

# INTEGRATED SCIENCE SYLLABUS

SENIOR HIGH SCHOOL

YEAR 1



# YEAR ONE

## SECTION 1: DIVERSITY OF MATTER

**General Objectives:** The students will:

1. appreciate the variety of living and non-living things and their interconnectedness.
2. develop a scientific approach to problem solving.
3. develop safety skills required to work with laboratory apparatus.
4. recognize the importance of measurement in science.
5. understand the nature of matter in its various forms.
6. be aware of the existence of geological diversity

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<b>UNIT: 1 INTRODUCTION TO INTEGRATED SCIENCE</b>	The student will be able to:  1.1.1 explain that there are various branches of science which are interrelated and relevant to the world of life.	Concept of integrated science	Let students:  discuss the following: - science as an interrelated body of knowledge consisting of various branches of science.  - why the need for science specialist to acquire all round knowledge in all science areas namely Chemistry, Biology, Physics, Geology, Astronomy, Agriculture, etc.  - careers in Science and Technology. - prominent Ghanaian and international scientists.  <b>GROUP ACTIVITY:</b> Students in groups design and draw diagrams to show the inter-relationship between the various branches of Science and Technology. Groups to display work in class for award of marks.	Discuss the relevance of the study of chemistry, Biology and Physics to a soil scientist
	1.1.2 apply the scientific method to arrive at scientific solutions to everyday problems.	The scientific method: identification of the problem, hypothesis formulation, experimentation/data collection, analysis and conclusion.	apply scientific concepts and principles in everyday life activities such as treatment of drinking water; finding cure for diseases.  discuss scientific method and explain how scientists solve problems.	

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<b>UNIT 1 (CONT'D)</b>	The student will be able to:		<p>Let students:</p> <p><b>NOTE:</b>            1. Explanation of scientific method should include identification of the problem, hypothesis, experimentation (observation, collection, recording and analysis of data) and conclusion.            2. The discovery of penicillin, radioactivity and the law of floatation may be used to illustrate the scientific method.            3. Explain to students that quest for knowledge and curiosity are necessary to arrive at the truth, facts and solutions to problems.</p> <p><b>PROJECT WORK:</b>            Teacher to assist students in small groups to investigate a common problem in the community e.g. frequent flooding, and apply scientific method to arrive at a solution to the problem.            Students can also select problems of interest to them and investigate.</p>	<p>There is malaria outbreak in your community. Outline the scientific method you would follow to control the outbreak.</p>
<b>UNIT 2 MEASUREMENT</b>	<p>1.1.3 follow basic safety precautions in the laboratory.</p> <p>1.2.1 use SI units in all measurements.</p>	<p>Safety precautions in the laboratory.</p> <p>Basic units and Derived units.</p>	<p>Carry out demonstrations on safety precautions in the use of the Laboratory; laboratory equipment, chemicals etc.</p> <p>Discuss the following basic units of scientific measurements:            Length (m), mass (kg), Time (s), Temperature (K), Current (A), Amount of substance (mol), Luminous intensity (cd)</p> <p>Discuss the following derived quantities and their units: Volume (<math>m^3</math>), Density (<math>kg\ m^{-3}</math>), Velocity (<math>ms^{-1}</math>), Force (N), Work and Energy (J), Quantity of electricity (C), electric resistance (<math>\Omega</math>), Potential difference(V), Power (W)</p>	<p>Suggest four (4) safety measures to be taken in a Science Laboratory</p> <p>Derive the formula for finding:            i. the density of a substance            ii. velocity of a body in motion.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<b>UNIT 2 (CONT'D)</b>	<p>The student will be able to:</p> <p>1.2.2 use scientific measuring instruments accurately.</p> <p>1.2.3 measure density and relative density.</p>	<p>Using scientific measuring instruments.</p> <p>Truthful and accurate recording of data.</p> <p>Concept of replication of results.</p> <p>Sources of errors in scientific experiments.</p> <p>Density and relative density.</p>	<p>Let students:</p> <p>use instruments such as ruler, balances, stop watches, thermometer, ammeter, measuring cylinder, calipers, pipettes, burette, hydrometer etc. to measure quantities in various units.</p> <p>Teacher to assist students to acquire skills in using eyes, hands and judgment when taking measurement.</p> <p>discuss the importance of replication and checking of results by different scientists using the same procedure to ensure accuracy and consistency of results; to arrive at hypothesis; to make better predictions; to add to scientific knowledge.</p> <p><b>NOTE:</b> Teacher to remind students that values such as honesty, integrity and truthfulness can be developed through measuring and recording of data accurately.</p> <p>review topic on <i>density</i> from JHS Syllabus. Carry out experiments to determine the density of equal volumes of water and salt solution. Compare densities of water and salt solution.</p>	<p>Give three reasons why quantities should be measured accurately and honestly.</p> <p>Mention six human values that are of importance to the scientist</p> <p>Describe an experiment to determine the density of a piece of stone.</p>
<b>UNIT: 3 DIVERSITY OF LIVING AND NON- LIVING THINGS</b>	1.3.1 differentiate between living and non-living things.	Life processes: Movement, nutrition, growth, respiration, excretion, reproduction, response to stimulus.	<p>review characteristic features and examples of living and non-living things from JHS syllabus.</p> <p>explore the school environment to observe and record diverse ways living organisms move, feed, grow, respire, reproduce and respond to stimuli.</p> <p>discuss their observations in class and relate them to the existence of biodiversity.</p> <p><b>NOTE:</b> Detailed treatment of the life processes not required at this stage.</p>	<p>Outline five basic life processes which unite all living organisms.</p> <p>Explain the term biodiversity.</p>



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<b>UNIT 4 MATTER</b>	<p>The student will be able to:</p> <p>1.4.1 describe the different building blocks of matter.</p> <p>1.4.2 differentiate between elements, compounds and mixtures.</p> <p>1.4.3 describe the formation of covalent and ionic compounds.</p> <p>1.4.4 relate atomic numbers, mass numbers, isotopes and relative atomic mass among each other.</p>	<p>Particulate nature of matter: atoms, molecules and ions.</p> <p>Elements, compounds and mixtures.</p> <p>Ionic and covalent compounds.</p> <p>Atomic number, mass number, isotopes and relative atomic mass of given elements.</p>	<p>Let students: review the nature, state and properties of matter through discussion.</p> <p><b>NOTE</b> Diagrammatic representation is necessary for atoms and molecules of the 1<sup>st</sup> to 18<sup>th</sup> elements of the periodic table.</p> <p>discuss and bring out the differences between elements, compounds and mixtures.</p> <p>prepare simple mixtures and compounds in class. e.g. solid-solid mixtures solid-liquid mixtures liquid-liquid mixtures. gas-gas mixtures</p> <p>use models or diagrams to assist the students to discuss:</p> <ol style="list-style-type: none"> <li>1. Ionic bond formation as a result of transfer of electrons from one atom to another resulting in the formation of cations and anions.</li> <li>2. Electrostatic attractions between cations and anion to give ionic bond.</li> <li>3. Covalent bond formation between atoms or groups to give covalent compound</li> <li>4. characteristic properties of ionic and covalent compounds</li> </ol> <p><b>NOTE:</b> IUPAC names of common compounds should be taught. discuss the items listed under the content.</p> <p>write down mass number of a given element based on given number of protons or electrons and number of neutrons.</p> <p>explain relative atomic masses using the periodic table.</p> <p><b>NOTE:</b> Carbon-12 isotope should be mentioned as the reference scale.</p>	<p>Draw and label the following atoms: Oxygen, Hydrogen and Chlorine</p> <p>Classify the following materials into elements, compounds and mixtures: water, salt, iron filings sea water, sulphur, air and glass.</p> <p>Describe the formation of sodium chloride (NaCl) and ammonia (NH<sub>3</sub>)</p> <p>Explain the term isotopes and give three examples of elements that exhibit isotopy.</p>

