INTRODUCTION
The overall goal of the course of study in Biology provides learners with the opportunity to learn about variations in the structures and functions of organisms and provides an understanding of the effects of the environment on living things.

The General objectives for Grades 10 – 12 Biology:
1. Explain the importance of biological knowledge in everyday living.
2. Develop an appreciation of nature and its significance in the survival of living things.
3. Acquire basic scientific and intellectual skills such as observation, classification and interpretation of data.
4. Develop the scientific attitude of problem solving and an acute sense of curiosity, creativity, innovation and critical thinking.
5. Comprehend the basic principles associated with the science of life including the impact of negative and positive issues.

A learner-centered approach is emphasized in this curriculum. This is based on the firm belief that learning becomes more permanent, meaningful and exciting when learners themselves take ownership of the learning process. Instructors are therefore urged to contrive those classroom strategies that engage learners actively in the teaching and learning process.
### SEMESTER ONE

**GRADE:** 10  
**PERIOD:** 1  
**TOPICS:** INTRODUCTION TO BIOLOGY AND ITS BRANCHES;  
THE STUDY OF CELL AS THE BASIC UNIT OF LIFE;  
AND MOVEMENT OF SUBSTANCES ACROSS CELL MEMBRANE

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<th>OUTCOMES</th>
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<th>MATERIALS/RESOURCES</th>
<th>COMPETENCIES/ASSESSMENT</th>
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</table>
| **Learners are able to:** | **Upon completion of these topics, learners will:**  
1. Acquire the fundamentals of laboratory skills in biology  
2. Attain the concept that living things have specific characteristics that distinguish them from nonliving things, and agree that all living things are made of cells. | **1. Definition of Biology - Major Branches:**  
Zoology and Botany along with some other branches of Biology.  
**2. Contributors:**  
Nationality and major contributions:  
   a) Aristotle  
   b) Linnaeus  
   c) Pasteur  
   d) Koch  
   e) Mendel, etc.  
3. Characteristics that distinguish Living things from Non-living things:  
   nutrition, respiration, excretion, irritability, movement, growth and reproduction  
4. Relate the structures and composition of the cell in relations to their functions  
5. Compare the basic functions of tissues, organs and systems  
6. Demonstrate the use of the microscope in studying Biology  
7. Determine the difference amongst Prokaryotic, | **Inclusive and differentiated learning**  
Mixed group presentation (gender, ability & style)  
**1. Class discussions:**  
   a. Using concept map, illustrate the branches of biology and other sub branches  
   b. Stating the contributions of some scientists to the field of biology  
   c. Describing the branches of biology and those specific ones that relate to STIs (Microbiology, Parasitology, Virology, and Bacteriology).  
   d. Distinguish the basic characteristics of living things including reproduction. | **A. Primary Text**  
**B. Secondary Texts**  
- Sue Hocking, *et al. OCR Biology* (OCR/Heinemann, 2008).  
Senior Secondary Guide *Senior secondary guide Biology* (star study guide series)  
**C. Other Resources/Supplementary Readings** | **EXPECTED COMPETENCIES**  
- Effective communication skills  
- Analytical and research skills  
- Research and problem solving skills  
**ASSESSMENT STRATEGIES:** To be used to test for competencies, select relevant options.  
- Quizzes  
- Class works  
- assignments, attendance  
- class participation  
- Individual presentations, Lab works  
- Test |
Eukaryotic, and Akaryotic cells

8. Discover the difference between the plant and animal cells

9. Examine the movement of substances into and out of the cell

10. Appreciate that all living organisms are made up of cells and that the cell is the building block of life

5. Biological tool
   - Light microscopes

6. Cell and Cell Theory
   a) Basic structures and functions of parts of a cell.
   b) Movement of substances into and out of the cell: osmosis, diffusion, facilitated diffusion, active transport, endocytosis (pinocytosis, phagocytosis), and exocytosis

2. Homework: Drawing cells (animal & plant) and labeling their parts.

3. LAB:
   a. Learners will draw and label the light microscope and outline the functions of each part.
   b. Learners will identify some laboratory materials and apparatus discuss their uses.
   c. Learners will use microscope to observe:
      a) onion epidermal cell; b) cheek cells

