the hazards and first aid administration in these cases (electric shock, burns, fire, explosion);		*	

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				K	U	A
		Students should be able to:				
6.6	Introduction of Ammeter, Voltmeter, Multimeter and their Uses	6.6.1	explain the construction and uses of ammeter, voltmeter and multimeter.		*	

Part II (Grade X)

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				K	U	A
7. Environment, Problems and Management		Students should be able to:				
7.1	Major Constituent of Environmental Spheres	7.1.1	define the term 'environment';	*		
		7.1.2	differentiate among environmental spheres, i.e., lithosphere, hydrosphere, biosphere and atmosphere;		*	
		7.1.3	identify the percentage composition of air by volume;		*	
		7.1.4	describe the properties of the commonly found gases in air (oxygen, carbon dioxide, nitrogen and rare gases);		*	
		7.1.5	describe the role of nitrogen, oxygen and carbon dioxide in nature;		*	
7.2	Greenhouse Effect and Global Warming	7.2.1	describe greenhouse effect and global warming;		*	
		7.2.2	describe the effect of global warming on the environment;		*	
7.3	Ozone Layer Depletion and its Effects	7.3.1	describe ozone layer, its formation and depletion;		*	
		7.3.2	explain the effects of ozone layer depletion on the environment;		*	
7.4	Different Kinds of Pollution, Effects and their Reduction	7.4.1	describe different kinds of pollution (air, land, water and noise), their various causes and ways to reduce them;		*	
		7.4.2	explain the impact of pollution (air, land, water and noise) on the ecosystem;		*	
		7.4.3	describe the harmful effects of excessive use of T.V., mobile and computer on individuals' health;		*	
7.5	Importance of Conservation of Wildlife, National Parks and Endangered Species	7.5.1	describe wildlife of Pakistan (animals and plants);		*	
		7.5.2	explain the factors that have contributed to the extinction of different species from Pakistan;		*	
		7.5.3	explain the importance of wildlife in Pakistan;		*	
		7.5.4	suggest ways to conserve endangered species of Pakistan;			*

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				K	U	A
		Students should be able to:				
7.6	Environmental Degradation and Legislations on Environmental Problems	7.6.1	analyse the factors (destruction of land, urbanisation, deforestation, desertification, earthquakes, storms, mismanagement of solid and hazardous wastes and migration) contributing to environmental degradation;			*
		7.6.2	identify the legislations or laws on environmental problems such as ozone depletion, global warming, air pollution, water pollution, drinking water quality and toxic substances;		*	
		7.6.3	describe the role of environmental impact assessment.		*	

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				K	U	A
8. Biotechnology		Students should be able to:				
8.1	DNA-Hereditary Material	8.1.1	define chromosome, genes, RNA, DNA and genome;	*		
		8.1.2	describe the structure of chromosome and DNA;		*	
		8.1.3	describe the central dogma of gene expression;		*	
8.2	Genetic Engineering	8.2.1	define genetic engineering;	*		
		8.2.2	describe steps of genetic engineering;		*	
		8.2.3	discuss the ethical and social issues related to GMOs (Genetically Modified Organisms);		*	
8.3	Applications of Biotechnology	8.3.1	describe the applications of genetic engineering in daily life (medicine, agriculture and livestock) with examples;		*	
		8.3.2	explain the role of biotechnology in medical advancement, i.e. insulin production, vaccine production, hormones and antibiotics, etc.;		*	
		8.3.3	explain the role of biotechnology in enhancing the agricultural yield (variety of plants species, fertilisers, insecticide and pesticide);		*	
		8.3.4	describe different types of fertilisers (organic and inorganic) and their importance for the production of crops;		*	
		8.3.5	discuss the effect of excessive use of insecticides and pesticides on plants, animals and human beings;		*	
8.4	Genetic Diseases	8.4.1	describe causes, symptoms, treatment and preventive measures of genetic disorders; a. sickle cell anemia b. thalassemia c. Down's syndrome.		*	

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				K	U	A
9. Chemical Reactions and their Practical Applications		Students should be able to:				
9.1	Nature of Common Consumer Products and their pH values	9.1.1	identify ingredients of common consumer products (e.g., food products, mineral water or cosmetics from the labels);		*	
		9.1.2	define pH;	*		
		9.1.3	classify different substances based on their pH values as acidic, basic or neutral);		*	
9.2	Chemical Reactions	9.2.1	recognise characteristics that indicate the occurrence of a chemical reaction, i.e. (change in state, colour, effervescence, heat, odour and pH etc.);		*	
		9.2.2	prepare soap from oil and sodium hydroxide and compare its lather formation with that of commercial soaps;			CA[2]
		9.2.3	relate chemical reactions to familiar processes encountered in everyday life (e.g. reactions in film processing, food processing, fabric and hair dying, agriculture, pulp and paper and mineral processes);		*	
9.3	Chemical Waste Management	9.3.1	elaborate the methods, impact and safety consequences of chemical disposal in Pakistan;		*	
		9.3.2	recommend appropriate disposal methods (e.g. dumping car batteries, tires, plastics, paints and metals in landfill sites).			*