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UNIT 4 (CONT'D)	<p>The student will be able to:</p> <p>1.4.5 perform calculations using the mole concept.</p> <p>1.4.6 prepare solutions of given concentrations.</p>	<p>Mole, molar mass and formula mass.</p> <p>Relationship between grams and moles</p> <p>Preparation of solutions of given concentrations.</p>	<p>Let students:</p> <p>calculate the following:</p> <ol style="list-style-type: none"> <li>1. Formula mass and molar mass using given relative atomic masses.</li> <li>2. Amount of substance in moles given its mass</li> </ol> <p><b>NOTE:</b> Mention should be made of the mole as a unit of the physical quantity, amount of substance.  <math>L = 6.02 \times 10^{23}</math> particles as the Avogadro constant;  use of <math>n = \frac{m}{M}</math> relationship to calculate amount of substance where  <b>n</b> is the symbol for amount of substance,  <b>m</b> is the mass,  <b>M</b> is the molar mass.</p> <p>brainstorm to define the concentration of a solution in units of <math>\text{mol dm}^{-3}</math>; <math>\text{g dm}^{-3}</math>; <i>part per million (ppm) and percentage.</i></p> <p>carry out simple calculations with the relationship</p> $c = \frac{\text{amount of substance}(n)}{\text{volume of solution}(v)}$ <p>prepare solutions of a given concentration  e.g. 1M solution of  a) NaOH (b) NaCl (c) sugar</p> <p>dilute solutions of given concentrations and discuss everyday application of dilution  e.g. food preparation, drug preparation.</p>	<p>Calculate the amount of substance in 9g of aluminum (Al = 27 g/mol)</p>

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<b>UNIT: 5 CELLS AND CELL DIVISION</b>	The student will be able to: 1.5.1 describe the structure and function of plant and animal cells.	Plant and animal cells.  Types of plant and animal cells  Specialized cells.	Let student:  review the structure and function of plant and animal cells in a discussion.  observe prepared slides of different types of plant and animal cells. e.g. red blood cell, nerve cell, leaf epidermal cell, sperm cell, leaf palisade cell, lymphocyte, phagocyte.  discuss the functions of cell organelles. draw and label plant and animal cells  <b>NOTE:</b> 1. Electron micrographs can be obtained from books. 2. Mention should be made of stem cells.	1. State six differences between plant and animal cells.  2. State one function of each of the following organelles: (i) Mitochondrion. (ii) Chloroplast. (iii) Nucleus. (v) Endoplasmic reticulum (vi) Vacuole.
	1.5.2 explain the process of cell division.	Cell division: mitosis and meiosis.	discuss the process of cell division and bring out the differences between mitosis and meiosis	State three importance of mitosis and two importance of meiosis.
<b>UNIT:6 ROCKS</b>	1.6.1 describe the major types of rocks, their formation and characteristics.	Rocks: Types (igneous, sedimentary and metamorphic), formation and characteristics.	explore the school environment/community to identify different types of rocks.  discuss the formation of igneous, sedimentary and metamorphic rocks and their characteristics	State two characteristics each of the following rock types: (i) Sedimentary rocks. (ii) Igneous rocks.
	1.6.2 explain the process of weathering of rocks.	Weathering of rocks: physical, biological, chemical.	discuss physical, biological and chemical weathering of rocks.  <b>NOTE:</b> Explanation of the effect of hydration, hydrolysis, carbonation and oxidation on rocks is required.	Investigate and write a report on types of weathering processes occurring in the school community.

## SECTION 2

### CYCLES

**General Objectives:** The students will:

1. recognise that there are repeated patterns of change in nature and understand how these patterns arise.
2. understand the pattern of air movements around the earth, their effects and the necessary precautions to take when storms occur.
3. appreciate the cyclic movement of nitrogen between the soil and the atmosphere.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<b>UNIT 1 AIR MOVEMENT</b>	<p>The student will be able to:</p> <p>2.1.1 explain the formation of land and sea breezes.</p> <p>2.1.2 identify the various types of air masses and describe their pattern of movement.</p> <p>2.1.3 describe the effect of moving air masses.</p>	<p>Land and sea breezes.</p> <p>Types of air masses and their movements. Trade winds: Easterlies and Westerlies</p> <p>Effect of moving air masses: Formation of storms/cyclones.</p> <p>Precautions against the effects of storms.</p>	<p>Let students:</p> <p>design models to demonstrate convectional current during the formation of land and sea breezes. <b>NOTE:</b> Examples of models that could be designed are the smoke box and heated water with crystals of <math>KMnO_4</math>.</p> <p>design models and discuss the direction of movement of major air masses on the earth's surface.</p> <p>discuss differences between air masses and storms. discuss early warning signs of approaching storms. discuss some effects of moving air masses: Spread of pollutants, effect on climate etc. <b>NOTE:</b> Tomadoes, hurricanes, typhoons are terms which describe cyclones in different parts of the world. <b>PROJECT:</b> Students in groups of two or three to use search engines from the internet or local newspapers or international news stations to gather information and write a report on storms around the world, forecasting procedures, early warning signs etc. Students make a presentation of report in class for discussion and award of marks.</p>	<p>Explain why sea breeze occurs during the day and land breeze during the night.</p> <p>Mention two warning signs of approaching storms and two precautions to be taken to ensure safety.</p> <p>Draw a future's wheel to show the consequences of the spread of pollutants by moving air masses around the earth.</p> <p>Explain how pollutants from one country could lead to problems in another country.</p>

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<b>UNIT: 2 NITROGEN CYCLE</b>	<p>The student will be able to:</p> <p>2.2.1 describe the nitrogen cycle.</p> <p>2.2.2 explain the importance of nitrogen cycle to plants and animals.</p>	<p>Nitrogen cycle.</p> <p>Importance of nitrogen cycle.</p>	<p>Let students:</p> <p>Draw and discuss the Nitrogen cycle.</p> <p>discuss the importance of the nitrogen cycle to plants and animals e.g. improvement of soil fertility.</p>	<p>Explain the following processes involved in the nitrogen cycle:</p> <ol style="list-style-type: none"> <li>1. nitrification</li> <li>2. denitrification</li> </ol>

## YEAR 1

### SECTION 3: SYSTEMS

**General Objectives:** The student will

1. recognize that a system is a whole, consisting of parts that work together to perform a function.
2. recognize that the mammalian skeleton consists of many different bones which work together.
3. understand the different parts of a plant and how they function together for plant growth and reproduction.
4. be aware of the parts of the body which operate to perform respiratory and digestive functions
5. recognize the process of transportation of substances in living organism as life system.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<p><b>UNIT: 1 SKELETAL SYSTEM</b></p>	<p>The student will be able to:</p> <p>3.1.1 describe the structure and functions of the mammalian skeleton.</p>	<p>Major parts of the mammalian skeleton and their functions.</p> <p>Axial skeleton: Skull and vertebral column.</p> <p>Appendicular skeleton: Limbs and the limb girdles.</p>	<p>Let students:</p> <p>use a model of a mammalian skeleton to discuss major parts of the mammalian skeleton and their functions.</p> <p><b>NOTE:</b></p> <ol style="list-style-type: none"> <li>1. Discussion to include types of joints.</li> <li>2. Detailed treatment of the structure of individual bones not needed.</li> </ol>	<p>Outline five functions of the mammalian skeleton.</p>
<p><b>UNIT: 2 REPRODUCTION AND GROWTH IN PLANTS</b></p>	<p>3.2.1 identify parts of a flower and variations in flower structure.</p>	<p>Structure of flowers</p>	<p>examine the following: Complete flower and also half flower with free parts. Bi-sexual flower, e.g. Flamboyant or Pride of Barbados or <i>Hibiscus</i>. Uni-sexual flower with free parts e.g. water melon, gourd, pawpaw and Paretusa.</p> <p><b>PROJECT:</b></p> <ol style="list-style-type: none"> <li>1. make a collection of about ten different flower specimens.</li> <li>2. open fully to locate the main parts.</li> <li>3. mount each flower on a separate sheet of paper and the parts separated out and labeled.</li> <li>4. enclose each flower with a plastic sheet and transparent tape.</li> <li>5. display work by groups on a bulletin board or science table for award of marks.</li> </ol>	<p>Make a half-flower drawing of a bi-sexual flower and label the parts.</p>

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<b>UNIT 2 (CONT'D)</b>	<p>The student will be able to:</p> <p>3.2.2 describe the processes of pollination and fertilization.</p> <p>3.2.3 describe different types of fruits.</p> <p>3.2.4 describe the structure of seeds and state the functions of their parts.</p> <p>3.2.5 describe the mechanisms of seed and fruit dispersal.</p>	<p>Mechanisms of pollination and fertilization.</p> <p>Formation of fruits and seeds.</p> <p>Types of fruits: dry fruits and fleshy or succulent fruits.</p> <p>Seed structure: Endospermous (monocots) and non-endospermous (dicots) seeds.</p> <p>Seeds and fruits dispersal</p>	<p>Let students:</p> <p>Refer to JHS syllabus to review the process of pollination and fertilization. Formation of fruits and seeds should be discussed.</p> <p>watch digitized or video version of pollination and fertilization.</p> <p>collect different types of fruits and group them into dry and fleshy or succulent fruits.</p> <p>draw a section of a drupe and a berry.</p> <p><b>GROUP ACTIVITY:</b></p> <ol style="list-style-type: none"> <li>1. make a collection of different seeds from the community.</li> <li>2. Study the features, draw and label the longitudinal section of two of the seeds.</li> <li>3. list the functions of the parts.</li> <li>4. keep information on each seed including name of collector, date of collection, differences in size, shape, colour and uses.</li> </ol> <p>study and discuss the structure of seeds/fruits and how they are adapted to their mode of dispersal; agents for dispersal.</p> <p>discuss the explosive mechanism in fruits of Balsam and Pride of Barbados.</p> <p>discuss the advantages and disadvantages of fruit and seed dispersal.</p>	<p>Draw and label a named endospermous seed and give the functions of each labeled part.</p> <p>Relate the structure of the seeds of Balsam and Pride of Barbados to their mode of dispersal</p>

