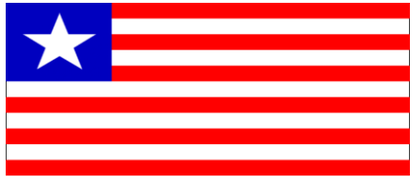

REPUBLIC OF LIBERIA

MINISTRY OF EDUCATION

NATIONAL CURRICULUM FOR GRADES 10 TO 12

PHYSICS

February 2011

MESSAGE FROM THE MINISTER OF EDUCATION

I wish to extend my thanks and appreciation to ECSEL, UNESCO and all our partners for their immense contribution to this important task of revising and strengthening of the National Curriculum. Special thanks to USAID through LTTP for their funding and technical support in the harmonization or realignment of the curriculum. We extend sincere thanks and appreciation to the Bureau of Curriculum Development and Textbook Research, the National Curriculum Taskforce, and the subject specialists from various institutions for the level of professionalism that went into this exercise.

The revision and strengthening of our National Curriculum comes at a time when our nation is faced with the Herculean task or challenge of education transformation, national reconstruction, recovery and renewal in the aftermath of a devastating civil war. Hence, critical to this national challenge is the rebuilding of the education sector as Liberians can not achieve the desired socio-economic progress in the absence of a strong, vibrant and productive education and training system.

The revised national curriculum has two features which include the regular core subject areas of Mathematics, Science, Language Arts and Social Studies and emphasis is being given to the global challenge of HIV/AIDS, Peace, Citizenship, Human Rights and Environmental education. Secondly, the new curriculum is developed in line with international standards especially those practiced and enshrined in the curriculum of our sisterly Republic of Nigeria and Ghana who are also members of the West African Examinations Council (WAEC) .

We wish to urge all our education partners including students, teachers, principals, proprietors of schools and members of school boards to use this curriculum in our schools to enhance quality and relevant instruction and to enable our students to be adequately prepared to take the West African Senior Secondary Certificate Examinations (WASSCE) come 2013 as envisaged by us in the education sector.

May I conclude by once again saying big thank-you to all those who contributed to make this project a success.

Hon. E. Othello Gongar
MINISTER

INTRODUCTION

This curriculum on Physics for Grades 10 to 12 has been designed to provide students with a sound knowledge of the fundamental concepts in Physics, and to nurture in them the skills, competencies, and proper attitudes for the successful study of Science generally, and Physics in particular. It assumes a conceptual approach that focuses on enabling students acquire an understanding of scientific phenomena, facts, concepts, theories, laws, and principles. Accordingly, the major concepts of Motion, Energy, Heat, Waves and Sounds, Matter, Light, etc. are treated in a manner appropriate for the levels targeted. The curriculum also provides ample scope for laboratory/practical work which is essential for students to develop the critical scientific skills needed in the successful study and application of Physics.

A student-centred approach is emphasized in this curriculum. This is based on the firm belief that learning becomes more permanent, meaningful, and exciting when students themselves take ownership of the learning process. Teachers are, therefore, urged to contrive those classroom strategies that would engage students actively in the teaching/learning process.

AIMS AND OBJECTIVES

Upon the completion of this course of study, students will be able to:

1. Demonstrate proper understanding of the basic principles and applications of Physics.
2. Exhibit scientific skills, competencies, and attitudes those are proper to the more advanced study of Physics in particular, and Science in general.
3. Apply their knowledge of Physics to their understanding of the natural and man-made phenomena of everyday life.
4. Recognize the usefulness as well as limitations of the scientific method.

SEMESTER: ONE

PERIOD: I

GRADE: 10

TOPIC: PHYSICAL QUANTITIES

SPECIFIC OBJECTIVES:
Upon completion of this topic, students will be able to:

1. Describe and demonstrate how some measuring instruments are used.
2. Identify and distinguish instruments of length, mass and capacity.
3. Calculate the area and volumes of irregular-shape objects.
4. Write figures in scientific notation.
5. Recognize significant figures.
6. Identify measuring instruments use in hospitals.
7. Identify / distinguished between fundamental and derive quantities and the SI units.
8. Distinguish between precision and accuracy.

OUTCOMES	CONTENTS	ACTIVITIES	MATERIALS	EVALATION
Describe the magnitude of quantities. Analyze the danger of errors during measurement. Clarify measuring instruments. Describe the units of various systems. Clarify how measuring instruments are used in hospitals.	**1. Systems of measurement.** **2. Fundamentals and derived units.** **3. Error calculations.** **4. Significant figures.** **5. Metrics prefixes and units.** **6. Measuring instruments.**	1. Measurement of length, width and height using meter rule. 2. Use micro-meter Varnier caliper to measure length, thickness and depth. 3. Use spherometer to measure thickness of glass and radius of curvature 4. Use spring and beam balances to measure mass	**A. Primary Text** • Brian Arnold, Steve Wolley & Penny Johnson, *Edexcel IGCSE Physics* (Pearson, 2009). **B. Secondary Text** • John Motey Addo & Barry Jackson, *Senior High Physics* (Longman, 2009) 2009). **C. Other Resources/Supplementary Readings** • Bob McDuell, *Senior High*	**Essential tasks students should be able to do:** 1. Describe and demonstrate how some measuring instruments are used. 2. Identify and distinguish instruments of length, mass and capacity. 3. Calculate the area and volumes of irregular-shape objects. 4. Write figures in scientific notation. 5. Recognize significant figures. 6. Identify measuring instruments use in hospitals. 7. Identify / distinguished between