Bob McDuell, Senior High Integrated Science (Pearson, 2009)

Biological charts on branches of biology;
Compound light microscopes; Onion bulbs; Tooth picks; prepared slides; Droppers; Razor blade;
Iodine solution
Links:
www.dictionary.com
www.khanacademy.com
www.biomanbio.com
www.biologyjunction.com
www.rankred.com
www.planeta42.com
www.saps.org
www.thoughtco.com
# THE HIERARCHY AND DIVERSITY OF LIVING THINGS; UNICELLULAR ORGANISMS

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<th>COMPETENCIES/ ASSESSMENT</th>
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<tbody>
<tr>
<td>Learners are able to: Appreciate the systematic classification of organisms based on their characteristics.</td>
<td>1. Classification and the importance of living things</td>
<td>Inclusive and differentiated learning</td>
<td>A. Primary Text</td>
<td>EXPECTED COMPETENCIES</td>
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<td>Explain the similarities and differences among the five major kingdoms of living things. Develop the concept that life evolved from the simplest to the complex forms.</td>
<td>2. Classification of organisms into Kingdom, Phylum, Class, Order, Family, Genus and Species</td>
<td>Mixed group presentation (gender, ability &amp; style)</td>
<td>Baffour Asante-Owusu, et al. <em>Senior High Biology</em> (Longman, 2009)</td>
<td>• Effective communication skills</td>
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<td>3. Unicellular organisms</td>
<td>1. List the general characteristics of each kingdom.</td>
<td>B. Secondary Texts</td>
<td>• Analytical and research skills</td>
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<td>A)STIs-causing agents: Fungus, Bacteria (gonorrhea, syphilis), Virus (HIV/AIDS), Protozoa (Trichomonas(Vaginalis))</td>
<td>2. LAB Draw and label one organism each belonging to each of the five kingdoms.</td>
<td>Sue Hocking, et al. <em>OCR Biology</em> (OCR/Heinemann, 2008).</td>
<td>• Research and problem solving skills</td>
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<td>5. Draw the life cycle of the plasmodium.</td>
<td>5. Draw the life cycle of the plasmodium.</td>
<td>C. Other Resources/Supplementary Readings Bob McDuell, <em>Senior High Integrated Science</em> (Pearson, 2009)</td>
<td>ASSESSMENT STRATEGIES: To be used to test for competencies, select relevant options.</td>
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<td>• Specimens or diagrams of various organisms, e.g.</td>
<td>• Quizzes</td>
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<td>• Class works</td>
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<td>• assignments, attendance</td>
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<td>• class participation</td>
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<td>• Individual presentations,</td>
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<td>• Lab works</td>
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<td>• Test</td>
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7. Name unicellular organisms that are causative agents of diseases and the diseases they cause

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<td>7.</td>
<td>histolytica - Amebic dysentery (amebiasis)</td>
<td>6. List and discuss causative agents of STIs and the diseases they cause.</td>
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<td>b) Giardia lamblia – (giardiasis)</td>
<td>7. Discussion of the effects and preventions of malaria and dysentery.</td>
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<td>c) Plasmodium falciparum- (malaria)</td>
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</table>

butterfly, cockroach, snail, earthworm, cat, man, etc.

- Charts on kinds of Protozoans
- Compound light microscopes
- Empty slides
- Prepared slides
- Cover slips

Links:
- [www.dictionary.com](http://www.dictionary.com)
- [www.khanacademy.com](http://www.khanacademy.com)
- [www.biomanbio.com](http://www.biomanbio.com)
- [wwwogyjunction.com](http://wwwogyjunction.com)
- [www.rankred.com](http://www.rankred.com)
- [www.planeta42.com](http://www.planeta42.com)
- [www.saps.org](http://www.saps.org)
- [www.thoughtco.com](http://www.thoughtco.com)
# SEMESTER: ONE

