



آغا خان یونیورسٹی ایگزامینیشن بورڈ

AGA KHAN UNIVERSITY EXAMINATION BOARD

**Secondary School Certificate  
Examination Syllabus**

**PHYSICS  
CLASSES IX-X**

(based on National Curriculum 2006)

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**Secondary School Certificate  
Examination Syllabus**

**PHYSICS  
CLASSES IX-X**

**This subject is examined in both  
May and September Examination sessions**

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## PREFACE

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

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

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

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

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

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

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

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

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

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

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

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



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

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

### Aims

The Aims of physics at higher secondary level are to enable student to:

- Develop among the students the habit of scientific and rational thinking and an attitude to search for order and symmetry in diverse phenomena of nature and thereby to appreciate the supreme wisdom and creative powers of the creator.
- Become life long learner, effective problem solver, responsible and productive citizens in a technological world.
- Strengthen the concepts developed at the secondary level to lay firm foundation for further learning of physics at the tertiary level, in engineering or in other physics dependent and vocational courses.
- Develop process skills and experimental observational, manipulative, decision making and investigatory skills in the students.
- Understand and interpret scientific information presented in verbal, mathematical or graphical form and to translate such information from one form to another.
- Understanding and appreciate the inter relationship and balance that exists in nature the problems associated with the over exploitation of the environmental resources and disturbance because of the human activities I the ecological balance, thus taking care of the environment.

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

### 2.1 General Rationale

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

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

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

- 2.1.2 This AKU-EB examination syllabus addresses these concerns. Without such guidance teachers and students have little option other than following a single textbook to prepare for an external examination. The result is a culture of rote memorization as the preferred method of examination preparation. The pedagogically desirable objectives of the National Curriculum which encourage “observation, creativity and other higher order thinking [skills]” are generally ignored. AKU-EB recommends that teachers and students use multiple teaching-learning resources for achieving the specific objectives of the National Curriculum reproduced in the AKU-EB examination syllabuses.
- 2.1.3 The AKU-EB examination syllabuses use a uniform layout for all subjects to make them easier for teachers to follow. Blank sheets are provided in each syllabus for writing notes on potential lesson plans. It is expected that this arrangement will also be found helpful by teachers in developing classroom assessments as well as by question setters preparing material for the AKU-EB external examinations. The AKU-EB aims to enhance the quality of education through improved classroom practices and improved examinations.
- 2.1.4 The Student Learning Outcomes (SLOs) in Section 3 start with command words such as list, describe, relate, explain, etc. The purpose of the command words is to direct the attention of teachers and students to specific tasks that candidates following the AKU-EB examination syllabuses are expected to undertake in the course of their subject studies. The examination questions will be framed using the same command words or the connotation of the command words to elicit evidence of these competencies in candidates’ responses. The definitions of command words used in this syllabus are given in Section 7. It is hoped that teachers will find these definitions useful in planning their lessons and classroom assessments.
- 2.1.5 The AKU-EB has classified SLOs under the three cognitive levels, Knowledge (K), Understanding (U) and Application of knowledge and skills (A) in order to derive multiple choice questions and constructed response questions on a rational basis from the subject syllabuses ensuring that the intentions of the National Curriculum should be met in full. The weighting of marks to the Multiple Choice and Constructed Response Papers is also derived from the SLOs, command words and cognitive levels. In effect the SLOs derived from the National Curriculum determine the structure of the AKU-EB subject examination set out in Section 4.
- 2.1.6 Some topics from the National Curriculum have been elaborated and enriched for better understanding of the subject and/or to better meet the needs of students in the twenty-first century. These additional topics have been italicized in Section 3 of this syllabus.



## 2.2 Specific Rationale of the AKU-EB Physics Examination Syllabus

2.2.1 The National Education Policy (1998-2010) outlines the following objectives for secondary education:

- a. To prepare the students well for the pursuit of professional and specialized education.
- b. To make available such teaching and learning materials that will make learning rewarding and attractive.
- c. To introduce a system of evaluation that emphasizes learning of concepts and discourages rote memorization.

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

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

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

#### Part I (Class IX)

Topics	Student Learning Outcomes		Cognitive levels <sup>2</sup>		
			K	U	A
<b>1. Physical Quantities and Measurement</b>	<b>Candidates should be able to:</b>				
1.1 Introduction	1.1.1	describe the crucial role of physics in science, technology and society;		*	
1.2 Physical Quantities	1.2.1	explain with examples that science is based on physical quantities which consist of numerical magnitude and a unit;		*	
1.3 International System of Units	1.3.1 1.3.2	differentiate between base and derived physical quantities; list the seven units of System International (SI) along with their symbols and physical quantities; (standard definitions of SI units are not required)	*	*	
1.4 Prefixes (Multiples and Sub-multiples)	1.4.1	convert the prefixes and their symbols to indicate multiple and sub-multiple for both base and derived units;			*
1.5 Standard Form / Scientific Notation	1.5.1	calculate the answer in scientific notation in measurements;			*

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

**NOTES**

				<b>K</b>	<b>U</b>	<b>A</b>
1.6	Measuring Instruments 1. Meter rule 2. Vernier calipers 3. Screw gauge 4. Physical balance 5. Stopwatch 6. Measuring cylinder	1.6.1	describe the working of Vernier calipers and screw gauge for measuring length;		*	
		1.6.2	identify the measuring instruments;	*		
		1.6.3	describe limitations of measuring instruments;		*	
1.7	An Introduction to Significant Figures	1.7.1	discuss the need of using significant figures for recording and stating results in the laboratory;		*	
		1.7.2	apply rules of significant figures in calculations.			*
<b>2.</b>	<b>Kinematics</b>	<b>Candidates should be able to:</b>				
2.1	Rest and Motion	2.1.1	describe using examples how objects can be at rest and in motion simultaneously;		*	
2.2	Types of Motion (Translatory, Rotatory, Vibratory)	2.2.1	describe different types of motion i.e. translatory, rotatory and vibratory motion and distinguish among them;		*	
2.3	Terms Associated with Motion, (Distance and Displacement, Speed and Velocity and Acceleration)	2.3.1	define the terms speed, velocity and acceleration and write their formulae;	*		
		2.3.2	differentiate between distance and displacement, speed and velocity;		*	
2.4	Scalars and Vectors	2.4.1	define scalar and vector quantities;	*		
		2.4.2	differentiate between scalar and vector quantities;		*	