Clarify the difference between fundamentals & derived quantities, and precision & accuracy	**7. Scientific notation.** **8. Units' conversion.**	5. Conversion from one metric prefix to another 6. Discussing the important of measurement to treatment. 7. Conversion of one system of measurement to another.	*Integrated Science* (Pearson, 2009) • Meter rule, screw gauge, speedometer Beaker, spring balance, Beam balance, venires, cylinders, mirror glass lab, geometry set,. • Thermometer, B.P. cuff	fundamental and derive quantities and the SI units. 8. Distinguish between precision and accuracy. **<u>Other essential evaluation tools:</u>** • Assignment • Test • Quizzes • Class work • Final Exams • (Project ,Oral, • Written, and practical exercises) • Laboratory Demonstration

SEMESTER: <u>ONE</u>

PERIOD: <u>II</u>

GRADE: <u>10</u>

TOPIC: VELOCITY AND ACCELERATION

SPECIFIC OBJECTIVES:

Upon completion of this topic, students will be able to:

1. Analyze motion.
2. Describe uniformly accelerated motion.
3. Apply the basic equations of motion.
4. Interpret motion graphs.
5. State Newton's laws of motion.
6. Analyze the effect of gravity on falling bodies.
7. Discuss the force of gravitation between objects.

OUTCOMES	CONTENTS	ACTIVITIES	MATERIALS	EVALUATION
Describe objects as it relate to places, position and time. Analyze motion by using graphs. Analyze the work of Sir Isaac Newton relative to motion.	**1. Nature of motion** **2. Types of motion** **3. Elements of motion** (position, displacement, speed, etc) **4. Speed and velocity** **5. Acceleration** (uniform) **6. Linear motion** **7. Graph and motion** **8. Newton's laws of motion.** **9. Newton's Law of Universal Gravitation**	1. Processes on finding acceleration of gravity using the simple pendulum 2. Demonstrating Newton's laws of motion 3. Exercise using the basic equations of motion 4. Analyze distance- time graph and velocity time graph 5. Distinction between distance and displacement, average and instantaneous velocities 6. Calculate force between masses of two objects.	**A. Primary Text** • Brian Arnold, Steve Wolley & Penny Johnson, *Edexcel IGCSE Physics* (Pearson, 2009). **B. Secondary Text** • John Motey Addo & Barry Jackson, *Senior High Physics* (Longman, 2009) 2009). **C. Other Resources/Supplementary Readings** • Bob McDuell, *Senior High Integrated Science* (Pearson, 2009) • Simple pendulum • meter stick • Stop watch/clock • Graph papers • Rubber band, balloon, cart, rubber or glass tube, cork	**Essential tasks students should be able to do:** 1. Analyze motion. 2. Describe uniformly accelerated motion. 3. Apply the basic equations of motion. 4. Interpret motion graphs. 5. State Newton's laws of motion. 6. Analyze the effect of gravity on falling bodies. 7. Discuss the force of gravitation between objects. • Assignment • Test • Quizzes • Class work • Final Exams • (Project Oral, written, and practical exercises). • Laboratory demonstration

SEMESTER: ONE

PERIOD: III

GRADE: 10

TOPIC: WORK, ENERGY AND POWER

SPECIFIC OBJECTIVES:
Upon completion of this topic, students will be able to:

1. Outline the concept and characteristics of work, energy and power;
2. Identify the types of simple machines
3. Distinguish between work input and work-output
4. Calculate potential and kinetic energies
5. State the law of conservation of mechanical energy
6. Recognize the SI units of work, energy and power.

OUTCOMES	CONTENTS	ACTIVITIES	MATERIALS	EVALUATION
Demonstrate how machines make work easier. Describe power as an outcome of work done in a given time. Explain the relationship between KE and PE.	**1. Concept and characteristics of work, energy and power.** **2. Simple machines.** **3. Efficiency.** **4. Potential and kinetic energies.** **5. Conservation of mechanical energy.**	1. Experimenting with system of pulleys and inclined plane. 2. Clarify Hooke's law by experimenting with helical spring showing that stress is proportional to strain 3. Identification of some simple machines at home and in school. 4. Working according to time. Timing your activities.	**A. Primary Text** • Brian Arnold, Steve Wolley & Penny Johnson, *Edexcel IGCSE Physics* (Pearson, 2009). **B. Secondary Text** • John Motey Addo & Barry Jackson, *Senior High Physics* (Longman, 2009) 2009). **C. Other Resources/Supplementary Readings** • Bob McDuell, *Senior High*	**Essential tasks students should be able to do:** 1. Outline the concept and characteristics of work, energy and power; 2. Identify the types of simple machines 3. Distinguish between work input and work-output 4. Calculate potential and kinetic energies 5. State the law of conservation of mechanical energy 6. Recognize the SI units of work, energy and power.

		5. Calculating the efficiency / IMA, AMA and the velocity ratio of a machine 6. Identifying the sources and forms of energy 7. Calculation involving work, energy & power	*Integrated Science* (Pearson, 2009) • Set of simple machines • Meter rule • Stop clock, coil spring, assorted masses	**Other essential evaluation tools:** • Assignment • Test • Quizzes • Class work • Exams • Projects • Oral, written, and practical exercises • Laboratory demonstration

SEMESTER: ONE

PERIOD: IV

GRADE: 10

TOPIC: TEMPERATURE AND THERMAL EXPANSION

SPECIFIC OBJECTIVES:

Upon completion of this topic, students will be able to:

1. Convert from one temperature scales to the other.
2. Explain coefficient of linear expansion & its disadvantages.
3. State at least three advantages of linear expansion.
4. Explain the abnormal expansions of water.
5. State Charles, Boyle's, combined gas laws, and pressure laws