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<b>UNIT: 3 RESPIRATORY SYSTEM</b>	The student will be able to: 3.2.6 describe the process and conditions necessary for germination.	Process and conditions of germination.  Types of seed germination: Hypogeal, Epigeal.	Let students:  review the process and conditions for germination of seeds in JHS syllabus.	Use diagrams to explain epigeal and hypogeal germination.
	3.2.7 describe vegetative (asexual) reproduction in plants.	Methods of vegetative reproduction in plants and their importance.	sow different types of seeds and identify the type of germination of each. e.g. maize – hypogeal cowpea, groundnut (peanut)- epigeal.	Outline two advantages and two disadvantages of vegetative propagation of plants.
	3.3.1 define respiration and explain its importance.	Respiration as a source of energy for body processes.	bring samples of propagatory materials to examine and discuss how new plants are produced from coms, setts, bulbs, rhizomes, cuttings, stolons runners, -  discuss budding and grafting.	Distinguish between budding and grafting.
	3.3.2 distinguish between aerobic and anaerobic respiration.	Aerobic and anaerobic respiration.	discuss the meaning of respiration and how energy is released from food substances for living organisms.  <b>NOTE:</b> Teacher, using controlled experiments, should demonstrate the release of heat energy and carbon dioxide during respiration of germinating seeds, small animals and yeast (fermentation of corn dough).	Differentiate between aerobic and anaerobic respiration.
	3.3.3 identify the respiratory organs of the respiratory system of a mammal and describe their functions.	Structure and functions of the respiratory system in mammals.	discuss aerobic and anaerobic respiration.  examine a dissected small mammal (e.g. guinea pig, rabbit)  draw and label the respiratory organs of humans. discuss the functions of the trachea, lungs, ribs, intercostal muscles and diaphragm.  identify the respiratory organs in humans using labeled diagrams/charts/models.	

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<b>UNIT 3 (CONT'D)</b>	<p>The student will be able to:</p> <p>3.3.4 explain the mechanism of inhalation and exhalation in humans.</p> <p>3.3.5 enumerate some problems and disorders associated with the respiratory system in humans.</p> <p>3.3.6 explain how respiratory gases are taken in and out of plants.</p>	<p>Inhalation and exhalation.</p> <p>Problems and disorders associated with the respiratory system in humans.</p> <p>Exchange of respiratory gases in plants.</p>	<p>Let students:</p> <p>Use an illustration to demonstrate breathing in humans.</p> <p>discuss the mechanism of inhalation and exhalation in humans.</p> <p>compare the composition of inhaled and exhaled air using simple experiments</p> <p>mention and discuss briefly some problems and disorders associated with the respiratory system e.g. Lung cancer, Asthma, T.B., Whooping Cough, Pneumonia etc.</p> <p>discuss how they can be prevented and controlled.</p> <p>discuss how respiratory gases, e.g. oxygen and carbon (IV) oxide are taken in and out of plants.</p> <p><b>NOTE:</b> Cell (tissue) respiration to be mentioned as a chemical process that produces energy for life activities of organisms (glycolysis and Krebs's cycle not required).</p>	<p>Describe the mechanism by which air is taken in and out of the lungs.</p> <p>Describe how respiratory gases enter and leave plant tissues.</p>

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<b>UNIT 4 FOOD AND NUTRITION</b>	<p>The student will be able to:</p> <p>3.4.1 outline the different classes of food and describe a balanced diet.</p>	<p>Classes of food and food substances and their importance: carbohydrates, proteins, lipids, vitamins, mineral salts and water.</p> <p>Balanced diet.</p>	<p>Let students:</p> <p>review topic on classes of food and food substances from the JHS syllabus</p> <p>test for starch, proteins and lipids in different types of foods.</p> <p>discuss the importance of food substances to the human body</p> <p>discuss the importance of a balanced diet.</p>	<p>Students to match the following nutrients and their functions</p> <ol style="list-style-type: none"> <li>i. starch</li> <li>ii. protein</li> <li>iii. lipids.</li> </ol>
	<p>3.4.2 state the effects of malnutrition.</p>	<p>Effects of malnutrition.</p>	<p>discuss malnutrition and its effects</p> <p><b>NOTE:</b> 1. Relationship between diet and certain diseases and disorders such as Night blindness, High Blood Pressure, Diabetes, Obesity, Lactose intolerance and Kwashiorkor should be stressed.</p> <p>2. Importance of roughage should be included in the discussion.</p>	<p>Explain the following terminologies</p> <ol style="list-style-type: none"> <li>i. balanced diet</li> <li>ii. malnutrition.</li> </ol>
<b>UNIT 5 DENTITION, FEEDING AND DIGESTION IN MAMMALS</b>	<p>3.5.1 identify the different types of teeth in mammals and relate them to their functions.</p>	<p>Structure of different types of teeth in relation to their functions.</p>	<p>review structure and functions of the teeth.</p> <p>draw and label the vertical section of a tooth.</p> <p>discuss differences in dentition in humans and other mammals.</p> <p><b>NOTE:</b> Relate dentition to diet.</p>	<p>Draw the structure of molar and canine teeth and label the parts.</p>
<p>3.5.2. enumerate various ways of preventing dental problems.</p>	<p>Care of the teeth in humans.</p>	<p>demonstrate proper ways of caring for the teeth to prevent dental problems, e.g.</p> <ol style="list-style-type: none"> <li>1. cleaning the teeth daily</li> <li>2. visiting the dentist at least twice a year</li> <li>3. feeding on mineral-rich food.</li> </ol>		

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<p><b>UNIT 5 (CONT'D)</b></p>	<p>The student will be able to:</p> <p>3.5.3 draw and label the digestive system of mammals</p> <p>3.5.4 describe the process of digestion, absorption and assimilation in mammals.</p> <p>3.5.5 mention some diseases and disorders associated with the digestive system of humans.</p>	<p>Structure and functions of the digestive system of mammals; humans, monogastrics farm animals and ruminants.</p> <p>Digestion, absorption and assimilation in mammals.</p> <p>Disorders and diseases associated with the digestive system of humans.</p>	<p>Let students:</p> <p>examine a dissected small mammal (e.g. guinea pig, rabbit) ,draw and label parts of the alimentary canal, the glands and organs associated with digestion. discuss the functions of the parts of the digestive system of mammals..</p> <p>discuss the digestive system of humans, a ruminant and a non-ruminant.</p> <p>discuss the process of digestion, absorption, egestion and uses of digested food.</p> <p><b>NOTE:</b> Digestion system of mammals to be compared to that of birds.</p> <p>discuss some disorders and diseases of the digestive system. e.g. jaundice, hepatitis, cirrhosis, stomach ulcer, lactose intolerance and indigestion.</p> <p><b>NOTE:</b> Effects of some drugs, food additives, preservatives and alcoholic drinks should be discussed.</p> <p>review topics in JHS syllabus on diffusion and osmosis.</p> <p>perform simple experiments to demonstrate diffusion in air and in liquids.</p> <p>perform experiments to demonstrate osmosis in a living tissue using yam/cassava/cocoyam and in a non-living tissue using cellophane sheet.</p> <p>record and discuss their observation.</p> <p>give examples of life processes in which diffusion and osmosis occur e.g. absorption in the small intestine, reabsorption of water in the kidney.</p>	<p>Draw and label the digestive system of a named ruminant</p> <p>1 a. Define the following terms (i) hypertonic solution (ii) hypotonic solution (iii) isotonic solution</p> <p>b. Explain the effect of introducing a plant cell and an animal cell into hypotonic, isotonic and hypertonic solutions.</p>
<p><b>UNIT: 6 TRANSPORT – DIFFUSION, OSMOSIS AND PLASMOLYSIS</b></p>	<p>3.6.1 explain the processes of diffusion, osmosis and plasmolysis.</p>	<p>Diffusion, osmosis and plasmolysis</p>		