**NOTES**

			K	U	A
2.5	Forces on Bodies	2.5.1	define like and unlike parallel forces;	*	
2.6	Addition of Forces	2.6.1	describe 'head to tail' rule of vector addition of forces / vectors;		*
2.7	Resolution of Forces	2.7.1	describe the resolution of force into its perpendicular components;		*
		2.7.2	determine the magnitude and direction of a force from its perpendicular components;		*
2.8	Graphical Analysis of Motion, (Distance Time Graph and Speed Time Graph)	2.8.1	draw vector quantities by using graph;		*
		2.8.2	plot and interpret distance-time graph and speed-time graph;		*
		2.8.3	determine and interpret the slope of distance-time and speed-time graph;		*
		2.8.4	determine from the shape of the graph, the state of a body; (i) at rest, (ii) moving with constant speed and (iii) moving with variable speed;		*
		2.8.5	calculate the area under speed-time graph of uniformly accelerated objects to determine the distance;		*
2.9	Equations of Motion $S = Vt$ $V_f = V_i + at$ $S = V_i t + \frac{1}{2}at^2$ $V_f^2 - V_i^2 = 2aS$	2.9.1	derive equations of motion for a body moving with a uniform acceleration in a straight line;		*
		2.9.2	solve problems related to uniformly accelerated motion using appropriate equations;		*
2.10	Motion due to Gravity	2.10.1	solve problems related to freely falling bodies using $10 \text{ m/s}^2$ as the acceleration due to gravity.		*

**NOTES**

			K	U	A
<b>3. Dynamics</b>	<b>Candidates should be able to:</b>				
3.1 Force	3.1.1	describe the concept of force with its S.I unit;		*	
	3.1.2	differentiate among different forces like gravitational force, drag force (push, pull), force of friction, electrostatic force and magnetic force;		*	
	3.1.3	analyse the concept of force by examples of daily life;			*
3.2 Momentum	3.2.1	define momentum;	*		
	3.2.2	solve problems related to force and momentum;			*
	3.2.3	state the law of conservation of momentum;	*		
	3.2.4	differentiate between elastic and inelastic collision;		*	
	3.2.5	apply the principle of conservation of momentum in the elastic collision of two objects;			*
	3.2.6	determine the velocity after collision of two objects using the law of conservation of momentum;			*
	3.2.7	<i>explain safety features by using the idea of momentum;</i>		*	
3.3 Newton's Laws of Motion	3.3.1	describe balance and unbalance forces;		*	
	3.3.2	state Newton's laws of motion and inertia;	*		
	3.3.3	distinguish between mass and weight;		*	
	3.3.4	solve problems using $F = ma$ and $W = mg$ ;			*
	3.3.5	derive the expression for the tension and acceleration in a string during motion of bodies connected by the string and passing over frictionless pulley using the second law of motion;		*	



**NOTES**

			K	U	A
	3.3.6	discuss the result while you are sitting inside a bus when the bus i. starts moving suddenly, ii. stops moving suddenly, iii. turns a corner to the left suddenly;		*	
3.4 Friction	3.4.1	explain the importance of friction on the motion of a vehicle in the context of type of surface, road conditions including skidding and braking force;		*	
	3.4.2	demonstrate that rolling friction is much lesser than sliding friction;			*
	3.4.3	list various methods to reduce friction;	*		
3.5 Uniform Circular Motion	3.5.1	define centripetal force;	*		
	3.5.2	explain that motion in a curved path is due to a perpendicular force on a body that changes direction of motion but not speed;		*	
	3.5.3	calculate centripetal force on a body moving in a circle using $mv^2/r$ .			*
<b>4. Turning Effect of Forces</b>	<b>Candidates should be able to:</b>				
4.1 Moment of Force	4.1.1	describe moment of force or torque as moment = force × perpendicular distance from pivot to the line of action of force;		*	
	4.1.2	explain the turning effect of force by relating it to everyday life;		*	

**NOTES**

			<b>K</b>	<b>U</b>	<b>A</b>
4.2	Principle of Moments	4.2.1	state the principle of moments; determine the weight of an unknown object using principle of moments; solve problems to verify the variation of normal reaction;	*	
		4.2.2			*
		4.2.3			*
4.3	Centre of Gravity	4.3.1	define centre of gravity of a body in a uniform gravitational field;	*	
4.4	Couple	4.4.1	define couple as a pair of forces tending to produce rotation;	*	
4.5	Equilibrium	4.5.1	prove that the couple has the same moments about all points; define equilibrium; classify its types by quoting examples from everyday life; state conditions of equilibrium; solve problems on simple balanced systems when bodies are supported by one pivot only; describe the states of equilibrium and classify them with common examples;	*	
		4.5.2			*
		4.5.3			*
		4.5.4			*
		4.5.5			*
4.5.6			*		
4.6	Stability	4.6.1	explain effects of position of the centre of gravity on the stability of simple objects.		*

**NOTES**

			K	U	A
<b>5. Gravitation</b>	<b>Candidates should be able to:</b>				
5.1 Law of Gravitation	5.1.1	state Newton's law of gravitation;	*		
	5.1.2	explain that the gravitational forces are consistent with Newton's third law;		*	
	5.1.3	explain gravitational field as an example of field of force;		*	
	5.1.4	define weight (as the force on an object due to a gravitational field);	*		
5.2 Measurement of Mass of Earth	5.2.1	calculate the mass of earth by using the law of gravitation;			*
	5.2.2	solve problems using Newton's law of gravitation;			*
5.3 Variation of 'g' with Altitude	5.3.1	explain that value of 'g' decreases with altitude from the surface of earth;		*	
5.4 Motion of Artificial Satellites	5.4.1	discuss the importance of Newton's law of gravitation in understanding the motion of satellites;		*	
5.5 <i>Earth and Space</i>	5.5.1	<i>recall that the moon orbits the earth and some planets also have moons;</i>	*		
	5.5.2	<i>explain that gravitational force;</i> <ul style="list-style-type: none"> <li>• <i>causes the planets to orbit the sun,</i></li> <li>• <i>causes the moon and artificial satellites to orbit the earth,</i></li> <li>• <i>causes comets to orbit the sun;</i></li> </ul>		*	
	5.5.3	<i>state that a galaxy is a large collection of billions of stars and a universe is a large collection of billions of galaxies;</i>	*		
	5.5.4	<i>explain that the orbit of a comet differs from that of a planet.</i>		*	

**NOTES**

6. Work and Energy		Candidates should be able to:		K	U	A
6.1	Work	6.1.1	define work and state its SI unit;	*		
		6.1.2	calculate work done;			*
6.2	Forms of Energy	6.2.1	define energy, kinetic energy and potential energy and state unit of energy;	*		
		6.2.2	prove that kinetic energy $K.E = \frac{1}{2}mv^2$ and potential energy $P.E = mgh$ and solve problems using these equations;			*
6.3	Kinetic Energy and Potential Energy	6.3.1	describe forms of energy stored in various objects at different positions and states;		*	
6.4	Major Sources of Energy	6.4.1	state law of conservation of energy;	*		
		6.4.2	describe the processes by which energy is converted from one form to another with reference to <ul style="list-style-type: none"> <li>● fossil fuel energy,</li> <li>● hydroelectric generation,</li> <li>● solar energy,</li> <li>● nuclear energy,</li> <li>● geothermal energy,</li> <li>● wind energy,</li> <li>● biomass energy;</li> </ul>		*	
		6.4.3	solve problems using mass energy equation $E = mc^2$ ;			*
		6.4.4	describe the process of electricity generation by drawing a block diagram of the process from fossil fuel input to electricity output;		*	
		6.4.5	list the environmental issues associated with power generation;	*		