OUTCOMES	CONTENTS	ACTIVITIES	MATERIALS	EVALUATION
Recognize that water expands abdominally between 0'C- and 4'C. Describe the construction and use of heat engines and cooling systems. Demonstrate expansion and contraction of objects during temperature change. Demonstrate the uses of temperature scales	**1. Temperature Scale.** **2. Types of Thermometers.** **3. Linear Expansion.** **1. Area and Volume Expansion.** **2. Abnormal Expansion of water.** **3. Charles and Boyle's laws.** **4. Combined gas law.** **5. Pressure Law ($P_2 T_1 = P_1 T_2$).**	1. Experimenting on linear expansion, Charles law using boiling water. 2. Demonstrating Conductivity of different metals. 3. Calculation involving Charles, Boye, Combined and Pressure Laws. 4. Lower and upper fixed points of thermometer. 5. Demonstration of a. Max-min temperature b. Air thermometer c. Alcoholic thermometer d. Mercury thermometer..	**A. Primary Text** • Brian Arnold, Steve Wolley & Penny Johnson, *Edexcel IGCSE Physics* (Pearson, 2009). **B. Secondary Text** • John Motey Addo & Barry Jackson, *Senior High Physics* (Longman, 2009) 2009). **C. Other Resources/Supplementary Readings** • Bob McDuell, *Senior High Integrated Science* (Pearson, 2009) • Linear expansion apparatus • Metal rods, weight meter stick • Heat engine apparatus • Rubber tubing • Thermo flask • Source of heat	**Essential tasks students should be able to do:** 1. Convert from one temperature scales to the other. 2. Explain coefficient of linear expansion & its disadvantages. 3. State at least three advantages of linear expansion. 4. Explain the abnormal expansions of water. 5. State Charles, Boyle's, combined gas laws, and pressure laws **Other essential evaluation tools:** Assessment • Test • Quizzes • Class room • Exams • Project • Oral, Written and practical exercises • Laboratory demonstration

SEMESTER: ONE

PERIOD: V

GRADE: 10

TOPIC: ELECTROSTATICS

SPECIFIC OBJECTIVES:

Upon completion of this topic, students will be able to:

1. Name the two kinds of electric charges.
2. State the methods of electrification.
3. Distinguish between conductors and insulators.
4. Distinguish between coulomb's law of electrostatics and the law of electric charges.
5. Draw lines of force relative to charges.
6. Calculate potential difference and capacitance.
7. Name the types of capacitors.

OUT COMES	CONTENTS	ACTIVITIES	MATERIALS	EVALUATION
Describe electric line of force as vectors. Recognize that electric charges can be stationery. Clarify that force exists between two or more charges. Demonstrate the uses of capacitors in electronic devices (television, radio, and calculators). .	**1. Charges at rest** **2. Coulombs law** **3. Electric field** **4. Potential difference** **5. Capacitance** **6. Distribution and storage of changes on surface**	1. Exercising using the equation of coulomb's law. 2. Displaying and demonstrating electroscope. 3. Demonstrating electrification using silk and glass rod . 4. Experiments involving Charge and discharge capacitors. 5. Calculating involving	**A. Primary Text** • Brian Arnold, Steve Wolley & Penny Johnson, *Edexcel IGCSE Physics* (Pearson, 2009). **B. Secondary Text** • John Motey Addo & Barry Jackson, *Senior High Physics* (Longman, 2009) 2009). **C. Other Resources/Supplementary Readings** • Bob McDuell, *Senior High Integrated Science* (Pearson, 2009)	**Essential tasks students should be able to do:** 1. Name the two kinds of electric charges. 2. State the methods of electrification. 3. Distinguish between conductors and insulators. 4. Distinguish between coulomb's law of electrostatics and the law of electric charges. 5. Draw lines of force relative to charges. 6. Calculate potential difference and capacitance. 7. Name the types of capacitors. • Assignments • Test

		electric field intensity, potential difference and gradients. 6. Discussing the structure and operation of capacitors, charging and discharging capacitors.	• Electroscope glass rod • silk, combs, pieces of paper, plastic pens capacitors, power source, voltmeter ammeter, conduction wires.	• Quizzes • Class work • Exams • Projects • Oral, written, and practical exercises • Laboratory demonstration

SEMESTER: ONE

PERIOD: VI

GRADE: 10

TOPIC: PROPERTIES OF MATTER

SPECIFIC OBJECTIVES:

Upon completion of this topic, students will be able to:

1. Distinguish between atoms and molecules
2. Explain the kinetic theory of matter
3. Distinguish between cohesion and adhesion
4. Name the properties of solid, liquid and gases
5. State Hooke's law
6. Apply Young's modulus in solving problems involving stress and strain.