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	<p>The student will be able to:</p> <p>6.2.2 state the importance of the xylem and phloem tissues in plants.</p>	<p>Importance of xylem and phloem tissues.</p>	<p>Let students:</p> <p><b>NOTE:</b> Discussion to include the process of transpiration which also involves diffusion.</p> <p><b>PROJECT:</b> Groups of students to apply the principle of osmosis in the following activities: i. salting of fish for preservation e.g. <i>Tilapia</i> ("koobi") ii. preservation of liquid produces e.g. food concentrates</p> <p>demonstrate plasmolysis using epidermal cells of <i>Rheo discolor</i>. Record and discuss their observations.</p> <p>dip the roots of a plant with transparent stem e.g. balsam into a red dye (eosin) solution. Cut and examine the transverse section of the stem. Record and discuss the observations.</p> <p>discuss how water and mineral salts are transported up the stem of a plant through the xylem.</p> <p>perform the ring experiment and discuss how food substances are transported by the phloem.</p> <p><b>NOTE:</b> Detailed structure of xylem and phloem not required.</p>	<p>Draw a transverse section of a dicot stem and label the xylem and phloem tissues.</p>



UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<b>UNIT: 2 SOLAR ENERGY</b>	<p>The student will be able to:</p> <p>4.2.1 identify the uses of solar energy.</p> <p>4.2.2. document the use of solar energy in daily activities.</p> <p>4.2.3. model solar heater and dryer.</p>	<p>Uses of solar energy:</p> <p>Generation of electricity from solar panel/solar cells.</p> <p>Drying.</p> <p>Solar heaters</p> <p>Application of solar energy in practical daily activities.</p> <p>Models of solar heater and dryer.</p>	<p>Let students:</p> <p>discuss the main applications of solar energy: generating electricity, drying materials and heating substances, reducing pollution.</p> <p>Carry out practical activities to demonstrate the application of solar energy to:</p> <ol style="list-style-type: none"> <li>1. dry clothes</li> <li>2. heat water for bathing</li> <li>3. dry crops for preservation</li> <li>4. cook, e.g. corn, sausages, hot dog, fish and ripe plantain</li> <li>5. boil an egg.</li> </ol> <p>model solar heater and dryer using appropriate materials e.g. curve shiny aluminium sheet.</p> <p><b>PROJECT:</b> <u>Construction of a solar heater.</u> Students to use curved shiny aluminium sheet to construct solar heater to boil an egg.</p>	<p>Describe the process involved in the generation of electricity from solar panel.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<b>UNIT: 3 PHOTOSYNTHESIS</b>	<p>The student will be able to:</p> <p>4.3.1 describe the process of photosynthesis.</p> <p>4.3.2. explain the process of the transformation of energy that occurs during photosynthesis.</p>	<p>The process of photosynthesis.</p> <p>Conditions for photosynthesis: Light, Chlorophyll, carbon dioxide, water.</p> <p>Conversion of light energy to chemical energy.</p>	<p>Let students:</p> <p>carry out control experiments to show the necessity of light, chlorophyll and carbon dioxide for photosynthesis.</p> <p>discuss the conditions of photosynthesis.</p> <p>use word and symbol equations to show how light energy is trapped during the process of photosynthesis and converted to glucose.</p> <p>Test for starch in food.</p>	<p>Outline the conditions necessary for photosynthesis</p> <p>Describe an experiment to demonstrate that light is essential for photosynthesis.</p>
<b>UNIT 4: ELECTRONICS</b>	<p>4.4.1 observe the behaviour of discrete electronic components in a d.c. and a.c. electronic circuit.</p>	<p>Behaviour of discrete electronic components: resistor, capacitor and inductor – in a d.c and a.c. electronic circuits.</p>	<p>connect a simple electronic circuit comprising a d.c. source, a resistor and an Light Emitting Diode (<i>LED</i>) in series.</p> <p>observe the behaviour of the <i>LED</i> when:</p> <ol style="list-style-type: none"> <li>1. the switch is closed</li> <li>2. switch is opened</li> <li>3. resistor is replaced with capacitor.</li> <li>4. capacitor is replaced with inductor or coil.</li> </ol> <p>repeat the experiment by replacing the d.c. source with a 12V a.c. source.</p> <p><b>PROJECT:</b> Design and construct an electronic mosquito repellent using the capacitor, inductor and transistor arrangement.</p>	<p>Compare the behaviour of an <i>LED</i> when a capacitor is in a d.c or a.c electronic circuit.</p>

**YEAR 1**  
**SECTION 5: INTERACTIONS OF MATTER**

**General Objectives:** The student will:

1. appreciate that the interaction between and within matter helps humans to better understand the environment and their role in it.
2. recognize the effect of changing climatic conditions on the environment.
3. be aware of movements of the earth and the effects of these movements.
4. recognize the harmful effects of disease-causing organisms and the need to control them.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<b>UNIT: 1 ECOSYSTEM</b>	<p>The student will be able to:</p> <p>5.1.1 define basic ecological terms.</p> <p>5.1.2 classify ecosystems and identify their components.</p>	<p>Basic biological terms: Ecology, Species, population, community, ecosystem, ecosphere etc.</p> <p>Types of ecosystem and components.</p> <p>Natural: fresh water, marine, estuarine, lake, rainforest, savanna and desert</p> <p>Artificial: farmland, man-made lakes, roads.</p> <p>Components of ecosystem: Biotic/living component including plants and animals.</p> <p>Abiotic / non-living component including soil, air and water.</p> <p>Ecological factors: Biotic - predation, competition, symbiosis, epiphytism. Abiotic – climatic (rainfall, humidity, temperature) salinity, altitude, slope of land etc.</p>	<p>Let students:</p> <p>brainstorm to bring out the meaning of ecosystem, species, population, community, ecosystem, ecosphere.</p> <p>Classify the various ecosystems: terrestrial, fresh water, marine etc.</p> <p>identify the components of an ecosystem and discuss how they affect each other.</p> <p>classify ecological factors (biotic and abiotic) and how they affect plants and animals (humans).</p> <p>discuss appropriate instruments used to measure abiotic factors.</p>	<p>Differentiate between the following ecological terms:</p> <ol style="list-style-type: none"> <li>i. ecosystem and ecology</li> <li>ii. ecosystem and ecosphere</li> <li>iii. species and population</li> <li>iv. population and community</li> </ol> <p>Describe the interaction between the components of a named ecosystem.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<b>UNIT: 1 (CONT'D) ECOSYSTEM</b>	<p>The student will be able to:</p> <p>5.1.3 explain food chain and food web and identify the components.</p>	<p>Components of a food chain and food web.</p>	<p>Let students:</p> <p>explain and describe food chain and food web and identify the components:</p> <ol style="list-style-type: none"> <li>1. Producers (green plants).</li> <li>2. Primary consumers (plant eaters or herbivores)</li> <li>3. Secondary consumers (flesh eaters/ carnivores).</li> </ol> <p><b>NOTE:</b></p> <ol style="list-style-type: none"> <li>1 Omnivores are grouped with primary and secondary consumers</li> <li>2. Decomposers/detrivores must be mentioned as indispensable in an ecosystem.</li> </ol> <p><b>FIELD TRIP:</b></p> <p>Students to visit natural habitat or relevant eco-centres e.g. National Parks.</p>	<p>Show how efficient the energy transfer between producers and consumers is</p> <p>Draw a simple food chain in a named ecosystem.</p> <p>Use the following organisms to construct a food web; green grass, lizard, hawk, locust, butterfly, frog, tiger and antelope.</p>
<b>UNIT: 2 ATMOSPHERE AND CLIMATE CHANGE</b>	<p>5.2.1 describe the various regions of the atmosphere.</p> <p>5.2.2 outline the effects of human activities on the atmosphere.</p> <p>5.2.3 describe the major pollutants of the atmosphere and their effects.</p>	<p>Regions of the atmosphere: Troposphere, stratosphere, mesosphere and thermosphere.</p> <p>Human activities and their effects on the atmosphere</p> <p>Major atmospheric pollutants sources and their effects.</p>	<p>brainstorm to bring out the layers of the atmosphere</p> <p>describe the characteristics of each layer in terms of thickness, temperature, air quality and composition, pressure and support for human activities</p> <p>gather information from the internet and scientific journals on the effects of human activities on the atmosphere i.e. air transport, defense, industrialization, agriculture etc.</p> <p>discuss the sources and the effects of the following pollutants: Oxides of lead, nitrogen and sulphur; ozone, halons (carbon and halogen compounds etc).</p>	<p>Differentiate between the troposphere and stratosphere in terms of the following: temperature, air composition and pressure</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<b>UNIT: 2 (CONT'D) ATMOSPHERE AND CLIMATE CHANGE</b>	The student will be able to: 5.2.4 explain Greenhouse effect on climate change.	Greenhouse effect and climate change  Desertification, drought Melting of ice and polar ice caps, rising sea levels Increase in number and intensity of hurricanes (cyclones), effects on biodiversity resources, etc.	Let students:  give examples of Greenhouse gases e.g. Carbon(IV) oxide, methane.  discuss what a “greenhouse” is and its effect: Global warming and climate change.  discuss possible factors to address the problem of global warming.  <b>PROJECT:</b> Students to interview people in the community to find out and report on climate change in the community over the past thirty to fifty years and its effect on the community.	Outline five effects of climate change on biodiversity resources.
	5.2.5 explain the causes and effects of the depletion of the ozone layer.	Causes and the effects of the depletion of the ozone layer	state what the ozone layer is and discuss how it protects living organisms.  relate the sources and effects of CFCs on the ozone layer.	Mention two effects of the supersonic air transport on the ozone layer.
	5.2.6 explain the causes and effects of acid rain.	Acid rain and its effects: Damage to buildings, paints and forests.	identify acidic pollutants which cause acid rain.  discuss the effects of acid rain the environment (damage to buildings, forests etc)	Mention three examples of acidic pollutants and how they affect forests and buildings