**NOTES**

			K	U	A
	6.4.6	differentiate non-renewable and renewable energy sources with examples of each;		*	
	6.4.7	explain systems such as a filament lamp, a power station, a vehicle travelling at a constant speed on a level road;		*	
6.5	Efficiency	6.5.1	define efficiency of a working system;	*	
		6.5.2	calculate the efficiency of an energy conversion using the formula; <i>Efficiency = energy converted into the required form / total energy input</i>		*
		6.5.3	conceptualize why a system cannot have an efficiency of 100%;		*
6.6	Power	6.6.1	define power and write its formula;	*	
		6.6.2	calculate power;		*
		6.6.3	define unit of power in SI system;	*	
		6.6.4	convert unit of power “watt” into horse power.		*

**NOTES**

			K	U	A
<b>7. Properties of Matter</b>	<b>Candidates should be able to:</b>				
7.1 Kinetic Molecular Model of Matter	7.1.1	explain kinetic molecular model of matter (solid, liquid and gas forms);		*	
	7.1.2	describe the fourth state of matter i.e. 'plasma';		*	
7.2 Density	7.2.1	define the term 'density';	*		
	7.2.2	compare the densities of three states of matter (solids, liquids and gases);		*	
7.3 Pressure	7.3.1	define the term pressure (as a force acting normally on unit area);	*		
	7.3.2	explain that pressure varies with force and area in the context of everyday examples;		*	
7.4 Atmospheric Pressure	7.4.1	explain atmospheric pressure;		*	
	7.4.2	describe the use of the height of a liquid column to measure the atmospheric pressure;		*	
	7.4.3	describe that atmospheric pressure decreases with the increase in height above the earth's surface;		*	
	7.4.4	explain that changes in atmospheric pressure in a region may indicate a change in the weather;		*	

**NOTES**

			<b>K</b>	<b>U</b>	<b>A</b>
7.5 Pressure in Liquids	7.5.1	state Pascal's law;	*		
	7.5.2	apply and demonstrate the use of Pascal's law;			*
	7.5.3	state relation for pressure beneath a liquid surface to depth and to density i.e., ( $P=\rho gh$ );	*		
	7.5.4	solve problems using the equation ( $P=\rho gh$ );			*
	7.5.5	state Archimedes principle;	*		
	7.5.6	determine the density of an object using Archimedes principle;			*
7.6 Upthrust	7.6.1	explain the significance of up thrust exerted by a liquid on a body;		*	
7.7 Principle of Floatation	7.7.1	state the principle of floatation;	*		
7.8 Elasticity	7.8.1	define elasticity;	*		
	7.8.2	explain that a force may produce change in size and shape of a body;		*	
7.9 Stress, Strain and Young's Modulus	7.9.1	define the terms stress, strain and Young's modulus;	*		
	7.9.2	state Hooke's law and explain elastic limit.		*	

**NOTES**

			K	U	A
<b>8.</b>	<b>Thermal Properties of Matter</b>	<b>Candidates should be able to:</b>			
8.1	Temperature and Heat	8.1.1	define temperature;	*	
		8.1.2	define heat;	*	
8.2	Thermometer	8.2.1	list basic thermometric properties for a material to construct a thermometer;	*	
		8.2.2	convert the temperature from one scale to another scale (Fahrenheit, Celsius and Kelvin scales);		*
		8.2.3	describe rise in temperature of a body in terms of an increase in its internal energy;		*
8.3	Specific Heat Capacity	8.3.1	describe the terms heat capacity and specific heat capacity;		*
8.4	Latent Heat of Fusion	8.4.1	describe heat of fusion and heat of vapourization;		*
8.5	Latent Heat of Vapourization	8.5.1	determine heat of fusion and heat of vapourization of ice and water respectively by sketching temperature-time graph;		*
8.6	Evaporation	8.6.1	explain the process of evaporation and differentiate between boiling and evaporation;		*
		8.6.2	explain that evaporation causes cooling;		*
		8.6.3	describe factors which influence surface evaporation;		*
8.7	Thermal Expansion	8.7.1	describe qualitatively the thermal expansion of solids (linear and volumetric expansion);		*
		8.7.2	explain the thermal expansion of liquids (real and apparent expansion).		*



**NOTES**

			K	U	A
<b>9. Transfer of Heat</b>	<b>Candidates should be able to:</b>				
9.1 Processes of Heat Transfer	9.1.1	describe thermal energy;		*	
	9.1.2	explain in terms of molecules and electrons how heat transfer occurs in solids;		*	
	9.1.3	describe the factors affecting the transfer of heat through solid conductors and hence define the term 'thermal conductivity';		*	
	9.1.4	solve problems based on thermal conductivity of solid conductors;			*
	9.1.5	identify examples of good and bad conductors of heat;	*		
	9.1.6	describe the uses of good and bad conductors;		*	
9.2 Conduction	9.2.1	explain that insulation reduces energy transfer by conduction;		*	
9.3 Convection	9.3.1	explain the convection currents in fluids due to difference in density;		*	
	9.3.2	state some examples of heat transfer by convection in everyday life;	*		
9.4 Radiation	9.4.1	describe the process of radiation from all objects;		*	
9.5 Consequences and Everyday Application of Heat Transfer	9.5.1	explain that energy transfer by radiation does not require a medium and that the rate of energy transfer is affected by; <ul style="list-style-type: none"> <li>• colour and texture of the surface</li> <li>• surface temperature</li> <li>• surface area</li> </ul>		*	

**NOTES**

Part II (Class X)

Topics	Student Learning Outcomes		Cognitive levels		
			K	U	A
<b>10. Simple Harmonic Motion and Waves</b>	<b>Candidates should be able to:</b>				
10.1 Simple Harmonic Motion	10.1.1	state the conditions necessary for an object to oscillate with SHM;	*		
	10.1.2	explain SHM with simple pendulum, ball and bowl examples;		*	
	10.1.3	draw forces acting on a displaced pendulum;			*
	10.1.4	solve problems by using the formula $T = 2\pi \sqrt{\frac{l}{g}}$ for simple pendulum;			*
	10.1.5	explain that damping progressively reduces the amplitude of oscillation;		*	
10.2 Waves, their Nature and Types	10.2.1	describe wave motion as illustrated by vibrations in rope, slinky spring and by experiments with water waves;		*	
	10.2.2	describe that waves are means of energy transfer without transfer of matter;		*	
	10.2.3	distinguish between mechanical and electromagnetic waves;		*	
	10.2.4	identify transverse and longitudinal waves in mechanical media,	*		
10.3 Properties of Waves	10.3.1	describe properties of waves such as reflection, refraction and diffraction with the help of ripple tank;		*	