OUTCOMES	CONTENT	ACTIVITIES	MATERIALS	EVALUATION
Recognize the structure of matter Describe the changes of phase. Analyzed that the properties of a material determines its uses. Clarify that stress is proportional to strain.	**1. The structure of matter.** **2. Kinetic theory.** **3. Forces between molecules.** **4. The phases of matter** **5. Young's modulus** **6. Hooke's Law**	1. Finding the specific gravity using a. U-tubes b. Specific gravity bottles c. Archimedes principles. 2. Verifying law of floatation. 3. Experimenting using test tube hydrometer 4. Demonstrating with a. Inner tubing b. Force siphons c. Life pumps d. Hydrometer. 5. Demonstrating a. Cohesion and adhesion b. Ductility and malleability c. Capillarity d. surface e. Tension with different liquids in tubes with various diameters. 6. Discussing viscosity and diffusion in solid, liquid and gas. 7. Discussing work done in springs and elastic strings.	**A. Primary Text** • Brian Arnold, Steve Wolley & Penny Johnson, *Edexcel IGCSE Physics* (Pearson, 2009). **B. Secondary Text** • John Motey Addo & Barry Jackson, *Senior High Physics* (Longman, 2009) 2009). **C. Other Resources/Supplementary Readings** • Bob McDuell, *Senior High Integrated Science* (Pearson, 2009) • U-tubes, liquids • Hares apparatus • Gravity bottle • hydrometer, test tubes, force siphons, life pump crystal samples • balloons	**Essential tasks students should be able to do:** 1. Distinguish between atoms and molecules 2. Explain the kinetic theory of matter 3. Distinguish between cohesion and adhesion 4. Name the properties of solid, liquid and gases 5. State Hooke's law 6. Apply Young's modulus in solving problems involving stress and strain. **Other essential evaluation tools:** • Assignments • Test • Quizzes • Class work • Exams • Project • Oral, written, and practical exercises • Laboratory demonstration

SEMESTER: ONE

PERIOD: I

GRADE: 11

TOPIC: MOTION IN TWO DIMENSIONS

SPECIFIC OBJECTIVES:

Upon completion of this topic, students will be able to:

1. Distinguish between scalar and vectors.
2. Apply equations of motion in solving problems (one and two dimensions).
3. Distinguish between centripetal and centrifugal forces.
4. Solve simple rotational inertial problems.
5. Recognize the pendulum as a time measuring device.
6. Distinguish rotary motion from circular motion.

OUTCOMES	CONTENTS	ACTIVITIES	MATERIALS	EVALUATION
State the difference between scalars and vectors. Recognize the use of vector in space and navigation. Describe the pendulum as a timing device. Recognize the importance of road banking and the use of sling.	**1. Scalars and vectors.** **2. Equations of motion.** **3. Projectile motion.** **4. Rotational motion.** **5. Circular motion.** **6. Simple harmonic motion.** **7. Oscillatory and relative motions.**	1. Exercise solving problem using equations of motion (projectile, rotary, circular etc). 2. Demonstration of motion using kits (toys cars, pendulum). 3. Calculation in projectile motion involving range, height and time of flight. 4. Finding acceleration due to gravity. 5. Performing centripetal force experiment using a T- sling. 6. Swinging small ball tied to a string in vertical and horizontal	**A. Primary Text** • Brian Arnold, Steve Wolley & Penny Johnson, *Edexcel IGCSE Physics* (Pearson, 2009). **B. Secondary Text** • John Motey Addo & Barry Jackson, *Senior High Physics* (Longman, 2009) 2009). **C. Other Resources/Supplementary Readings** • Bob McDuell, *Senior High Integrated Science* (Pearson, 2009) • Motion demonstration kit	**Essential tasks students should be able to do:** 1. State the difference between scalars and vectors. 2. Recognize the use of vector in space and navigation. 3. Describe the pendulum as a timing device. 4. Recognize the importance of road banking and the use of sling. **Other essential evaluation tools:** • Assignment • Test • Quizzes • Class work • Exams • Project; Oral, written, and practical exercises.

		circles at varying length and discusses what they observed.	• Toy cars, stop clocks, meter stick, twine • Pendulum bulbs • Geometry set • Rotation bar • Force	• Lab. demonstration

SEMESTER: ONE

PERIOD: II

GRADE: 11

TOPIC: COMPOSITION AND RESOLUTION OF FORCES

SPECIFIC OBJECTIVES:

Upon completion of this topic, students will be able to:

1. Combine force vectors.
2. Apply the cosine and sine laws.
3. Find components of a given force.
4. Distinguish between resultant and equilibrant force.
5. State and apply the two conditions for equilibrium.
6. Define and calculate coefficient of friction.
7. Distinguish between center of gravity and center of mass.

OUTCOMES	CONTENTS	ACTIVITIES	MATERIALS	EVALUATION
Outline the role of friction as hindrance and necessity. Demonstrate the application of torque in the use of seesaw and merry-go-round.	**1. Resultant and equilibrant forces.** **2. Composition of forces.** **3. Resolution of forces** **4. Parallel forces.**	1. Performing center of gravity and equilibrium experiment using force table. 2. Demonstrating composition and resolution of forces	**A. Primary Text** • Brian Arnold, Steve Wolley & Penny Johnson, *Edexcel IGCSE Physics* (Pearson, 2009). **B. Secondary Text** • John Motey Addo & Barry	**Essential tasks students should be able to do:** 1. Outline the role of friction as hindrance and necessity. 2. Demonstrate the application of torque in the use of seesaw and merry-go-round. 3. Describe the two conditions of

Describe the two conditions of equilibrium. Clarify the position that center of gravity determines stability or instability of an object.	**5. Torque.** **6. Center of gravity.** **7. Friction.**	using the force table. 3. Performing co-efficient of friction experiments (kinetic and static)using the inclined plan. 4. Calculation involving forces. 5. Discussing the methods of reducing friction..	Jackson, *Senior High Physics* (Longman, 2009) 2009). **C. Other Resources/Supplementary Readings** • Bob McDuell, *Senior High Integrated Science* (Pearson, 2009) • Weights • Pulleys, force table • Air track and accessories • Hard board • Inclined plane wooden blocks.	equilibrium. 4. Clarify the position that center of gravity determines stability or instability of an object. **Other essential evaluation tools:** • Assignment • Test • Quizzes • Class work • Exams • Project • Oral, Written and practical exercises • Laboratory demonstration

SEMESTER: ONE

PERIOD: III

GRADE: 11

TOPIC: MOMENTUM AND ITS CONSERVATION

SPECIFIC OBJECTIVES:

Upon completion of this topic, students will be able to:

1. Describe the nature of momentum.
2. Explain the relationship between impulse and momentum.
3. Distinguish between elastic and inelastic collisions.
4. State the laws of conservation of linear and angular momentum.