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<b>UNIT: 3 TECTONIC MOVEMENTS</b>	<p>The student will be able to:</p> <p>5.3.1 identify the layers of the earth.</p> <p>5.3.2 describe the significance of plate tectonics.</p> <p>5.3.3 explain how plate tectonics cause earth tremors, earthquakes, volcanoes and Tsunamis.</p> <p>5.3.4 give examples of recent land formations and submerging lands.</p>	<p>Layers of the earth: crust, mantle and core.</p> <p>Plate tectonics</p> <p>Effects of plate tectonics: earth tremors, earthquakes, volcanoes and Tsunamis</p> <p>Recent land formations and submerging lands.</p>	<p>Let students:</p> <p>use drawings /charts to describe various layers inside the earth: the crust, mantle and core (inner core and outer core)</p> <p>examine charts and photographs of major and minor earth “plates”.</p> <p><b>ACTIVITY:</b> Students crush the shell of half cooked egg and compare to continental plates</p> <p>examine charts and photographs of the aftermath of volcanoes, earthquakes and Tsunamis.</p> <p>discuss the effects of volcanoes, earthquakes and Tsunamis .</p> <p>map out earthquake zones in Ghana. A resource person from Geological Survey Department may be invited.</p> <p>discuss the roles of agencies which monitor plate tectonics in Ghana.</p> <p><b>PROJECT:</b> Students to model a map of Ghana and a map of Africa with plasticine or paper maché and indicate earthquake prone zones. Students to give reasons why those areas are prone to earthquakes.</p> <p>Use internet search engines or scientific journals to find out some of the recent land formations and submerging lands and report on them.</p>	<p>Why is an expert on earth movement important for the construction industry?</p> <p>What are the reasons why we should not build in earthquake prone zones?</p> <p>Check internet sites to find out latest information on: 1. Formation of new lands as a result of tectonic movements. 2. Prediction of earthquakes and report in class.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<b>UNIT: 4 INFECTIONS AND DISEASES</b>	<p>The student will be able to:</p> <p>5.4.1 describe the causes of diseases.</p> <p>5.4.2 describe the modes of transmission, symptoms and modes of control of common diseases.</p>	<p>Pathogenic: bacteria, virus, fungi, protozoa.</p> <p>Non-pathogenic: nutritional, genetic, stress.</p> <p>Modes of transmission.</p> <p>Symptoms and modes of control of diseases which are: Air borne, Water related, Insect borne (vectors), Food contaminated (food poisoning), Nutrition related, Sexually transmitted Communicable, Zoonotic diseases.</p>	<p>Let students:</p> <p>discuss the causes of pathogenic diseases under the following headings: bacteria, virus, fungi, protozoa and rickettsia.</p> <p>describe the causes of non-pathogenic diseases under the following headings: poor nutrition, genetic, stress conditions, poor sanitation etc.</p> <p>discuss modes of transmission, symptoms, method of prevention and control of at least two examples of pathogenic and non-pathogenic diseases.</p> <p>give examples of the diseases mentioned under the content, their modes of transmission, symptoms and method of control.</p> <p><b>NOTE:</b> Detailed treatment of individual diseases not needed.</p>	<p>Discuss the causes, symptoms, mode of transmission, prevention and control of the following common diseases: anthrax, Newcastle, avian flu, CSM.</p> <p>1. Outline two common diseases that result from infections due to (a) bacteria (b) fungi (c) virus (d) protozoa</p> <p>2 State five life-styles that make people prone to HIV/AIDS infection.</p>

## YEAR 2

### SECTION 1: DIVERSITY OF MATTER

**General Objectives:** The students will:

1. appreciate the diversity of chemical substances and their effect on matter
2. recognize the variety of substances that improve soil for optimum productivity.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<b>UNIT: 1 ACIDS, BASES AND SALTS</b>	<p>The student will be able to:</p> <p>1.1.1 define acids, bases and salts and state their properties.</p>	<p>Simple definitions of acids and bases in terms of proton transfer (Bronsted- Lowry concept) and definition of salts.</p> <p>Physical and chemical properties of acids, bases and salts.</p>	<p>Let students:</p> <p>brainstorm to bring out the definitions of acids, bases and salts.</p> <p>discuss the properties and uses of acids, bases and salts.</p> <p>perform the following chemical tests to show the properties of acids, bases and salts:</p> <ol style="list-style-type: none"> <li>(a) Reaction of acid and base (neutralization reaction).</li> <li>(b) Dilute acid + metal (production of H<sub>2</sub>(g))</li> <li>(c) Acid + trioxocarbonate (IV) compounds (production of CO<sub>2</sub> gas).</li> <li>(d) Test for hydrogen, carbon dioxide and ammonia gases.</li> </ol>	<p>Describe the laboratory preparation of NH<sub>3</sub> gas. How would you test for Ammonia.</p>
	<p>1.1.2 identify common chemical substances as acids, bases or salts and classify them according to their sources.</p>	<p>Acids, bases and salts, e.g. Organic acids – vinegar, Organic bases - ammonia, Salts - common salt. Inorganic acids – dilute HCl Inorganic base – milk of magnesia</p>	<p>perform chemical tests to classify each chemical substance listed under the content as an acid, a base or a salt.</p> <p>discuss the uses of acids, bases and salts in everyday life and in industry, e.g. sodium hydroxide and tetraoxosulphate(VI) acid.</p> <p>visit a salt/chemical industry and write a report on the activities observed.</p>	
	<p>1.1.3 prepare salts.</p>	<p>Methods of preparation of salts.</p>	<p>prepare salts using any of the following methods: neutralization, precipitation, acid + salt.</p>	



UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<b>UNIT 2: (CONT'D)</b>	<p>The student will be able to:</p> <p>1.2.3 state the functions of soil nutrients and their deficiency symptoms.</p> <p>1.2.4 describe methods of maintaining soil fertility.</p> <p>1.2.5 classify fertilizers into organic and inorganic fertilizers.</p>	<p>Functions and deficiency symptoms of N, P, K, Ca, Mg, Mn, Fe, B, Mo.</p> <p>Maintenance of soil fertility: application of organic and inorganic manures/ fertilizers, crop rotation, cover cropping, liming, green maturing.</p> <p>Organic and inorganic fertilizers. Methods of applying fertilizers.</p>	<p>Let students:</p> <p>Identify and discuss plants having nutrient deficiency symptoms.</p> <p><b>NOTE:</b> Students to refer to Nitrogen Cycle in SHS and the Carbon Cycle in JHS syllabuses and relate them to the maintenance of soil fertility.</p> <p>demonstrate ways of improving soil fertility.</p> <p>demonstrate ways of preparing planting medium, compost, soil mixtures, etc.</p> <p>identify and classify organic and inorganic fertilizers.</p> <p>classify inorganic fertilizers as straight (single) or compound fertilizers with examples.</p> <p>demonstrate the various ways of applying fertilizer.</p> <p><b>PROJECT:</b> Students prepare compost and an earth box and use them to make vegetable or flower gardens. They keep record of the procedure in a farm diary.</p>	<p>Describe the deficiency symptoms of the following nutrients in plants: nitrogen, potassium and phosphorus.</p> <p>Outline the factors that should be considered during fertilizer application.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<b>UNIT 2: (CONT'D)</b>	<p>The student will be able to:</p> <p>1.2.6 outline factors which lead to the depletion of soil resources.</p>	<p>Factors which lead to the depletion of soil resources:</p> <ol style="list-style-type: none"> <li>1. Erosion</li> <li>2. Overgrazing</li> <li>3. Poor farming and tillage methods,</li> <li>4. Dumping of non-biodegradable waste on land</li> <li>5. Improper irrigation and drainage practices.</li> <li>6. Surface mining and quarrying.</li> <li>7. Deforestation.</li> <li>8. Excessive use of fertilizer</li> </ol>	<p>Let students:</p> <p>discuss how the factors listed under content lead to the depletion of soil resources.</p> <p><b>NOTE:</b> Detailed discussion of erosion is required Discussion should cover types of erosion, effect and control.</p> <p><b>PROJECT</b> Design a model of a farm to illustrate the harvesting of runoff water for irrigation.</p>	<p>Outline three effects of soil erosion on soil productivity</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<b>UNIT: 3 WATER</b>	<p>The student will be able to:</p> <p>1.3.1 describe the physical and chemical properties of water.</p> <p>1.3.2 distinguish between hard and soft water.</p> <p>1.3.3 demonstrate how to soften water.</p> <p>1.3.4 describe the steps involved in the treatment of water for public consumption.</p>	<p>Physical and chemical properties of water.</p> <p>Hardness and softness of water.</p> <p>Advantages and disadvantages of hard and soft water.</p> <p>Softening hard water.</p> <p>Treatment of water for public consumption</p>	<p>Let students:</p> <p>refer to JHS syllabus for a review of sources of water, physical and chemical properties of water and the treatment of hard and soft water.</p> <p>perform experiments to investigate properties of water:</p> <ul style="list-style-type: none"> <li>(i) determine boiling point of water.</li> <li>(ii) demonstrate the solvent action of water on a variety of substances.</li> <li>(iii) determine the presence of dissolved substances in some sources of water</li> <li>(iv) demonstrate the polar nature of water.</li> </ul> <p><b>NOTE:</b> discussion should include uses of water.</p> <p>discuss the advantages and the disadvantages of hard and soft water.</p> <p>collect water from different sources and determine their hardness using the same brand of soap.</p> <p>demonstrate through an activity any one of the following processes to soften hard water: addition of washing soda, ion exchange, boiling and distillation.</p> <p>draw a flow chart to show the steps involved in the treatment of water for public consumption</p> <p>discuss the importance of water as well as the role of the Ghana Water Company in public water supply.</p> <p><b>PROJECT:</b> Organise a visit to local water treatment plant and write a report on the visit.</p>	<p>Explain what an aqueous solution is and give three examples.</p> <p>Name two compounds which cause permanent hardness of water and two compounds which cause temporary hardness of water.</p> <p>Name two advantages and two disadvantages of hard and soft water.</p> <p>Describe one method by which hard water can be softened.</p> <p>Perennial water shortage and frequent disruptions in water supply in most communities in Ghana can be traced to erosion of human values. Discuss.</p> <p>Outline the role of Ghana Water Company in the control of water supplies in cities, towns and villages.</p>

## YEAR 2

### SECTION 2: CYCLES

**General Objectives:** The students will:

1. recognize that there are repeated patterns of change in nature and understand how these patterns arise.
2. understand how the attraction between the sun, earth and moon leads to the formation of tides.
3. be aware of the natural distribution of the earth's water and the need to conserve water for plant and animal use.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<b>UNIT: 1 WATER MOVEMENT</b>	<p>The student will be able to:</p> <p>2.1.1 explain the causes of high and low tides.</p>	<p>Causes of tides: Spring tides and Neap tides.</p>	<p>Let the students:</p> <p>discuss the formation of Spring and Neap tides.</p> <p>use illustrations to explain that when the sun, moon and earth are in straight line they produce maximum gravitational pull on the earth.</p> <p>explain that when the sun, earth and moon are at right angles there is minimum gravitational pull on the earth.</p>	<p>1. Discuss the causes of high and low tides each day.</p> <p>2. Define: (i) Ebb tides (ii) incoming tides</p>
<b>UNIT: 2 HYDROLOGICAL CYCLE</b>	<p>2.1.2 outline the effects of tidal waves.</p> <p>2.2.1 explain the distribution of the earth's water.</p>	<p>Effects of tidal waves.</p> <p>Distribution of the earth's water: Groundwater Surface water (fresh water saline water)</p>	<p>discuss the effects of tidal waves on coastal lands to include Keta, Ada and Elmina.</p> <p>use search engines from the internet to gather information on tides/tidal waves for group presentation in class.</p> <p>discuss where earth's water is located and how much of it is available for human use.</p> <p><b>NOTE:</b> Percentage distribution of water on the earth's surface to be mentioned</p>	

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
	<p>The student will be able to:</p> <p>2.2.2 explain the relevance of the hydrological cycle to plants and animals.</p> <p>2..2.3 outline the main sources of water contamination and the effects on humans</p> <p>2.2.4 describe household water conservation methods.</p>	<p>Hydrological cycle</p> <p>Main sources of water contamination: domestic waste, trade waste, industrial and mining waste, agricultural waste, radioactive waste, and “special” waste such as waste from hospitals.</p> <p>Effects of water contamination water-related diseases, infections, etc.</p> <p>Water conservation methods</p>	<p>Let students:</p> <p>discuss the processes involved in the hydrological cycle using appropriate diagrams.</p> <p>discuss the various sources of water contamination to include items listed under content.</p> <p>discuss the effects such as water-related diseases under the following headings: water-borne, water-washed, water-based and insect based diseases.</p> <p>gather more information on the topic using search engines from internet sites</p> <p>discuss household water treatment, waste water treatment, safe water storage, modern and traditional rainwater harvesting systems.</p> <p><b>PROJECT:</b></p> <p>1. Gather information on modern and traditional rainwater harvesting system from the following sources:</p> <p>i. interviewing people in the community, ii. library, websites and scientific journals</p> <p>2. Design a simple water harvesting technique or a domestic water reuse system.</p>	<p>Draw a hydrological cycle and comment on its importance to plants and animals.</p> <p>Give one example each of the following water-related diseases:</p> <p>(i) water-washed (ii) water-borne (iii) water-based</p> <p>Discuss the importance of rainwater harvesting.</p>