## TOPIC: MULTICELLULAR ORGANISMS AND REPRODUCTIVE STRUCTURES

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<th>COMPETENCIES/ ASSESSMENT</th>
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<tr>
<td>Learners are able to develop the concept that tissues are formed from cells, organs from tissues, and systems from organs</td>
<td>Upon completion of this topic, students will be able to: 1. Discuss the functions of the four types of tissues 2. Explain the concept of organ as a combination of tissues and systems as a combination of organs 3. Describe the general characteristics of multicellular organisms 4. Describe the general characteristics and morphological features of sponges and hydra 5. Classify and structurally differentiate worms</td>
<td><strong>1. Tissues, Organs, and Systems</strong>  2. <strong>General characteristics</strong>a. Sponges  b. Hydra  3. <strong>Worms:</strong>  a) flat worms  Planarian (free living)  - blood &amp; liver flukes  - tape worms  b) Parasitic round worms  - ascaris  - hook worm  - filarial worm  - trichina worm  c) Segmented worms  - Earth worm and leeches  4. <strong>Human reproductive structures</strong> a. structure and functions of male and female reproductive organs(Naming the male</td>
<td>Explanation of tissues in relation to organs and systems  <strong>Assignment</strong>: Draw and label the body structure of a sponge and stating the functions of each labelled parts a. Draw the three different cells of a sponge and stating the function of each b. Draw and label the parts of a hydra and state the functions of each labelled part 5. Explanation of the conditions for the oral transmission of intestinal parasites to their host 6. Outlining the effects, symptoms and methods of prevention of any intestinal parasite. (measures: washing hands after the use of latrine, before eating and eating well-cooked meat) 7. Dissecting an earth worm and identifying its external and internal features.</td>
<td><strong>A. Primary Text</strong>  Baffour Asante-Owusu, et al. <em>Senior High Biology</em> (Longman, 2009)  <strong>B. Secondary Texts</strong>  - Sue Hocking, et al. <em>OCR Biology</em> (OCR/Heinemann, 2008).  - Doris Koto, et al., <em>Senior Secondary Guide – Biology</em>(Pearson, 2000)  Senior Secondary Guide  - <em>Senior secondary guide Biology</em> (star study guide series) Martin Barker &amp; David Darch 2nd edition, 2016</td>
<td><strong>EXPECTED COMPETENCIES</strong>  - Effective communication skills  - Analytical and research skills  - Research and problem skills  - Organizational ability  - Digital skills  - Creativity and innovation skills  <strong>ASSESSMENT STRATEGIES</strong>: To be used to test for competencies, select relevant options.  - Quizzes  - Class works  - assignments, attendance  - class participation  - Individual presentations,  - Lab works  - Test</td>
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<td>6.</td>
<td>Explain parasitism among worms and the alternative hosts considering their life cycles.</td>
<td>and female reproductive organs Functions of these organs, Myths about reproduction)</td>
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<td>7.</td>
<td>Outline measures for preventing parasitic worm infections.</td>
<td>b. Human Life cycle: infancy, juvenile, adolescence, adult, senescence-old age (what influences sexual desires (hormones) and how can one control sexual desire)</td>
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<td>8.</td>
<td>Differentiate between the leech and earth worm based on morphology.</td>
<td>c. Menstruation Menstruation and pregnancy Menstrual hygiene</td>
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<td>9.</td>
<td>Compare the structures and functions of the human reproductive systems.</td>
<td>c. Pregnancy and STIs prevention -Abstinence -Use of condoms (Importance, Challenges/risky behavior &amp; values)</td>
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<td>10.</td>
<td>Identify the various stages of the menstrual cycle and explain essence of contraceptive.</td>
<td>- Contraceptives (Methods of contraceptives &amp; Role of contraceptive (condom) in STI prevention)</td>
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<td>11.</td>
<td>Recognize that substance abuse (alcohol and drugs) is harmful to life.</td>
<td>5. Substance abuse and Sexual desires</td>
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<td>8. Observe and draw the external structures of:</td>
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<td>a. filarial worm b. tape worm c. hook worm d. round worm</td>
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<td>Individual presentations/ Mixed group presentation (gender, fast, middle and slow learners,)</td>
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<td>a. Use visual aids to demonstrate natural family planning method. i) Mention the challenges of this method and why some girls cannot use it. ii) Mention that this method of prevention does not prevent STI and HIV.</td>
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<td>b. Encourage girls to consider double protection.</td>
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<td>Drama: A female refusing to have sex because it’s her unsafe period of the menstrual cycle.</td>
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<td>Demonstrate care for oneself during menstruation</td>
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<td>Case study showing what influences sexual desires</td>
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<td>Discussion: Hold class discussion on the effects of hormones, drugs and substance abuse on sexual desires</td>
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<td>Roll play on resisting things that influence sexual desires</td>
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<td>including sponges, hydram, etc…</td>
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<td>• charts/specimens of various kinds of worms</td>
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<td>• flat worms,</td>
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<td>• hook worm</td>
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<td>• filarial worm</td>
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<td>• trichina worm</td>
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<td>• dissecting tray</td>
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<td>• Petri dish</td>
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<td>a) Definition of Drugs and Substance abuse</td>
<td>Experience sharing by people who succeeded from abstinence</td>
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<td>- Names of Drugs and Substances commonly abused</td>
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<td>- Classify drugs and Substances abused</td>
<td>Professional talks or explanation: Invite a health professional to speak about how contraceptives stop conception. Explain each method including strength and side effects.</td>
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<td>i) alcohol</td>
<td>Experience sharing: Considering former drug addict or one who has lived with a drug addict to share the influence of drugs on one’s life.</td>
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<td>ii) narcotics</td>
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<td>iii) opioids etc…</td>
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### SEMESTER TWO