**NOTES**

			K	U	A
10.4 Characteristics of Waves	10.4.1	define the terms speed ( $v$ ), frequency ( $f$ ), wavelength ( $\lambda$ ), time period ( $T$ ), amplitude, crest, trough, cycle, wave front, compression and rarefaction;	*		
	10.4.2	derive equation $V=f\lambda$ ;		*	
	10.4.3	solve problems by applying the relation $f = 1/T$ and $V = f\lambda$ .			*
<b>11. Sound</b>	<b>Candidates should be able to:</b>				
11.1 Sound Waves	11.1.1	explain production of sound waves;		*	
	11.1.2	describe the longitudinal nature of sound waves;		*	
11.2 Characteristics of Sound	11.2.1	define the terms pitch, loudness and quality of sound;	*		
	11.2.2	describe the effect of change in amplitude on loudness and the effect of change in frequency on pitch of sound;		*	
	11.2.3	define intensity and state its SI unit;	*		
	11.2.4	describe intensity level and mention its unit;		*	
	11.2.5	describe the importance of acoustic protection;		*	
11.3 Noise Pollution	11.3.1	describe that noise is a nuisance;		*	
	11.3.2	describe how reflection of sound may produce echo;		*	
11.4 Audible Frequency Range	11.4.1	describe audible frequency range;		*	
	11.4.2	describe the uses of ultrasound.		*	

**NOTES**

			K	U	A
<b>12. Geometrical Optics</b>	<b>Candidates should be able to:</b>				
12.1 Reflection Of Light	12.1.1	describe the terms used in reflection including normal, angle of incidence, angle of reflection;		*	
	12.1.2	state laws of reflection;	*		
12.2 Image Location by Spherical Mirror Equation	12.2.1	solve problems of image location by spherical mirrors by using mirror formula;			*
12.3 Refraction of Light	12.3.1	define the terms 'angle of incidence (i)' and 'angle of refraction (r)';	*		
	12.3.2	state laws of refractions;	*		
	12.3.3	demonstrate the passage of light through parallel-sided transparent material;			*
	12.3.4	<i>solve problems by using different formulae;</i> i. $\sin \angle i / \sin \angle r$ ii. <i>speed of light in vacuum / speed of light in the given medium</i> iii. <i>real depth / apparent depth</i>			*
	12.3.5	demonstrate the passage of light through a glass prism;			*
12.4 Total Internal Reflection	12.4.1	state the conditions necessary for total internal reflection;	*		
	12.4.2	describe the use of total internal reflection in light propagation;		*	
	12.4.3	<i>describe the relation between critical angle and refractive index;</i>		*	
12.5 Image Location By Lens Equation	12.5.1	demonstrate that light is refracted through lenses;			*
	12.5.2	solve problems of image location by lenses using lens formula;			*



**NOTES**

			K	U	A	
12.6	Magnifying Power and Resolving Power	12.6.1	define power of a lens and state its unit;	*		
		12.6.2	define the terms resolving power and magnifying power;	*		
12.7	Compound Microscope	12.7.1	draw a ray diagram of a simple microscope and determine its magnifying power;			*
		12.7.2	draw a ray diagram of a compound microscope and mention its magnifying power;			*
12.8	Telescope	12.8.1	draw a ray diagram of a telescope and mention its magnifying power;			*
12.9	Defects in Vision	12.9.1	draw ray diagrams to show the formation of images in the normal eye, a short-sighted eye and a long-sighted eye;			*
		12.9.2	describe the correction of short-sightedness and long-sightedness.		*	
<b>13. Electrostatics</b>		<b>Candidates should be able to:</b>				
13.1	Electric Charge	13.1.1	describe simple experiments to show the production and detection of electric charge;		*	
		13.1.2	<i>discuss the potential dangers of electrostatic charges;</i>		*	
13.2	Electrostatic Induction	13.2.1	describe experiments to show electrostatic charging by induction;		*	
		13.2.2	state that there are positive and negative charges;	*		
13.3	Electroscope	13.3.1	describe the construction and working principle of electroscope;		*	

**NOTES**

			<b>K</b>	<b>U</b>	<b>A</b>
13.4 Coulomb's Law	13.4.1	explain Coulomb's law;		*	
	13.4.2	solve problems on electrostatic charges by using Coulomb's law;			*
13.5 Electric Field and its Intensity	13.5.1	define electric field and electric field intensity;	*		
	13.5.2	draw electric field lines for an isolated positive and negative point charges;			*
13.6 Electrostatic Potential	13.6.1	describe the concept of electrostatic potential;		*	
	13.6.2	define the unit 'volt';	*		
	13.6.3	describe potential difference;		*	
13.7 Applications of Electrostatic	13.7.1	describe a situation in which static electricity is dangerous and discuss the precautions taken to ensure the safe discharge of static electricity;		*	
	13.7.2	describe the application of electrostatics;		*	
13.8 Capacitors and Capacitance	13.8.1	describe a capacitor;		*	
	13.8.2	define capacitance and state its unit;	*		
	13.8.3	derive the formula for the effective capacitance of a number of capacitors connected in series and in parallel;		*	
	13.8.4	apply the formula for the effective capacitance of a number of capacitors connected in series and in parallel to solve related problems;			*
13.9 <i>Different Types of Capacitors</i>	13.9.1	<i>differentiate between a fixed and a variable capacitor.</i>		*	

**NOTES**

			K	U	A
<b>14. Current Electricity</b>	<b>Candidates should be able to:</b>				
14.1 Electric Current	14.1.1	define electric current;	*		
	14.1.2	describe the concept of conventional current;		*	
14.2 Potential Difference and e.m.f	14.2.1	investigate the potential difference across a circuit component and mention its unit;			*
14.3 Ohm's Law	14.3.1	describe Ohm's law and its limitations;		*	
14.4 Resistance (Series and Parallel Combinations)	14.4.1	define resistance and its unit;	*		
	14.4.2	calculate the effective resistance of a number of resistances connected in series and also in parallel;			*
	14.4.3	describe the factors affecting the resistances of a metallic conductor;		*	
	14.4.4	distinguish between conductors and insulators;		*	
14.5 The I-V Characteristics for Ohmic and Non-Ohmic Conductors	14.5.1	draw and interpret the I-V characteristics graph for a metallic conductor, a filament lamp and a thermistor;			*
14.6 Electrical Power and Joule's Law	14.6.1	describe that energy is dissipated in a resistance and explain Joule's law;		*	
	14.6.2	apply the equation $E=IVt = I^2Rt = V^2 t/R$ to solve numerical problems;			*
	14.6.3	calculate the cost of energy when given the cost per kWh;			*
	14.6.4	distinguish between D.C and A.C.;		*	
14.7 Uses of Circuit Components	14.7.1	identify circuit components and describe their uses;		*	