[2] CA = Classroom Activity, not to be assessed under examination conditions

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				K	U	A
10. Water Resources		Students should be able to:				
10.1	Properties of Water	10.1.1	describe the physical properties of water;		*	
		10.1.2	explain properties of water that contribute to the sustainability of life on Earth, i.e. polarity, cohesion, specific heat, density and heat of vapourisation;		*	
10.2	Forms of Water (Oceans, Seas, Lakes, Rivers, Springs, Glaciers, Underground Water)	10.2.1	recognise the various forms of water available on Earth;		*	
		10.2.2	describe different sources and significance of fresh water on Earth;		*	
10.3	Utilisation and Conservation of Water Resources in Pakistan	10.3.1	describe the existing ways of utilisation of water resources in Pakistan;		*	
		10.3.2	analyse the issues that Pakistan is facing in utilising the water resources effectively for its people;			*
		10.3.3	suggest methods for the conservation of water;			*
10.4	Various Threats to Water Resources	10.4.1	explain threats to water resources caused by human activities such as pollution, climate change, urban growth and landscape changes (deforestation);		*	
10.5	Sustainable Development of Water Resources e.g. Potable Water System	10.5.1	describe the implication of the growing demand of water in the world;		*	
		10.5.2	suggest ways for the sustainable development of water resources in Pakistan.			*

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				K	U	A
11. Basic Electronics		Students should be able to:				
11.1	Semi-conductor Diode and their Basic Uses	11.1.1	define semi-conductor diode;	*		
		11.1.2	describe the basic working principle of semi-conductor diode;		*	
		11.1.3	describe the uses of semi-conductor diode; a. rectifier b. light emitting diode c. photodiode;		*	
		11.1.4	differentiate between the types of semiconductor diode, i.e. N-type and P-type;		*	
		11.1.5	illustrate the forward and reversed biased diodes;			*
11.2	Computer Microprocessors, their Importance and Uses	11.2.1	trace the development of computers from Babbage's calculating; machine to the modern chip through valves and diodes;		*	
		11.2.2	discuss the importance of microprocessors and their uses in different fields;		*	
		11.2.3	differentiate between binary and decimal numbering system;		*	
		11.2.4	convert decimal to binary numbers and vice versa;			*
11.3	Information Technology and Some Communication System	11.3.1	define the term information technology with examples;	*		
		11.3.2	describe the properties of radio waves;		*	
		11.3.3	explain the use of radio waves in different communication systems, i.e. a. radio b. television c. cable T.V. d. satellite T.V.;		*	
		11.3.4	describe the term 'communication system';		*	
		11.3.5	describe the components of communication system, i.e. sending device, link/ medium and receiving device;		*	

Topics and Sub-topics	Student Learning Outcomes		Cognitive Level		
			K	U	A
	Students should be able to:				
	11.3.6	describe the types of communication links, i.e. boosted pairs, fiber optic technology and microwave transmission;		*	
	11.3.7	exemplify the use of communication system, i.e. internet, e-mail, mobile;		*	
	11.3.8	analyse the role of information technology in different fields of life;			*
11.4 Logic Gates	11.4.1	identify and draw the symbols for the logic gates (NOT, OR, AND, NOR and NAND);		*	
	11.4.2	state the action of the logic gates in truth table form with two inputs;	*		
	11.4.3	describe the simple uses of logic gates.		*	

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				K	U	A
12. Science and Technology		Students should be able to:				
12.1	Advancement of Science and Technology	12.1.1	exemplify the role of science and technology in the development of a country;		*	
12.2	Functions and Uses of Lasers Optical Fiber System, Satellites and Radar	12.2.1	explain the functions and applications of lasers, optical fibers, satellites and radars in different fields with examples;		*	
12.3	Radioactivity and its Uses	12.3.1 12.3.2 12.3.3	describe radioactivity and its properties; differentiate among the types of radiation, i.e. alpha, beta and gamma; describe the uses of radioisotopes in various fields (health, agriculture, industry etc.);		* * *	
12.4	Modern Methods of Medical Diagnosis	12.4.1	explain different modern methods of medical diagnosis, i.e. ultrasound, X-rays, ECG, EEG, MRI, CT-Scan, angiography;		*	
12.5	Important Industries of Pakistan and their Impact on Country's Economy	12.5.1 12.5.2 12.5.3	list the main industries of Pakistan (sugar, steel, pharmaceuticals, synthetic fibers, textiles, leather, etc.); explain the uses of technology in these industries; recognise the impact of these industries on the economic and social progress of Pakistan;	*	 * *	
12.6	Space Exploration and its Benefits to Science and Technology	12.6.1 12.6.2 12.6.3	identify the role of space technology in human progress; explain the principle and working mechanism of geo stationary satellites; describe the role of geo stationary satellites in daily life (communication and weather satellites, rockets and spaces shuttles);		* * *	