**GRADE:** 10  
**PERIODS:** IV  
**TOPIC:** ARTHROPOD AND BIOLOGICAL CONTROL OF PESTS

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<th>ACTIVITIES/ LAB WORK</th>
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<th>COMPETENCIES/ ASSESSMENT</th>
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| Learners are able to classify arthropods, outline the various ways to control pests, and explain the economic importance of some arthropods. | Upon completion of this topic, learners will:  
1. Describe and classify arthropods according to their morphology  
2. Explain the process of metamorphosis (complete & incomplete) and Ecdysis (molting) in arthropods;  
3. Discuss the role of vectors (cockroach, mosquito, house-fly, and tsetse fly) | 1. **Arthropod: General characteristics & classification**  
   a) morphology and life processes  
   i) respiration  
   ii) feeding  
   iii) mouth parts and body segments  
   c) life cycle:  
   2. **metamorphosis and Molting** (complete and incomplete)  
3. **Vectors:** (Mosquitoes, teste fly, house fly, and cockroach.) General characteristics: - Mouth parts, feeding, life cycle and transmission of diseases. | **Inclusive and differentiated learning**  
Mixed group presentation (gender, fast, middle and slow learners, )  
1. **Field trip**- collection of different species of insect outdoor: butterfly, grasshopper, cockroach, weevils, cotton strainers and housefly and observing their external body structures  
   a) study specimen: grasshopper/locust or cockroach, weevils and cotton stainers  
2. **Assignment** - Collecting mosquito larvae/wigglers and bringing to the lab for observation. | **A. Primary Text**  
**B. Secondary Texts**  
Senior Secondary Guide  
- *Senior secondary guide Biology* (star study guide series)  
**C. Other Resources/Supplementary Readings**  
- Bob McDuell, *Senior High Integrated Science* (Pearson, 2009)  
**EXPECTED COMPETENCIES:**  
- Effective communication skills  
- Analytical and research skills  
- Research and problem skills  
- Organizational ability  
- Digital skills  
- Creativity and innovation skills  
**ASSESSMENT STRATEGIES:** To be used to test for competencies, select relevant options.  
- Quizzes  
- Class works  
- assignments, attendance  
- class participation  
- Individual presentations, |
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<tr>
<th>4. Explain the general characteristic of butterfly</th>
<th>4. Caste System in Social Insects</th>
<th>5. Listing methods of controlling the spread of malaria.</th>
<th>6. Draw and label the parts of each of the classes of arthropods, For instance: grasshopper, mosquitoes, millipede, crab, crayfish, spider, etc.</th>
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</thead>
</table>
| 5. Elaborate on the economics importance of the honey bees and termites | 5. **Economic importance of social insects**
   a. Honey bees
   b. Termites |
| 6. Discuss pests, their economic importance and control measures. Describe the features and economic importance of grasshoppers. | 6. **Pests**
   - Economic importance
   - Chemical control
   - Biological control |
| 7. Stating the economic importance of honey bees and termites | |
| 8. Discussing honey bees and termites as social insects. | |