**NOTES**

			K	U	A	
14.8	Measuring Instruments (Galvanometer, Ammeter, Voltmeter)	14.8.1	describe the use of electrical measuring devices like galvanometer, ammeter and voltmeter; construct simple series and parallel circuits; explain the behaviour of light bulbs in series and parallel circuit such as, for celebration lights;		*	
		14.8.2				*
		14.8.3			*	
14.9	Alternating Current (A.C)	14.9.1	state the functions of live, neutral and earth wires in the domestic main supply; explain why domestic supplies are connected in parallel series;	*		
		14.9.2			*	
14.10	Safety Measures	14.10.1	describe hazards of electricity; (damage insulation, overheating of cables, damp condition) explain the use of safety measures in household electricity (fuse, circuit breaker, earth wire).		*	
		14.10.2			*	
<b>15. Electromagnetism</b>		<b>Candidates should be able to:</b>				
15.1	Magnetic Effect of a Steady Current	15.1.1	demonstrate that an electric current in a conductor produces a magnetic field around it;			*
15.2	Force on a Current Carrying Conductor in a Magnetic Field	15.2.1	describe that a force acts on a current carrying conductor placed in a magnetic field as long as the conductor is not parallel to the magnetic field;		*	
15.3	Turning Effect on a Current Carrying Coil in a Magnetic Field	15.3.1	describe that a current carrying coil in a magnetic field experiences a torque <i>with the help of Fleming's left hand rule</i> ;		*	



**NOTES**

			<b>K</b>	<b>U</b>	<b>A</b>
15.4	D.C Motor	15.4.1	relate the turning effect on a coil to the action of a D.C. motor;	*	
15.5	Electromagnetic Induction	15.5.1	describe an experiment to show that a changing magnetic field can induce e.m.f. in a circuit;	*	
		15.5.2	describe factors affecting the magnitude of an induced e.m.f.;	*	
		15.5.3	explain that the direction of an induced e.m.f opposes the change causing it and relate this phenomenon to conservation of energy;	*	
15.6	A.C Generator	15.6.1	describe a simple form of A.C generator;	*	
15.7	Mutual Induction	15.7.1	describe mutual induction and state its units;	*	
15.8	Transformer	15.8.1	explain that a transformer works on the principle of mutual induction between two coils;	*	
		15.8.2	describe the purpose of transformers in A.C circuits.	*	
<b>16. Introductory Electronics</b>		<b>Candidates should be able to:</b>			
16.1	Thermionic Emission	16.1.1	explain the process of thermionic emission emitted from a filament;	*	
16.2	Electron Gun and Cathode Rays	16.2.1	describe the simple construction and use of an electron gun as a source of electron beam;	*	
16.3	Deflection of Electron by Electric Field	16.3.1	describe the effect of electric field on an electron beam;	*	
16.4	Deflection of Electron by Magnetic Field	16.4.1	describe the effect of magnetic field on an electron beam;	*	

**NOTES**

				K	U	A
16.5	Cathode Rays Oscilloscope (CRO)	16.5.1	describe the basic principle of CRO and make a list of its uses;		*	
16.6	Introduction to Electronics	16.6.1 16.6.2	differentiate between analogue and digital electronics; <i>describe that digital signals can carry more information;</i>		* *	
16.7	Analogue and Digital Electronics	16.7.1	state the basic operations of digital electronics;	*		
16.8	Logic Gates	16.8.1 16.8.2 16.8.3	identify and draw the symbols for the logic gates; (NOT, OR, AND, NOR and NAND) state the action of the logic gates in truth table form with two inputs; describe the simple uses of logic gates.	*		*
<b>17. Information and Communication Technology</b>		<b>Candidates should be able to:</b>				
17.1	Components of IT	17.1.1	describe information technology (IT) and the components of information technology;(hardware, software, data, procedure and people)		*	
17.2	Flow of Information	17.2.1	describe the transmission of; <ul style="list-style-type: none"> <li>● electric signals through wires,</li> <li>● radio waves through air,</li> <li>● light signals through optical fibres;</li> </ul>		*	
17.3	Communication Technology	17.3.1 17.3.2	describe working and uses of fax machine, cell phone, photo phone and computer; state the purpose of using e-mails and internet;	*	*	

**NOTES**

			K	U	A	
17.4	Storing Information	17.4.1	describe the use of information storage devices such as audio cassettes, video cassettes, hard discs, floppy discs, compact discs and flash drive;		*	
17.5	Handling Information	17.5.1	identify the functions of word processing, data managing, monitoring and controlling.	*		
<b>18. Radioactivity</b>		<b>Candidates should be able to:</b>				
18.1	Atom and Atomic Nucleus	18.1.1	<i>describe Rutherford's nuclear model;</i>		*	
		18.1.2	describe the composition of the nucleus of an atom in terms of protons and neutrons;		*	
		18.1.3	explain that the number of protons in a nucleus distinguishes one element from the other;		*	
		18.1.4	show various nuclides by using the symbol of proton number Z, nucleon number A and the nuclide notation X;		*	
18.2	Natural Radioactivity	18.2.1	explain that some nuclei are unstable;		*	
		18.2.2	describe the three types of radiation ( $\alpha$ , $\beta$ & $\gamma$ );		*	
		18.2.3	state, for radioactive emissions;	*		
			<ul style="list-style-type: none"> <li>● their nature,</li> <li>● their relative ionizing effects,</li> <li>● their relative penetrating abilities,</li> </ul>			
		18.2.4	explain that an element may change into another element when radioactivity occurs;		*	
18.3	Natural Transmutations	18.3.1	show changes in the composition of the nucleus by symbolic equations when alpha or beta particles are emitted;		*	

**NOTES**

			K	U	A
18.4	Background Radiation	18.4.1	describe that radioactive emissions occur randomly over space and time; show an awareness of the existence of background radiation and its sources;	*	
		18.4.2		*	
18.5	Half Life	18.5.1	explain the meaning of half life of a radioactive material; <i>calculate the half life and draw its graph;</i>	*	
		18.5.2			*
18.6	Radio Isotopes	18.6.1	describe radio isotopes and their uses; describe the process of carbon dating to estimate the age of ancient objects;	*	
		18.6.2		*	
18.7	Fission and Fusion	18.7.1	describe the processes of fission and fusion;	*	
18.8	Hazards of Radioactivity and Safety Measures	18.8.1	describe hazards of radioactive materials.	*	