OUTCOMES	CONTENTS	ACTIVITIES	MATERIALS	EVALUATION

Recognize the dangers in the collision of moving objects and avoid them.
 	
Clarify that momentum depends on mass and velocity.
 	
Demonstrate the role of spinning flywheels attached to shafts in doing work.
	1. Impulse of forces.
	
	2. Elastic and inelastic collisions.
	
	3. Nature of momentum.
	
	4. Angular Momentum.
	
	5. Conservation of Momentum.
		1. Demonstrating conservation of momentum (momentum carts) elastic and elastic).
		
		2. Performing experiment verifying conservation of momentum using pendulum.
		
		3. Calculation involving elastic and inelastic collision.
			A. Primary Text
			• Brian Arnold, Steve Wolley & Penny Johnson, *Edexcel IGCSE Physics* (Pearson, 2009).
			B. Secondary Text
			• John Motey Addo & Barry Jackson, *Senior High Physics* (Longman, 2009) 2009).
			C. Other Resources/Supplementary Readings
			• Bob McDuell, *Senior High Integrated Science* (Pearson, 2009)
			  • Air track (set)
			  • Bump putty cars
				Essential tasks students should be able to do:
				1. Recognize the dangers in the collision of moving objects and the means to avoid them.
				2. Clarify that momentum depends on mass and velocity.
				3. Demonstrate the role of spinning flywheels attached to shafts in doing work.
				
				Other essential evaluation tools:
				• Assignments
				• Class work
				• Test
				• Quizzes
				• Exams
				• Project Oral, Written, and Practical exercises)
				• Laboratory demonstration

SEMESTER: ONE

PERIOD: IV

GRADE: 11

TOPIC: HEAT AND ITS MEASUREMENTS

SPECIFIC OBJECTIVES:

Upon completion of this topic, students will be able to:

1. Outline the concept and characteristics of heat.
2. Distinguish between specific heat and specific heat capacity.
3. State the methods of heat transfer.
4. State the laws of heat exchange.
5. Recognize that object changes phase from one to another.

OUTCOMES	CONTENTS	ACTIVITIES	MATERIALS	EVALUATION
1. Describe heat as a form of energy. 2. Distinguish between heat and temperature. 3. Demonstrate that the amount of heat a substance contains depends on the type of substance. 4. Clarify that heat flows from high to low temperate zones. 5. Explain the effects of heat in our environment.	**1. Heat** **2. Specific heat and specific capacity** **3. Heat transfer** **4. Latent heat of fusion and vaporization** **5. Change of Phase** **6. heat engines**	1. Calorimeter heat experiments 2. Find specific heat of various metals latent heat of fusion and heat of vaporization 3. with triple point cell 4. Displaying and demonstrating the principles of the combustion engines. i.	**A. Primary Text** • Brian Arnold, Steve Wolley & Penny Johnson, *Edexcel IGCSE Physics* (Pearson, 2009). **B. Secondary Text** • John Motey Addo & Barry Jackson, *Senior High Physics* (Longman, 2009) 2009). **C. Other Resources/Supplementary Readings** • Bob McDuell, *Senior High Integrated Science* (Pearson, 2009) • Calorimeter thermometer,	**Essential tasks students should be able to do:** 1. Outline the concept and characteristics of heat. 2. Distinguish between specific heat and specific heat capacity. 3. State the methods of heat transfer. 4. State the laws of heat exchange. 5. Recognize that object changes phase from one to another. **Other essential evaluation tools:** • Assignments • Quizzes • Class work • Test • Exams • Project; oral, written and practical exercises

			hydrometer, liquids, heat sources, Beakers, triple point cell, ice camphor ball, solid air freshener	• Laboratory demonstrations

SEMESTER: ONE

PERIOD: V

GRADE: 11

TOPIC: WAVES AND SOUND

SPECIFIC OBJECTIVES:

Upon completion of this topic, students will be able to:

1. Outline the characteristics and the concept of waves.
2. State the properties and characteristics of waves.
3. Name the two categories of waves.
4. Calculate the speed of wave.
5. Explain methods of production and transmittal of sound wave.
6. Calculate the speed of sound relative to temperature.
7. Explain the Doppler effect.

OUTCOMES	CONTENTS	ACTIVITIES	MATERIALS	EVALUATION
Describe various methods of energy transfer. Clarify that vibration causes waves. Recognize the application of Doppler Effect to detect red shift, radar techniques and satellite tracking system. Explain the occurrence of fundamental and harmonics notes in music.	**1. Nature of waves.** **2. Wave interactions.** **3. Nature of sound waves.** **4. Characteristics of sound waves.** **5. Speed of sound.** **6. Properties of sound wave.** **7. Doppler Effect.**	1. Performing ripple tank experiment. 2. Demonstrating transverse wave using a string 3. Demonstrating longitudinal wave using a cool spring 4. Doing exercises relative to the wave equations (v=Xf) 5. Demonstrating Doppler effect using turning forks 6. Using percussion instrument (drum, bells, cymbal, horn, guitar, flute etc) sassa. to produce different sounds to illustrate methods of sound transmission. 7. Detail discussions should include types of waves, transmission of sound, classification of musical instruments, beat, noise, echoes etc.	**A. Primary Text** • Brian Arnold, Steve Wolley & Penny Johnson, *Edexcel IGCSE Physics* (Pearson, 2009). **B. Secondary Text** • John Motey Addo & Barry Jackson, *Senior High Physics* (Longman, 2009) 2009). **C. Other Resources/Supplementary Readings** • Bob McDuell, *Senior High Integrated Science* (Pearson, 2009) • Ripple tank • Strings (ropes) • Coil spring • Turning forks • Resonance boxes • Open and closed tubes • Drums, bells, cymbals, horn, flute sassa, guitar, etc.	**Essential tasks students should be able to do:** 1. Describe various methods of energy transfer. 2. Clarify that vibration causes waves. 3. Recognize the application of Doppler Effect to detect red shift, radar techniques and satellite tracking system. 4. Explain the occurrence of fundamental and harmonics notes in music. **Other essential evaluation tools:** • Assignments • Quizzes • Test • Class work • Exams • Projects oral, written and practical exercises • Laboratory demonstration