- Charts on various kinds of arthropods and malaria cycle
- Specimens: crab, crayfish, spiders, centipede, millipede, grasshoppers, butterflies cockroaches, weevils and cotton stainers
- Insect collecting net
- Dissecting set
- Dissecting tray and gloves
- Hand lenses
- Compound microscope

Links:
- [www.dictionary.com](http://www.dictionary.com)
- [www.khanacademy.com](http://www.khanacademy.com)
- [www.biomanbio.com](http://www.biomanbio.com)
- [www.biologyjunction.com](http://www.biologyjunction.com)
- [www.rankred.com](http://www.rankred.com)
- [www.planeta42.com](http://www.planeta42.com)
- [www.saps.org](http://www.saps.org)
- [www.thoughtco.com](http://www.thoughtco.com)

- Lab works Test
- Lab works Test
<table>
<thead>
<tr>
<th>OUTCOMES</th>
<th>OBJECTIVES</th>
<th>CONTENT</th>
<th>ACTIVITIES/ LAB WORKS</th>
<th>MATERIALS RESOURCES</th>
<th>COMPETENCIES/ ASSESSMENT</th>
</tr>
</thead>
</table>
| Learners are able to understand that algae are producers of atmospheric oxygen and serve as food for organisms. Learners are able to appreciate that mosses and ferns are non-vascular plants Understand that some fungi are disease causing agents while others are used as food | Upon completion of this topic, Learners will: 1. Describe the general characteristics, structures and life cycles of algae, mosses ferns, and Fungi 2. Explain the economic importance of algae and mosses ferns, and Fungi | 1. Algae:  
a) General characteristics  
b) classification  
c) phytoplankton (floating microbe)  
d) green algae  
e) Spirogyra-reproduction (sexual and asexual)  
f) Economic importance of algae in food, medicine & industry  
1. Mosses (e.g. brachymerium and Funaria)  
a) general characteristics  
b) reproduction: alternation of generations | Inclusive and differentiated learning  
Individual work/ Mixed group presentation (gender, fast, middle and slow learners, )  
1. Drawing and labeling the parts of a spirogyra  
2. Drawing and labeling the stages of sexual reproduction in spirogyra  
3. Observing and identifying a piece of molded bread under the microscope, drawing and labeling the parts of the hyphae of a rhizopus.  
4. Illustrating the life cycle of rhizopus. | A. Primary Text  
Baffour Asante-Owusu, et al.  
Senior High Biology (Longman, 2009)  
B. Secondary Texts  
• Sue Hocking, et al.  
OCR Biology (OCR/Heinemann, 2008).  
Senior Secondary Guide  
• Senior secondary guide Biology (star study guide series)  
Martin Barker & David Darch 2nd edition, 2016 | Expected competencies:  
• Effective communication skills  
• Analytical and research skills  
• Research and problem skills  
• Organizational ability  
• Digital skills  
• Creativity and innovation skills  
Assessment strategies to be used to test for competencies, select relevant options:  
• Quizzes  
• Class works  
• Assignments, attendance  
• Class participation  
• Individual presentations,
3. Explain the processes of Photosynthesis in relation to how autotrophs make their food.

4. Describe the process of reproduction in algae.

5. Explain types of nutrition of fungi.

6. Describe symbiotic relations of Fungi in relation to *parasitism and saprophytism*.

7. List common fungal diseases of plants and animals such as (athlete foot, ringworm).

8. Explain the life cycle of a club fungus.

9. Collecting and studying a bracket fungus and identifying the annual rings.

10. Stating ways of preventing fungal infections.

11. Diagramming reproduction in fungus.

12. Drawing and labeling the life cycles of mosses and ferns.

13. Experimenting by growing two plants, one in sunlight and one in the shade to observe the effects of sunlight on plant growth.

14. Wrapping some leaves of a growing plant with aluminum foil and comparing it with other leaves of the same plants after four days.