**NOTES**

#### 4. Scheme of Assessment

##### Class IX

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

Topic No.	Topics	No. of Sub-topics	SLOs			Total
			K	U	A	
1.	Physical Quantities and Measurement	7	2	6	3	11
2.	Kinematics	10	3	7	8	18
3.	Dynamics	5	5	10	7	22
4.	Turning Effect of Forces	6	5	5	4	14
5.	Gravitation	5	4	6	2	12
6.	Work and Energy	6	7	6	6	19
7.	Properties of Matter	9	8	11	3	22
8.	Thermal Properties of Matter	7	3	8	2	13
9.	Transfer of Heat	5	2	8	1	11
	<b>Total</b>	<b>60</b>	<b>39</b>	<b>67</b>	<b>36</b>	<b>142</b>
	<b>Percentage</b>		<b>28</b>	<b>47</b>	<b>25</b>	

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

Topic No.	Topics	No. of Sub-topics	Marks			Total
			Multiple Choice Questions	Constructed Response Questions	Extended Response Questions	
1.	Physical Quantities and Measurement	7	3	3	-	6
2.	Kinematics	10	5	6	5	16
3.	Dynamics	5				
4.	Turning Effect of Forces	6	3	3	-	6
5.	Gravitation	5	3	3	-	6
6.	Work and Energy	6	6	6	5	17
7.	Properties of Matter	9				
8.	Thermal Properties of Matter	7	5	4	5	14
9.	Transfer of Heat	5	25	25	15	65
	<b>Total</b>	<b>60</b>				
	Practical (see annex B)					10
	<b>Total</b>					<b>75</b>

**Table 3: Paper Specifications**

<b>Topic No.</b>	<b>Topics</b>	<b>Marks Distribution</b>			<b>Total Marks</b>
1.	Physical Quantities and Measurement	MCQ 3 @ 1 Mark CRQ 1 @ 3 Marks			06
2.	Kinematics	MCQ 5 @ 1 Mark CRQ 2 @ 3 Marks *ERQ 1 @ 5 Marks Choose any ONE from TWO			16
3.	Dynamics				
4.	Turning Effect of Forces	MCQ 3 @ 1 Mark CRQ 1 @ 3 Marks			06
5.	Gravitation	MCQ 3 @ 1 Mark CRQ 1 @ 3 Marks			06
6.	Work and Energy	MCQ 6 @ 1 Mark CRQ 2 @ 3 Marks ERQ 1 @ 5 Marks Choose any ONE from TWO			17
7.	Properties of Matter				
8.	Thermal Properties of Matter	MCQ 5 @ 1 Mark CRQ 1 @ 4 Marks ERQ 1 @ 5 Marks Choose any ONE from TWO			14
9.	Transfer of Heat				
	<b>Total</b>	<b>MCQs</b> <b>25</b>	<b>CRQs</b> <b>25</b>	<b>ERQs</b> <b>15</b>	<b>65</b>
	<b>Practical</b>				<b>10</b>
	<b>Total</b>				<b>75</b>

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

**Class X**

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

Topic No.	Topics	No. of Sub-topics	SLOs			Total
			K	U	A	
10.	Simple Harmonic Motion and Waves	4	3	7	3	13
11.	Sound	4	2	9	0	11
12.	Geometrical Optics	9	6	4	10	20
13.	Electrostatics	9	4	12	3	19
14.	Current Electricity	10	3	12	6	21
15.	Electromagnetism	8	0	10	2	12
16.	Introductory Electronics	8	2	8	1	11
17.	Information and Communication Technology	5	2	4	0	6
18.	Radioactivity	8	1	15	1	17
	<b>Total</b>	<b>65</b>	<b>23</b>	<b>81</b>	<b>26</b>	<b>130</b>
	<b>Percentage</b>		<b>18</b>	<b>62</b>	<b>20</b>	

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

Topic No.	Topics	No. of Sub-topics	Marks			Total
			Multiple Choice Questions	Constructed Response Questions	Extended Response Questions	
10.	Simple Harmonic Motion and Waves	4	4	4	5	13
11.	Sound	4				
12.	Geometrical Optics	9	4	5	5	14
13.	Electrostatics	9	4	6	5	15
14.	Current Electricity	10				
15.	Electromagnetism	8	4	3	-	7
16.	Introductory Electronics	8	4	3	-	7
17.	Information and Communication Technology	5				
18.	Radioactivity	8	5	4	-	9
	<b>Total</b>	<b>65</b>	<b>25</b>	<b>25</b>	<b>15</b>	<b>65</b>
	Practical (see annex B)					10
	<b>Total</b>					<b>75</b>

**Table 6: Paper Specifications**

<b>Topic No.</b>	<b>Topics</b>	<b>Marks Distribution</b>			<b>Total Marks</b>
10.	Simple Harmonic Motion and Waves	MCQ 4 @ 1 Mark CRQ 1 @ 4 Marks *ERQ 1 @ 5 Marks Choose any ONE from TWO			13
11.	Sound				
12.	Geometrical Optics	MCQ 4 @ 1 Mark CRQ 1 @ 2 Marks CRQ 1 @ 3 Marks ERQ 1 @ 5 Marks Choose any ONE from TWO			14
13.	Electrostatics	MCQ 4 @ 1 Mark CRQ 2 @ 3 Marks ERQ 1 @ 5 Marks Choose any ONE from TWO			15
14.	Current Electricity				
15.	Electromagnetism	MCQ 4 @ 1 Mark CRQ 1 @ 3 Marks			07
16.	Introductory Electronics	MCQ 4 @ 1 Mark CRQ 1 @ 3 Marks			07
17.	Information and Communication Technology				
18.	Radioactivity	MCQ 5 @ 1 Mark CRQ 1 @ 4 Marks			09
	<b>Total</b>	<b>MCQs 25</b>	<b>CRQs 25</b>	<b>ERQs 15</b>	<b>65</b>
	<b>Practical</b>				<b>10</b>
	<b>Total</b>				<b>75</b>

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

- 4.1 Tables 1 and 4 summarize the number and nature of SLOs in each topic in classes IX and X. This will serve as a guide in the construction of the examination paper. It also indicates that more emphasis has been given to Understanding (47% and 62%), Application and higher order skills (25% 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 of duration of 3 hours.
- 4.4 Paper I theory will consist of 25 compulsory, multiple choice items. These questions will involve four response options.