SEMESTER: ONE

PERIOD: VI

GRADE: 11

TOPIC: LIGHT

SPECIFIC OBJECTIVES:

Upon completion of this topic, students will be able to:

1. List the sources of radiant energy and give examples
2. Illustrate and discuss production of shadow and eclipses
3. Explain and demonstrate the image formation using a mirror
4. State the major regions of the electromagnetic spectrum
5. Explain the photoelectric effect
6. Explain the basic principle of a laser
7. Distinguish between luminous and illuminate objects
8. State the effects of burning on the environment

OUTCOMES	CONTENTS	ACTIVITIES	MATERIALS	EVALUATION
Describe optical instruments and states their uses. Demonstrate object image relationship. Recognize that photometry is a study of light Describe total internal reflection in crystal. Clarify that some objects emit their own light while others only reflect light.	**1. Nature of light.** **2. Sources of light.** **3. Illumination.** **4. Reflection.** **5. Inclined and spherical mirror.** **6. Laser.** 7. **Photoelectric** effect	1. Demonstrating the production of shadows and ellipses 2. Experimenting with Pin-hole camera to illustrate rectilinear propagation of light rays. 3. Displaying and demonstrating a laser pointer 4. Exercise using the mirror equation (1/f = 1/u + 1/v)	**A. Primary Text** • Brian Arnold, Steve Wolley & Penny Johnson, *Edexcel IGCSE Physics* (Pearson, 2009). **B. Secondary Text** • John Motey Addo & Barry Jackson, *Senior High Physics* (Longman, 2009) 2009). **C. Other Resources/Supplementary Readings** • Bob McDuell, *Senior High Integrated Science*	**Essential tasks students should be able to do:** 1. Describe optical instruments and states their uses. 2. Demonstrate object image relationship. 3. Recognize that photometry is a study of light 4. Describe total internal reflection in crystal. 5. Clarify that some objects emit their own light while others only reflect light. **Other essential evaluation tools:** • Assignment • Test

			(Pearson, 2009) **C. Other Resources/Supplementary Readings** • Ray-box • Pin-hole camera • Laser pointer • Photometer • Plane and curve • Mirrors • Air track (set) • Meter rule • Posters • Markers	• Class work • Quizzes • Exams • Project oral, written, and practical exercises • Laboratory demonstration

SEMESTER: ONE

PERIOD: I

GRADE: 12

TOPIC: REFRACTION AND DISPERSION

SPECIFIC OBJECTIVES:

Upon completion of this topic, students will be able to:

1. Explain and illustrate the laws of refraction.
2. Calculate and discuss the refractive index of various materials.
3. Demonstrate Snells law in solving problems.
4. Distinguish between primary colors and primary pigments.
5. Explain total internal reflection and critical angle.
6. Distinguish between constructive and destructive interference.
7. Explain how polarization confirms the transverse wave function of light.

OUTCOMES	CONTENTS	ACTIVITIES	MATERIALS	EVALUATION
Explain how rainbow is a direct result of refraction. Clarify that the shapes of objects in liquids are refractive index dependent Recognize that the brilliancy of diamond is due to its high index of refraction Identify eye defects and state how they can be corrected using lenses Demonstrate the polarization of light in	**1. Optical refraction** **2. Lens optics** **3. Dispersion** **4. Interference and diffraction** **5. Polarization** **6. Snells law and critical angles.** **7. Eye defects**	1. Displaying optical instruments for description. 2. Using prism to disperse light. 3. Experimenting with glass block and prism to find the refractive index of material of glass. 4. Demonstrating constructive and destructive interference of waves. 5. Using polarizer to illustrate polarization	**A. Primary Text** • Brian Arnold, Steve Wolley & Penny Johnson, *Edexcel IGCSE Physics* (Pearson, 2009). **B. Secondary Text** • John Motey Addo & Barry Jackson, *Senior High Physics* (Longman, 2009) 2009). **C. Other Resources/Supplementary Readings** • Bob McDuell, *Senior High Integrated Science*	**Essential tasks students should be able to do:** 1. Explain how rainbow is a direct result of refraction. 2. Clarify that the shapes of objects in liquids are refractive index dependent 3. Recognize that the brilliancy of diamond is due to its high index of refraction 4. Identify eye defects and state how they can be corrected using lenses 5. Demonstrate the polarization of light in photographing **Other essential evaluation tools:** • Assignments

photographing		of light, 6. Discussion should include the eye defects and correction, the camera, projection, simple and compound microscopes and telescopes.	(Pearson, 2009) **C. Other Resources/Supplementary Readings** • lenses (set) • prisms • glass slab. • color charts • color filters • water color set • color mixer • polarizer • Interferometers	• Tests • Quizzes • Class work • Final Exams • Projects, • Oral, written, and practical exercises • Laboratory demonstration

SEMESTER: ONE

PERIOD: II

GRADE: 12

TOPIC: **ELECTRODYNAMICS**

SPECIFIC OBJECTIVES:

Upon completion of this topic, students will be able to:

1. Identify sources of direct current.
2. Distinguish and analyze series and parallel circuits.
3. State Ohms law.
4. State Kirchhoff's laws of electric energy.