Topics and Sub-topics		Student Learning Outcomes		Cognitive Level		
				K	U	A
12. Science and Technology		Students should be able to:				
12.7	Pakistan's Space Programme (SUPARCO)	12.7.1	describe Pakistan's space programme for the betterment of the country, i.e. Space and Upper Atmosphere Research Commission (SUPARCO);		*	
12.8	Pakistan's Nuclear Programme	12.8.1	describe the salient features of Pakistan's nuclear programme;		*	
		12.8.2	discuss the implications of Pakistan's nuclear programme for the future of the country;		*	
		12.8.3	describe nuclear energy usage in the world and its impact on life on Earth;		*	
		12.8.4	describe the uses of atomic energy for peace purposes.		*	

Scheme of Assessment

Grade IX

Table 1: Number of Student Learning Outcomes by Cognitive level

Topic No.	Topics	No. of Sub-Topics	SLOs			Total SLOs
			K	U	A	
1.	History and Nature of Science	4	1	10	-	11
2.	Our Life and Chemistry	7	2	19	-	21
3.	Human Health, Diseases and Preventions	13	6	31	3	40
4.	Population and Environment	3	2	5	1	8
5.	Energy Sources	7	2	13	1	16
6.	Electricity in Everyday Life	6	2	11	2	15
	Total	**40**	**15**	**89**	**7**	**111**
	Percentage		**14**	**80**	**6**	**100**

Table 2: Exam Specification

Topic No.	Topics	Marks Distribution			Total Marks
		MCQs	CRQs	ERQs	
1.	History and Nature of Science	3	Total 3 Marks (1 CRQ)	5 Marks Choose any ONE from TWO	17
4.	Population and Environment	3	Total 3 Marks (1 CRQ)		
2.	Our Life and Chemistry	8	Total 4 Marks (1 CRQ)	5 Marks Choose any ONE from TWO	32
3.	Human Health, Diseases and Preventions	8	Total 4 Marks (1 CRQ)		
			Total 3 Marks (1 CRQ)		
5.	Energy Sources	6	Total 4 Marks (1 CRQ)	5 Marks Choose any ONE from TWO	26
6.	Electricity in Everyday Life	7	Total 4 Marks (1 CRQ)		
	Total	**35**	**25**	**15**	**75**

- Multiple Choice Question (MCQ) requires candidates to choose one best/ correct answer from four options for each question. Each MCQ carries ONE mark.
- Constructed Response Question (CRQ) requires students to respond with a short text (few phrases/ sentences), calculations or diagrams.
- Extended Response Question (ERQ) requires students to answer in a more descriptive form. The answer should be in paragraph form, with diagrams where needed, and address all parts of the question.

Grade X

Table 3: Number of Student Learning Outcomes by Cognitive level

Topic No.	Topic	No. of Sub-Topics	SLOs			Total SLOs
			K	U	A	
7.	Environment, Problems and Management	6	1	16	2	19
8.	Biotechnology	4	2	10	-	12
9.	Chemical Reactions and their Practical Applications	3	1	5	1	07
10.	Water Resources	5	-	7	3	10
11.	Basic Electronics	4	3	14	3	20
12.	Science and Technology	8	1	16	-	16
	Total	**30**	**7**	**68**	**9**	**84**
	Percentage		**8**	**81**	**11**	

Table 4: Exam Specification

Topic No.	Topics	Marks Distribution			Total Marks
		MCQs	CRQs	ERQs	
7.	Environment, Problems and Management	8	Total 3 Marks (1 CRQ)	5 Marks Choose any ONE from TWO	25
10.	Water Resources	5	Total 4 Marks (1 CRQ)		
8.	Biotechnology	6	Total 2 Marks (1 CRQ)	5 Marks Choose any ONE from TWO	28
			Total 3 Marks (1 CRQ)		
9.	Chemical Reactions and their Practical Application	7	Total 2 Marks (1 CRQ)		
			Total 3 Marks (1 CRQ)		
11.	Basic Electronics	5	Total 4 Marks (1 CRQ)	5 Marks Choose any ONE from TWO	22
12.	Science and Technology	4	Total 4 Marks (1 CRQ)		
	Total	**35**	**25**	**15**	**75**

- Tables 1 and 3 indicate the number and nature of SLOs in each topic in grades IX and X respectively. This will serve as a guide in the construction of the examination paper. It also indicates that more emphasis has been given to the Understanding (80% in IX and 81% in X), Application and higher order skills (6% in IX and 11% in X) to discourage rote memorization. Tables 1 and 3, however, do not translate directly into marks.
- There will be two examinations, one at the end of grade IX and one at the end of grade X.
- In each grade, the theory paper will be in two parts: paper I and paper II. Both papers will be of duration of 3 hours.
- Paper I theory will consist of 35 compulsory, multiple choice items. These questions will involve four response options.
- 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.
- All constructed response questions will be in a booklet which will also serve as an answer script.

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