- 4.5 Paper II theory will carry 40 marks and consist of a number of compulsory, structured questions and a number of extended response questions. Each extended response question will be presented in an either/or form.
- 4.6 Practical examination will be conducted separate from the theory paper. It will be based on the list of practical activities listed in the examination syllabus.
- 4.7 All constructed response questions will be in a booklet which will also serve as an answer script.
- 4.8 Practical exams to assess performance skills will carry 10 marks in class IX and 10 marks in class X.
- 4.9 It is essential for each school to equip its laboratories with chemicals, instruments, apparatus, specimens etc. according to the requirements of the practicals. Each school will be responsible to make sure that each student is provided the opportunity to do the practicals.

List of practicals is attached as annex B.

## 5. Teaching-Learning Approaches and Classroom Activities

- Instead of one way communication that is lecture by the teachers or dictating notes, it should be interactive teaching with full and increased involvement of students.
- Teachers should encourage question/answer sessions in the classroom.
- Investigative approach through increased opportunities for inquiry and finding the solutions by students themselves.
- Use of videos, software and internet.
- Demonstrations
- Group discussions/work
- Teacher should relate physics to daily life
- Activity-based learning including project assignment

## 6. Recommended Text and Reference Material

### Recommended Books

1. Punjab Textbook Board (2012). *Physics for Class IX*. Lahore: Punjab Textbook Board.
2. Punjab Textbook Board (2012). *Physics for Class X*. Lahore: Punjab Textbook Board.
3. Abbas, Ghayyur. (2012). *Physics Practical Notebook for Class IX*: New Star Book Depot.
4. Abbas, Ghayyur. (2004). *Physics Practical Notebook for Class X*: New Star Book Depot.

## Reference Books

1. Pople, S. (2001). *Explaining Physics/Complete Physics*. Karachi: Oxford University Press.
2. Duncan, T (1995). *O Level Physics (3`d Ed)*. United Kingdom: John Murray.
3. Abbot, A. F. (1989). *Physics*. India: Heinemann Educational Publishers.
4. Sindh Textbook Board (2007). *Physics for Classes IX and X*. Jamshoro: Sindh Textbook Board.
5. John Avison, (Rev Edition). *The World of Physics*. Nelson.

## Recommended Websites

1. [www.learningsupport.akueb.edu.pk](http://www.learningsupport.akueb.edu.pk)
2. [www.extremescience.com](http://www.extremescience.com)
3. [www.wyp-ptm.org](http://www.wyp-ptm.org)
4. [www.particleadventure.org](http://www.particleadventure.org)
5. [www.physorg.com](http://www.physorg.com)
6. [www.explorelearning.com](http://www.explorelearning.com)
7. [www.fearofphysics.com](http://www.fearofphysics.com)
8. [www.aip.org/success/](http://www.aip.org/success/)
9. [www.scienceworld.wdfram.com](http://www.scienceworld.wdfram.com)
10. [www.iaps.info/index.php](http://www.iaps.info/index.php)
11. [www.gravitycontrol.org](http://www.gravitycontrol.org)
12. [www.strategian.com](http://www.strategian.com)
13. [www.opticsnotes.com](http://www.opticsnotes.com)
14. [www.iit.edu/~smile/ph9115.html](http://www.iit.edu/~smile/ph9115.html)
15. [www.explorescience.com](http://www.explorescience.com)
16. [www.practicalphysics.org](http://www.practicalphysics.org)
17. [www.physics2005.org](http://www.physics2005.org)
18. [www.amasci.com/ele-projs.html](http://www.amasci.com/ele-projs.html)
19. [www.tpt.org/newtons/](http://www.tpt.org/newtons/)
20. [www.junkscience.com](http://www.junkscience.com)
21. [www.physlink.com](http://www.physlink.com)
22. [www.amasci.com/amateur/answers1.html](http://www.amasci.com/amateur/answers1.html)
23. [www.edge.org](http://www.edge.org)
24. [www.aerospaceweb.org](http://www.aerospaceweb.org)
25. [www.makaku.org/article\\_physicsof\\_extra.html](http://www.makaku.org/article_physicsof_extra.html)
26. [www.electronicpeasant.com/](http://www.electronicpeasant.com/)
27. [www.fourmilab.ch/earthview/satellite.html](http://www.fourmilab.ch/earthview/satellite.html)
28. [www.dansworkshop.com](http://www.dansworkshop.com)
29. [www.chemcases.com/nuclear/](http://www.chemcases.com/nuclear/)
30. [www.physics.nist.gov/cuu/units/index.html](http://www.physics.nist.gov/cuu/units/index.html)

## 7. Definition of Cognitive Levels and Command Words

### 7.1 Definition of Cognitive Levels

#### Knowledge

This requires knowing and remembering facts and figures, vocabulary and contexts, and the ability to recall key ideas, concepts, trends, sequences, categories, etc. It can be taught and evaluated through questions based on: who, when, where, what, list, define, 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:** Pick out, recognizing specified information from a given content or situation.
- List:** Requires a number of points, generally each of one word, with no elaboration. Where a given number of points are specified, this should not be exceeded.
- Recall:** To bring back to mind and write down, as it is given in the text that you have already memorized.



**State:** Implies concise answer with little or no supporting argument, for example a numerical answer that can be obtained by inspection.

**Write:** To construct full sentences of continuous prose, not abbreviated text.

## **Understanding**

**Classify:** To state a basis for categorization of a set of related entities and assign examples to categories.

**Compare:** To list the main characteristics of two entities clearly identifying similarities (and differences).

**Conceptualize:** To form or prove a concept through observation, experience, facts or given data.

**Derive:** To arrive at a general formula by calculating step by step.

**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:** To identify those characteristics which are always or sometimes distinguish between two categories.

**Discuss:** To give a critical account of the point involved in the topic.

**Distinguish:** To identify those characteristics which are always or sometimes distinguish between two categories.

**Explain:** To reason or use some reference to theory, depending on the context.

**Relate:** Describe how things depend upon, follow from or are part of another.

**Show:** Demonstrate with evidence.

## **Application**

<b>Analyse:</b>	To go beyond using the information for relating different characteristics of the components in given material and for drawing conclusions on the basis of common characteristics.
<b>Apply:</b>	To use the available information in different contexts to relate and draw conclusions.
<b>Calculate:</b>	Is used when a numerical answer is required. In general, working should be shown, especially where two or more steps are involved.
<b>Construct:</b>	Make a simple freehand sketch or diagram. Care should be taken with proportions and the clear labelling of parts.
<b>Convert:</b>	Change or adapt from one system or units to another.
<b>Demonstrate:</b>	To show by argument, facts or other evidences the validity of a statement or phenomenon.
<b>Determine:</b>	Often implies that the quantity concerned cannot be measured directly but is obtained by calculation, substituting measured or known values of other quantities into standard formula, e.g. relative molecular mass.
<b>Draw:</b>	To make a simple freehand sketch or diagram. Care should be taken with proportions and the clear labelling of parts.
<b>Interpret:</b>	Clarify both the explicit meaning and the implications of given information.
<b>Investigate:</b>	Thoroughly and systematically consider a given problem or a statement in order to find out the result or rule applied.
<b>Plot:</b>	To locate and mark one or more points, on a graph by means of coordinates and to draw a graph through these points.
<b>Prove:</b>	To establish a rule or law by using an accepted sequence of procedures on statements.
<b>Solve:</b>	To work out systematically the answer of a given problem.