OUTCOMES	CONTENTS	ACTIVITIES	MATERIALS	EVALUATION
Recognize that radiant energy is a source of electricity. Describe internal resistance of emf sources. Recognize the advantage of parallel circuit over series circuit in house wiring	**1. Sources of direct current** **2. Series and parallel circuits** **3. Internal resistance** **4. Factors affecting resistance of a conductor** **5. Heating effects** **6. Electrolysis** **7. Kirchhoff's Law of electric energy**	1. Displaying and illustrating sources of direct current. 2. Constructing series and parallel circuits using lamps. 3. Solving practical problems applying ohms law. 4. Demonstrating heating effect in circuits using cells and tungsten wire) 5. Detail discussion should include the meter bridge, potentiometer, shunt and multiplier and the measuring	**A. Primary Text** • Brian Arnold, Steve Wolley & Penny Johnson, *Edexcel IGCSE Physics* (Pearson, 2009). **B. Secondary Text** • John Motey Addo & Barry Jackson, *Senior High Physics* (Longman, 2009) 2009). **C. Other Resources/Supplementary Readings** • Bob McDuell, *Senior High Integrated Science* (Pearson, 2009) • Sources of emf(cells) • Electric meters	**Essential tasks students should be able to do:** 1. Identify sources of direct current. 2. Distinguish and analyze series and parallel circuits. 3. State Ohms law. 4. State Kirchhoff's laws of electric energy. **Other essential evaluation tools:** • Assignments • Tests • Quizzes • Class work • Final Exams • Projects • Oral, written and practical exercises • Laboratory demonstration

		instruments of elective circuits.	• Wheatstone bridge • Constantan wire (28 gauge) • Conduction wires • Photocell • Tungsten wire • Resistance box • Lamps (6 or 12 vl)	

SEMESTER: ONE

PERIOD: III

GRADE: 12

TOPIC: **MAGNETISM AND ELECTRO - MAGNETISM**

SPECIFIC OBJECTIVES:

Upon completion of this topic, students will be able to:

1. State the origin of magnets.
2. Explain the relationship between electricity and magnetism.
3. Distinguish motor from generator.
4. Demonstrate the principle of transformer and perform calculation involving transformer.
5. State the difference between AC and DC motors.

OUTCOMES	CONTENTS	ACTIVITIES	MATERIALS	EVALUATION
Recognize the usage of magnets in electromagnetism Clarify that magnets exerts forces Demonstrate the uses of transformers Demonstrate interaction between electricity and magnetisms	**1. Magnetism** **2. Electromagnetism** **3. Induced Current** **4. Generator and Motors** **5. Inductance (transformer)**	1. Discussion should include the magnetization, demagnetization, the magnet domain of a magnet. 2. Displaying various types of magnets for description. 3. Demonstrating the laws of magnetism for verification. 4. Converting AC to DC and vice versa. 5. Demonstrating magnetic field using	**A. Primary Text** • Brian Arnold, Steve Wolley & Penny Johnson, *Edexcel IGCSE Physics* (Pearson, 2009). **B. Secondary Text** • John Motey Addo & Barry Jackson, *Senior High Physics* (Longman, 2009) 2009). **C. Other Resources/Supplementary Readings** • Bob McDuell, *Senior High Integrated Science* (Pearson, 2009) • Magnets (Bar, U-shape and	**Essential tasks students should be able to do:** 1. State the origin of magnets. 2. Explain the relationship between electricity and magnetism. 3. Distinguish motor from generator. 4. Demonstrate the principle of transformer and perform calculation involving transformer. 5. State the difference between AC and DC motors. **Other essential evaluation tools:** • Assignments • Tests • Quizzes • Class work • Final Exams • Projects

		iron fillings. 6. Displaying a transformer and illustrate its uses.	horse-shoe) • Iron fillings • Magnetometer • Mapping compass • Nails, galvanometer • transformer • Demonstration motor • Ammeter and volt meter	• Oral, written and practical exercises • Laboratory demonstration

SEMESTER: ONE

PERIOD: IV

GRADE: 12

TOPIC: **ALTERNATING CURRENT**

SPECIFIC OBJECTIVES:

Upon completion of this topic, students will be able to:

1. Identify electrical measuring instruments and state their uses.
2. Demonstrate the functions of alternating current.
3. Distinguish between resistance and impedance.
4. Explain the R, C, L circuits.
5. Draw a phase diagram R.C.L. Circuits.
6. Explain the principle of the cathode ray tube.
7. State applications of transistors and diodes.