## YEAR 2

### SECTION 3: SYSTEMS

**General Objectives:** The students will:

1. recognize that a system is a whole consisting of parts that work together to perform a function.
2. recognize the processes of excretion, reproduction, and transportation of substances in living organisms as life systems.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<b>UNIT: 1 EXCRETORY SYSTEM</b>	<p>The student will be able to:</p> <p>3.1.1 explain the meaning of excretion.</p> <p>3.1.2 identify organs of the excretory system and their products in mammals.</p> <p>3.1.3 mention some disorders of the urinary system in humans and their remedies.</p> <p>3.1.4 state excretory products of flowering plants and explain how they are excreted.</p>	<p>Excretion in mammals</p> <p>Organs of excretory system and their products.</p> <p>Disorders of urinary system in humans.</p> <p>Excretion in flowering plants</p>	<p>Let students:</p> <p>brainstorm to bring out the meaning of excretion.</p> <p>discuss to bring out the differences between excretion and egestion</p> <p>discuss the main organs of excretory system (lungs, skin, and kidneys) and match them against their products</p> <p><b>NOTE</b> Discussion to include: 1. How the products are eliminated from the body. 2. Structure of the skin and kidneys.</p> <p>discuss the disorders of the human urinary system e.g. bed wetting, urine retention, kidney stones and their remedies.</p> <p>discuss the waste products of respiration and photosynthesis and how they are excreted in flowering plants.</p> <p>mention other excretory products in plants e.g. excess salt, gums, latex, resin and lignin</p>	<p>Distinguish between excretion and egestion in humans.</p> <p>Draw and label the parts of the nephron.</p> <p>Explain how plants excrete their waste products.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<b>UNIT: 2 REPRODUCTIVE SYSTEM AND GROWTH IN MAMMALS</b>	<p>The student will be able to:</p> <p>3.2.1 identify the reproductive organs of a mammal and their functions.</p> <p>3.2.2 state the advantages and disadvantages of male and female circumcision.</p> <p>3.2.3 outline the processes leading to fertilization, zygote development and birth in humans.</p> <p>3.2.4 describe the process of birth in mammals and ways to care for the young ones.</p> <p>3.2.5 analyse problems associated with reproduction in humans.</p>	<p>Structure and function of the mammalian reproductive system.</p> <p>Male and female circumcision.</p> <p>Fertilization, development of the zygote (pregnancy) and birth in humans.</p> <p>The process of birth and care of the young.</p> <p>Problems associated with reproduction in humans: Miscarriage, ectopic pregnancy, infertility, impotence, fibroid, disease infections ovarian cyst.</p>	<p>Let students:</p> <p>examine a dissected small mammal (e.g. guinea pig, rabbit); draw and label the male and female reproductive systems.</p> <p>discuss the advantages and disadvantages of circumcision.</p> <p><b>NOTE:</b> Pay particular attention to the dangers of female circumcision.</p> <p>discuss the process of fertilization, development of zygote (pregnancy) and birth using charts, models and diagrams.</p> <p><b>NOTE:</b> 1. Discussion to include: formation of twins: Identical, fraternal and Siamese. 2. Details of cell division and anatomy of the embryo not required.</p> <p>discuss the process of birth in mammals, including pre-natal, postnatal and parental care.</p> <p><b>NOTE:</b> Students to refer to JHS syllabus on the causes and effects of teenage pregnancy.</p> <p>discuss problems associated with reproduction in humans as listed under content. Causes of infertility in both males and females to be discussed as well as illegal abortion.</p> <p><b>CASE STUDY:</b> A childless couple thinks their problem is due to witchcraft. Use scientific method and reasoning to explain the possible cause of the infertility.</p>	<p>Draw and label the male and female reproductive systems of humans.</p> <p>Explain the formation of identical, fraternal and Siamese twins.</p> <p>State one cause of each of the following:</p> <ol style="list-style-type: none"> <li>1. ectopic pregnancy</li> <li>2. infertility</li> <li>3. fibroid</li> <li>4. impotence</li> </ol>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<b>UNIT 2 (CONT'D)</b>	<p>The student will be able to:</p> <p>3.2.6 mention types of STIs including HIV/AIDS, how they are transmitted and their effects.</p> <p>3.2.7 identify the phases of growth and development in humans and the associated changes.</p>	<p>Sexually transmitted infections (STIs): HIV/AIDS, gonorrhoea, herpes, Chlamydia.</p> <p>Mode of transmission</p> <p>Effects: prolonged sickness, infertility.</p> <p>Phases of growth and development in humans.</p>	<p>Let students:</p> <p>discuss various sexually transmitted diseases and their modes of transmission.</p> <p>analyse the effects of STIs including HIV/AIDS on the health and reproduction in humans.</p> <p>discuss the various phases of growth and the physical and behavioural changes associated with each phase of human development.</p> <p><b>NOTE:</b> The changes may include losing milk teeth and development of permanent teeth, increase in mass, height, development of secondary sexual characters, e.g. menstruation in girls (pre-menstrual syndrome (PMS) in some women-accompanied by violent moods or depression), wet dreams in boys. Changes in old age should include menopause and its associated problems.</p> <p>invite a psychologist and gynaecologist to talk about changes during adolescence and symptoms associated with menopause.</p>	<p>Discuss the effects of HIV/AIDS on the family and the society.</p> <p>Discuss the development of secondary sexual characteristics in males and females.</p>
<b>UNIT: 3 THE CIRCULATORY SYSTEM</b>	<p>3.3.1 describe the structure and functions of the circulatory system.</p>	<p>structure and functions of the circulatory system.</p>	<p>use a dissected small mammal to study organs concerned with blood circulation.</p> <p>use charts/models/diagrams to trace the flow of blood through the heart, the lungs and the body of humans.</p> <p><b>NOTE:</b> Detailed structure of the cellular components of the blood vessels not required</p>	<p>Discuss the functions of the heart, the veins and the arteries in the circulatory system.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 3 (CONT'D)	<p>The student will be able to:</p> <p>3.3.2 describe the composition and functions of blood and lymph.</p> <p>3.3.3 identify disorders associated with blood and the blood circulatory system.</p>	<p>Composition and functions of blood and lymph</p> <p>Disorders associated with blood and the blood circulatory system: high blood pressure, low blood pressure, hole-in-heart</p>	<p>Let students:</p> <p>discuss the composition and functions of the blood and lymph.</p> <p><b>NOTE:</b> Discussion should include the mechanism of blood clotting.</p> <p><b>CLASS ACTIVITY:</b> Carry out activities using the appropriate equipment and chemicals to measure their own blood pressure and to determine their own blood groups.</p> <p>explain the causes of disorders of blood and blood circulatory system.</p> <p><b>NOTE:</b> Invite a resource person/haematologist to assist in the activity.</p>	<p>Explain the term <i>haemophilia</i>. State the various stages of blood clotting.</p>



UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<b>UNIT 1 (CONT'D)</b>	<p>The student will be able to:</p> <p>4.1.3 calculate resistance, current, potential difference and power.</p> <p>4.1.4 demonstrate the processes involved in electric power generation.</p> <p>4.1.5 describe the stages of electric power transmission.</p>	<p>Resistance (R), current (I), potential difference (V) and power (P)</p> <p>Electric power generation.</p> <p>Power transmission: Transformers (step up and step down transformers).</p> <p>Wiring a plug Household wiring Stabilizers, fuses and Earthing.</p>	<p>Let students:</p> <p>state Ohm's law and carry out simple calculations using the relation <math>V = IR</math></p> <p>carry out simple calculations for electric power.</p> $P = IV = I^2R = \frac{V^2}{R}$ <p>mention power ratings (wattage) of some electrical devices, e.g. stove 750W and bulbs 40W, 60W,</p> <p>discuss the importance of power ratings of electric appliances.</p> <p>discuss the importance of power rationing of electric appliances.</p> <p>discuss sources of electric power generation: Hydro, thermal, nuclear, solar, wind, tidal and biogas.</p> <p>discuss the basic principles underlying the production of electricity e.g. relative motion between a coil and magnet.</p> <p><b>PROJECT:</b></p> <p>i. Students to apply the principle to design and construct a miniature electric power plant to generate electricity from any of the above listed power sources.</p> <p>ii. Visit a thermal/hydro-electric power station and write report.</p> <p>discuss the gadgets and processes involved in the transmission of power under the following headings:</p> <ol style="list-style-type: none"> <li>1. Use of step up and step down transformer.</li> <li>2. Wiring of a plug.</li> <li>3. Household wiring.</li> <li>4. Use of stabilizers.</li> <li>5. Use of fuse.</li> <li>6. Use of earthing.</li> </ol>	<p>Resistors <math>2\Omega</math> and <math>6\Omega</math> are connected in (i) parallel and (ii) series to a 1.5 V cell. Calculate the current flowing in each arrangement</p> <p>An electric appliance is rated 240V, 750W. Calculate (i) the current (ii) the resistance</p> <p>Discuss how electric power reaches your home from a hydro-electric power station (Akosombo).</p>



UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
	<p>The student will be able to:</p> <p>4.2.3 identify the parts of the human ear and describe their functions.</p>	<p>Structure and functions of the human ear.</p>	<p>Let students:</p> <p>describe the human ear and the functions of each part.</p> <p>discuss the effect of loudness and pitch on humans e.g. sound pollution.</p> <p>discuss the importance of ear muffs.</p>	<p>What is the effect of high pitch sound on humans</p> <p><b>GROUP EXERCISE:</b> Explore and write a report on the principle on which the following operate.</p> <ol style="list-style-type: none"> <li>1. Line phone</li> <li>2. Cell (mobile) phone</li> </ol>

**YEAR 2**  
**SECTION 5: INTERACTIONS OF MATTER**

**General Objectives:** The Students will:

1. appreciate that interaction between and within matter helps humans to better understand the environment and their role in it
2. understand the principles of operation of magnets, forces and motion of objects
3. recognise the importance of proper sanitation in communities for healthy living
4. be aware of safety precautions at the community and to prevent hazards