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

AKU-EB as a national board offers SSC and HSSC 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 <b>OR</b> Urdu Aasan <sup>a</sup> <b>OR</b> History and Geography of Pakistan-I <sup>b</sup>	75	-	75	Urdu Urdu English
Islamiyat-I <b>OR</b> Ethics-I <sup>c</sup>	*30	-	*30	English / Urdu
Pakistan Studies-I	*45	-	*45	English / Urdu
Mathematics-I	75	-	75	English / Urdu
Physics-I	65	10	75	English / Urdu
Chemistry-I	65	10	75	English / Urdu
Biology-I <b>OR</b> Computer Science-I	65	10	75	English / Urdu English
<b>Total:</b>	<b>*495</b>	<b>30</b>	<b>*525</b>	

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

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

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

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

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

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

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

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

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

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

a. Candidates from the province of Sindh may appear in "Urdu Aasan" in SSC Part I and in "Sindhi" in Part II examination.

b. Foreign students may opt HISTORY and GEOGRAPHY OF PAKISTAN in lieu of Urdu Compulsory, subject to the Board's approval.

c. For non-Muslim candidates only.

d. Subject will be offered as Additional Subject.

\* The above will be implemented in

SSC Part I 2013 Examinations and onwards

SSC Part II 2014 Examinations and onwards

**\*\*These subjects are offered ONLY in the May examination.**

## List of Practical Activities

## Class IX

S. No.	SLO No.	OBJECTIVE	APPARATUS
<b>Topic 1: Physical Quantities and Measurement</b>			
1.	1.6.1	To measure the area of cross section by measuring diameter of a solid cylinder with vernier callipers.	Vernier callipers, solid cylinder.
2.	1.6.3	To measure the thickness of a metal strip or a wire by using a screw gauge.	Screw gauge, wire or metal strip.
<b>Topic 2: Kinematics</b>			
3.	2.6.1	To find the weight of an unknown object by using vector addition of forces.	Gravesand's apparatus, slotted weights with hangers, plane mirror strips, plumb line, thread.
4.	2.8.3	To find the acceleration of a ball rolling down an angle iron by drawing a graph between $2S$ and $T^2$ .	Angle iron, iron ball, iron stand, stopwatch, set square.
5.	2.8.4	To study the relationship between load and extension (Helical spring) by drawing a graph.	Helical spring with stand, pan, weight box, meter rod.
6.	2.10.1	To find the value of "g" by free fall method.	Free fall apparatus, pendulum bob, thread, candle, piece of chalk, plumb line.
<b>Topic 3: Dynamics</b>			
7.	3.3.5	To find the tension in strings by balancing a meter on the stands.	Two iron stands, two spring balance, metre rod, wedge, slotted weight with hangers, thread.

S. No.	SLO No.	OBJECTIVE	APPARATUS
<b>Topic 4: Turning Effect of Forces</b>			
8.	4.2.2	To find the weight of an unknown object by using principle of moments.	Meter rod, weight box, thread, wooden wedge.
9.	4.2.2	To verify the principle of moments by using a meter rod balanced on a wedge.	Meter rod, weight box, thread, wooden wedge.
<b>Topic 7: Properties of Matter</b>			
10.	7.5.6	To find the density of a body heavier than water by Archimedes principle.	Physical balance, weight box, beaker, thread, small wooden bench, thermometer, water.
<b>Topic 8: Thermal Properties of Matter</b>			
11.	8.3.1	To find the specific heat by the method of mixture using polystyrene cups. (used as container of negligible heat capacity).	Polystyrene cup with lid and stirrer, hypsometer, burner, thermometer, physical balance, weight box, water.
12.	8.5.1	To draw a graph between temperature and time when ice is converted into water and then to steam by slow heating.	Thermometer, beaker, spirit lamp, sand, ice, stop watch, burner.

Class X

S. No.	SLO No.	OBJECTIVE	APPARATUS
<b>Topic 10: Simple Harmonic Motion and Waves</b>			
1.	10.1.2	To study the effect of the length of simple pendulum on time and hence find “g” by calculation.	A metallic bob with a hook, stop watch, cork, Vernier callipers, thread, iron stand, meter rod, piece of chalk.
2.	10.1.2	To prove that time period of a simple pendulum is independent of (i) mass of the pendulum (ii) amplitude of the vibration.	Different metallic bobs with a hook, stop watch, cork, Vernier callipers, thread, iron stand, meter rod, piece of chalk.
<b>Topic 12: Geometrical optics</b>			
3.	12.3.3	To verify the laws of refraction by using a glass slab.	Glass slab, drawing pins, common pins, drawing board, white paper.
4.	12.3.5	To trace the path of a ray of light through glass prism and measure the angle of deviation.	Glass prism, drawing board, common pins, drawing pins, white paper, meter rod.
5.	12.5.1	To find the refractive index of water by using concave mirror.	Concave mirror, sharp pointed bright needle, stand, meter rod, set square, knitting needle, two wooden blocks.
6.	12.7.1	To find the focal length of a convex lens by parallax method.	Convex lens, knitting needles, convex lens holder, needle stands, optical bench.

S. No.	SLO No.	OBJECTIVE	APPARATUS
<b>Topic 14: Current Electricity</b>			
7.	14.3.1	Verify Ohm's law (using wire as conductor).	Voltmeter, ammeter, battery, connecting wires, resistance, rheostat.
8.	14.4.2	To study resistors in series circuit.	Two resistances, voltmeter, ammeter, key, battery, connecting wires, sand paper.
9.	14.4.2	To study resistors in parallel circuit.	Two resistances, voltmeter, ammeter, key, battery, connecting wires, sand paper.
10.	14.8.1	To find the resistance of galvanometer by half deflection method.	Galvanometer, high resistance box, fractional resistance box, two key plugs, cell, connecting wires.
<b>Topic 15: Electromagnetism</b>			
11.	15.1.1	To trace the magnetic field due to a current carrying circular coil.	Circular coil of insulated copper fitted in a board, white paper plain sheet (A-4 size), scissors, compass needle, battery, key plug, rheostat, connecting wires.
<b>Topic 16: Introductory electronics</b>			
12.	16.8.2	To verify the truth table of OR, AND, gates.	DC power supply, OR gate (7432), AND gate (7408), LED indicator module, two key plugs, connecting wires.