OUTCOMES	CONTENTS	ACTIVITIES	MATERIALS	EVALUATION
Recognize the usage of alternating current Demonstrate how capacitors store current Recognize television screen as a vacuum tube Clarify that transistors are important components of transceivers and receivers	**1. AC measurements** **2. Function of AC** **3. Resonance** **4. Vacuum tubes** **5. Transistors and diodes**	1. Displaying electrical measuring instruments for verification. 2. Performing experiment in circuits involving: a) inductor b) capacitor c) resistor 3. Describing and discussing vacuum tubes 4. Demonstrating the uses of transistors and diodes.	**A. Primary Text** • Brian Arnold, Steve Wolley & Penny Johnson, *Edexcel IGCSE Physics* (Pearson, 2009). **B. Secondary Text** • John Motey Addo & Barry Jackson, *Senior High Physics* (Longman, 2009) 2009). **C. Other Resources/Supplementary Readings** • Bob McDuell, *Senior High Integrated Science* (Pearson, 2009)	**Essential tasks students should be able to do:** 1. Identify electrical measuring instruments and state their uses. 2. Demonstrate the functions of alternating current. 3. Distinguish between resistance and impedance. 4. Explain the R, C, L circuits. 5. Draw a phase diagram R.C.L. Circuits. 6. Explain the principle of the cathode ray tube. 7. State applications of transistors and diodes. **Other essential evaluation tools:** • Assignments

			• Vacuum tubes • Voltmeter, ammeter ohm meter • Resistors, capacitors and inductors • Diodes and transistors • Conduction wires • Power source	• Tests • Quizzes • Class work • Final Exams • Projects • Oral, written and practical exercises • Laboratory demonstration

SEMESTER: ONE

PERIOD: V

GRADE: 12

TOPIC: **ATOMIC AND NUCLEAR PHYSICS**

SPECIFIC OBJECTIVES:

Upon completion of this topic, students will be able to:

1. State the properties of an electron.
2. Discuss and explain the effect of radioactivity substances on the human body.
3. Draw and label a typical atom.
4. State some applications of nuclear energy.
5. Distinguish between fission and fusion.

OUTCOMES	CONTENTS	ACTIVITIES	MATERIALS	EVALUATION
Identify substances that can emit harmful particles Recognize the sun as bi-product of fission. Demonstrate conversion of nuclear energy into other forms. Take appropriate precautions against the harm of long term exposure to radioactive substances,	**1. The electron** **2. The nucleus** **3. Types of nuclear Reactions** **1. Uses of nuclear energy** **2. Radioactive substances** **- effects on lives** **3. Nuclear fission and fusion** **4. Thermionic emission, cathode and x - rays**	1. Displaying and demonstrating the existence and strength of radioactive detectors and radioactive substance. 2. Drawing and displaying a simple fission and fusion reaction.. (exp. U238 disintegration). 3. Listing application of nuclear energy. 4. Performing tracer experiment. 5. Stating and discussing effects of radioactive	**A. Primary Text** • Brian Arnold, Steve Wolley & Penny Johnson, *Edexcel IGCSE Physics* (Pearson, 2009). **B. Secondary Text** • John Motey Addo & Barry Jackson, *Senior High Physics* (Longman, 2009) 2009). **C. Other Resources/Supplementary Readings** • Bob McDuell, *Senior High Integrated Science* (Pearson, 2009) • Atomic model • Heavy nuclei chart	**Essential tasks students should be able to do:** 1. State the properties of an electron. 2. Discuss and explain the effect of radioactivity substances on the human body. 3. Draw and label a typical atom. 4. State some applications of nuclear energy. 5. Distinguish between fission and fusion. **Other essential evaluation tools:** • Assignments • Tests • Quizzes • Class work • Final Exams • Projects • Oral, written and practical exercises

		substances on lives. 6. Explanation should include the cathode ray and x – rays, their nature, properties and characteristics.	• Periodic table • Geiger, counter and muller • Radioactive sources • Lead shields • Nuclear actors • Posters • Markers • Newspapers / Magazines	• Laboratory demonstration

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SEMESTER: ONE

PERIOD: VI

GRADE: 12

TOPIC: **HIGH ENERGY PHYSICS**

SPECIFIC OBJECTIVES:

Upon completion of this topic, students will be able to:

1. State the uncertainty principle
2. Name the principle quantum numbers and describe the motion of an electron
3. State and discuss various types of particle accelerators
4. Identify and discuss the four basic interactions between particles of matter
5. State the conservation laws of particle physics.

OUTCOMES	CONTENTS	ACTIVITIES	MATERIALS	EVALUATION
Explain how the disintegration of atoms produces energy Recognize other subatomic particles. Explain how particles can be accelerated and captured	**1. Quantum mechanics** **2. Particle Accelerators** **3. Detecting instruments** **4. Subatomic reactions** **5. Einstein's photoelectric equation**	1. Half –life experiment using Geiger counters 2. Electron configuration of some light elements 3. Drawing and libeling diagram of various particle accelerators 4. Preparing a chart of subatomic particles.	**A. Primary Text** • Brian Arnold, Steve Wolley & Penny Johnson, *Edexcel IGCSE Physics* (Pearson, 2009). **B. Secondary Text** • John Motey Addo & Barry Jackson, *Senior High Physics* (Longman, 2009) 2009). **C. Other Resources/Supplementary Readings** • Bob McDuell, *Senior High Integrated Science* (Pearson, 2009) • Geiger muller counter • Half-life chart	**Essential tasks students should be able to do:** 1. State the uncertainty principle 2. Name the principle quantum numbers and describe the motion of an electron 3. State and discuss various types of particle accelerators 4. Identify and discuss the four basic interactions between particles of matter 5. State the conservation laws of particle physics. 6. State the uncertainty principle 7. Name the principle quantum numbers and describe the motion of an electron 8. State and discuss various types of particle accelerators 9. Identify and discuss the four basic interactions between particles of

			• Electron configuration chart • List of subatomic particles.	matter 10. State the conservation laws of particle physics. **Other essential evaluation tools:** • Assignments • Tests • Quizzes • Class work • Final Exams • Projects • Oral, written and practical exercises • Laboratory demonstration

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