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<b>UNIT: 1</b> <b>MAGNETISM</b>	<p>The student will be able to:</p> <p>5.1.1 distinguish between magnetic and non magnetic materials.</p> <p>5.1.2 explain magnetic field.</p> <p>5.1.3 outline the processes of magnetization and demagnetization.</p>	<p>Magnetic and non-magnetic materials.</p> <p>Magnetic field.</p> <p>Processes of magnetization and demagnetisation</p>	<p>Let students:</p> <p>move magnets closer to various kinds of materials and classify them as: magnetic and non-magnetic materials.</p> <p>discuss permanent and temporary magnet</p> <p>explain the functions of magnets in the following gadgets: Telephone earpiece Loud speakers Microphones Magnetic compass Generation of electricity Fridge doors Electricity meters</p> <p>brainstorm to bring out the meaning of a magnetic field use a compass or iron fillings to demonstrate magnetic fields around a bar magnet, then around a wire carrying an electric current.</p> <p>demonstrate the use of magnetic compass in finding the direction of the north pole.</p> <p>discuss the magnetization of a steel bar using single/double stroke method.</p> <p>discuss the magnetization of a steel bar using electrical (d.c.) method</p> <p>discuss the production and use of electromagnets</p> <p>discuss complete demagnetization of a permanent magnet.</p>	<p>Draw magnetic fields around:</p> <p>(i) a bar magnet</p> <p>(ii) a wire carrying an electric current (d.c)</p> <p>Describe how you would magnetize a steel bar by electrical method.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<p><b>UNIT 2</b></p> <p><b>FORCE, MOTION AND PRESURE</b></p>	<p>The student will be able to:</p> <p>5.2.1 define force and outline various types.</p> <p>5.2.2 state the Archimedes Principle and the law of floatation.</p>	<p>Force: Definition and types: Frictional, Viscous, Gravitational, Electrostatic, Magnetic, Upthrust</p> <p>Archimedes Principle and law of floatation.</p>	<p>brainstorm to define force.</p> <p>investigate the effect of force by:</p> <ol style="list-style-type: none"> <li>1. stretching a piece of elastic string</li> <li>2. by pushing a wall..</li> </ol> <p>Explain the various types of forces as listed in the content and carry out activities to demonstrate each one of them.</p> <p>discuss Archimedes principle and the law of floatation and use them to explain the following phenomena:</p> <ol style="list-style-type: none"> <li>1. the flight of birds</li> <li>2. the flight of aeroplanes</li> <li>3. why boats float in water</li> <li>4. floatation of ships and submarines</li> </ol> <p><b>GROUP ACTIVITY:</b></p> <ol style="list-style-type: none"> <li>1. Observe and record what happens when different metallic and wooden objects are placed in water.</li> <li>2. Place an egg first in water and then in salt solution and explain the observation in each case.</li> </ol>	<p>State three effects of force on a body.</p> <p>Explain the term upthrust.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 2 (CONT'D)	<p>The student will be able to:</p> <p>5.2.3 explain the terms distance, displacement, speed, velocity, acceleration and momentum.</p> <p>5.2.4 explain types of motion and the Newton's laws of motion.</p>	<p>Distance, displacement, speed, velocity, acceleration and momentum.</p> <p>Types of motion.</p> <ul style="list-style-type: none"> <li>- linear</li> <li>- circular</li> <li>- rotational</li> <li>- vibrational</li> <li>- random</li> </ul> <p>Newton's laws of motion</p> <ul style="list-style-type: none"> <li>- inertia</li> <li>- momentum</li> <li>- balanced and unbalanced force</li> </ul>	<p>Let students:</p> <p>define distance, displacement, speed, velocity, acceleration and momentum</p> <p>(i) <math>\text{speed} = \frac{\text{distance travelled}}{\text{time taken}}</math></p> <p>(ii) <math>\text{velocity} = \frac{\text{displacement}}{\text{time taken}}</math></p> <p>(iii) <math>\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}</math></p> <p>(iv) <math>\text{momentum} = \text{mass} \times \text{velocity}</math>.</p> <p>demonstrate different types of motion: linear, rotational, circular.... e.g.</p> <ol style="list-style-type: none"> <li>1. a stone tied to a thread – circular</li> <li>2. a toy car pushed on a floor-linear</li> <li>3. the movement of a wheel – rotational</li> <li>4. a crown cork carrying two holes and a string – vibrational</li> </ol> <p>explain the term <i>inertia</i></p> <p>demonstrate that to every action there is an equal and opposite reaction.</p> <p>investigate the forces at play in the following:</p> <ol style="list-style-type: none"> <li>(i) an object is placed on a table</li> <li>(ii) a passenger jerking forward when a moving car comes to a sudden stop.</li> <li>(iii) a passenger steps out of a moving vehicle.</li> </ol> <p><b>NOTE:</b></p> <ol style="list-style-type: none"> <li>1. Centripetal force should be mentioned.</li> <li>2. Discussion of Newton's second law of motion should lead to the relation: Force = mass x acceleration.</li> </ol> <p>discuss that the force of gravity or the weight (W) of an object = mg, where g is the acceleration due to gravity, m is the mass of object.</p>	<p>An object of mass 4kg moving with initial velocity of <math>20\text{ms}^{-1}</math> accelerates for 10s and attains a final velocity of <math>60\text{ms}^{-1}</math>. Calculate:</p> <ol style="list-style-type: none"> <li>i. the acceleration</li> <li>ii. initial momentum.</li> </ol> <p>Explain why passengers lurch forward or are thrown backwards whenever the vehicle changes motion e.g. braking and rounding curves.</p> <p>Explain the importance of the use of seat belt in vehicles</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<b>UNIT 2 (CONT'D)</b>	<p>The student will be able to:</p> <p>5.2.5 define centre of gravity and distinguish between stable, unstable and neutral equilibrium.</p> <p>5.2.6 explain moment of a Force.</p> <p>5.2.7 define pressure and describe the effects and application of pressure in solids, liquids and gases.</p>	<p>Centre of gravity and stability of objects.</p> <p>Stability of objects: stable, unstable and neutral equilibrium.</p> <p>Moment of a force</p> <p>Pressure; definition and effects.</p>	<p>Let students:</p> <p>use the plumb line or knife edge (wedge) method to determine the centre of gravity of rectangular, triangular and circular cardboards.</p> <p>demonstrate the three types of equilibrium using a cone on a flat surface.</p> <p>discuss stability based on the following activities:</p> <ul style="list-style-type: none"> <li>(i) walking on stilts</li> <li>(ii) acrobats walking on ropes</li> <li>(iii) spinning a pan with fingers or stick</li> </ul> <p>brainstorm to define moment of a force.</p> <p>discuss the principle of moment of a force about a point.</p> <p>demonstrate the principle of moment of a force using a see-saw.</p> <p>perform simple calculations on the principle of moment.</p> <p>brainstorm to define pressure</p> <p>use a rectangular block of wood on a table to demonstrate pressure exerted by solids</p> <p>use a tall container with three holes at different heights to demonstrate pressure in liquids.</p> <p>use bicycle pump to demonstrate the transmission of pressure.</p> <p>observe the operation of water pump, siphons and hydraulics .</p> <p><b>CLASS PROJECT:</b> Students to design a simple fountain or sprinkler system.</p>	<p>Explain the terms stable, unstable and neutral equilibrium and give example of each type of equilibrium.</p> <p>State the principle of moment</p> <p>A boy of weight 80.0N sits at a distance of 2.0m from the pivot of a see-saw. What distance from the other end should another boy of weight 40.0N sit to keep the see-saw in equilibrium?</p> <p>A cement block of weight 50.0N and one side of area <math>0.2\text{m}^2</math> rests on a table. Calculate the pressure exerted on the table by the cement block.</p>

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<b>UNIT 3 SAFETY IN THE COMMUNITY</b>	<p>The student will be able to:</p> <p>5.3.1 identify appliances used at home and how to use them properly.</p> <p>5.3.2 use first aid methods to treat accidents at home.</p> <p>5.3.3 identify hazardous substances at the work place and their effects on humans.</p>	<p>Safe use of appliances at the home.</p> <p>First Aid methods</p> <p>Hazardous substances and their effect.</p>	<p>Let students:</p> <p>discuss proper use or handling of household appliances to prevent accidents at home: avoidance of overloading of electric sockets, extreme care in using the heating coil in metal/plastic containers, use of gas stoves.</p> <p><b>NOTE:</b> Precautions to include:  1. Keeping hands dry before touching electrical gadgets.  2. Viewing television from a distance.</p> <p>demonstrate the following using models:  1. mouth-to-mouth resuscitation method.  2. methods extinguishing different fires.  3. treatment of burns, cuts and electric shocks.</p> <p>invite a Fire Service Officer or Red Cross Personnel to talk to class on accidents prevention and first aid.  <b>ACTIVITY:</b> Students to make a first aid box for the class.</p> <p>discuss possible hazards that can occur in any working environment, e.g. dust, fumes, toxic gases, corrosive substances, fire, food contamination, harmful radiation (x-rays), poisonous chemicals e.g. dioxins from heated or frozen plastics.</p> <p>discuss the effects of hazardous substances on the human body, e.g. blindness, burns, nausea, vomiting, and allergies.</p> <p>discuss various hazards, warning labels on containers and other places, and appraise their adequacy.</p> <p>discuss the proper storage of some hazardous substances and other safety measures at work places, e.g. protective clothing.</p> <p>discuss the techniques involved in preventing fires due to electrical and chemical causes, and bush fires.</p>	<p>State two methods of extinguishing</p> <ol style="list-style-type: none"> <li>1. electric fire</li> <li>2. gas fire</li> </ol> <p>Illustrate three safety symbols and state their meanings.</p>