15. Testing a leaf for starch.

16. Testing to break down cell wall and starches.

Readings
- Bob McDuell, *Senior High Integrated Science* (Pearson, 2009)
- Charts on algae, mosses, ferns & fungi
- Specimens (yeast, molded bread) club fungi, bracket fungi
- Microscope
- Plain slide & prepared slide, cover slips
- Droppers
- Beakers
- Charts on the life cycles of algae, mosses, ferns, and fungi
- Specimens of growing plants
- Aluminum foil
- Empty cans
- Boiling water
- White tile
- Iodine solution
- Dropper
- Green leaf
- Ethanol
- Variegated leaf
- Test tube
- Test tube holder
- Test tube rack
- Clamp and Clamp stand
- Bench lamp
- Filter funnel
- Aquatic plant

Links:
- Lab works
- Test
<table>
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</thead>
<tbody>
<tr>
<td>Photosynthesis</td>
<td>Photosynthesis (light dependent reactions, light independent reactions)</td>
<td>d) products of photosynthesis</td>
<td>14. Testing to extract chlorophyll</td>
<td>e) fate of photosynthetic products</td>
<td>15. Experimenting to demonstrate the need for chlorophyll in photosynthesis</td>
<td>f) Macronutrients and micronutrients: their effects in photosynthesis</td>
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</tbody>
</table>
**SEMESTER: TWO**

**GRADE: 10**  
**PERIOD: VI**  
**TOPIC: FLOWERING PLANTS**

<table>
<thead>
<tr>
<th>OUTCOMES</th>
<th>OBJECTIVES</th>
<th>CONTENTS</th>
<th>ACTIVITIES/LAB WORKS</th>
<th>MATERIALS/RESOURCES</th>
<th>COMPETENCIES/ASSESSMENT</th>
</tr>
</thead>
</table>
| Learning are able to accept that flowering plants are major food producers in the biosphere and are very important in the food chain. | Upon completion of this topic, learners will:  
1. Identify the characteristics of flowering plants and distinguish them  
2. Classify flowering plants into **monocotyledonae** (monocots) and **dicotyledonae** (dicots)  
3. Distinguish the structural characteristics of monocots and dicots  
4. Describe the structures and functions of roots, stems, and leaves; and flowers in flowering plants.  
5. Explain sexual and asexual reproduction in flowering plants.  
6. Determine the floral formulae of flowers such as flamboyant (*Delonix*), Pride of Barbados (*Caesalpinia*) and Rattle Box (*Crotalaria*).  
7. Discuss types of pollination and list agents of pollination.  
8. Explain the process of zygote and embryo. | 1. **Flowering plants:**  
- a) classification (monocots & Dicots)  
- b) Success of flowering plants  
2. **Functions of roots, stems, leaves and flowers:**  
- 3. **Floral formulae of flowers:**  
- i.e. Flamboyant (*Delonix*), pride of Barbados (*Caesalpinia*) and Rattle Box (*Crotalaria*).  
3. **Types of plants tissues**  
- 4. **Root system:**  
- a) types  
- b) regions of root tip,  
- c) functions and structures of root hairs  
5. **Modified roots, stems and leaves -tubers,** | 1. Drawing and labeling the parts of a complete flower and stating their functions  
2. Illustration of the types of vegetative propagation (cutting, grafting, etc)  
3. **LAB** Setting up an experiment to demonstrate the two types of germination - using corn seed (kernel) and bean seed.  
4. Examine the internal structure of leaf using the microscope  
5. Collecting various fruits and seeds and classifying them into types. | **A. Primary Text**  
Baffour Asante-Owusu, et al.  *Senior High Biology*  
(Longman, 2009)  
**B. Secondary Texts**  
• Sue Hocking, et al.  *OCR Biology*  
(OCR/Heineman, 2008).  
• Doris Koto, et al., *Senior Secondary Guide – Biology*  
(Pearson, 2000)  
• Senior Secondary Guide  
*Senior secondary guide Biology* (star study guide series) | **EXPECTED COMPETENCIES:**  
• Effective communication skills  
• Analytical and research skills  
• Research and problem skills  
• Organizational ability  
• Digital skills  
• Creativity and innovation skills |

**EXPECTED COMPETENCIES:**  
• **ASSESSMENT STRATEGIES** to be used to test for competencies. Select relevant options:  
  • Quizzes  
  • Class works  
  • assignments, attendance  
  • class participation  
  • Individual presentations,  
  • Lab works  
  • Test
<p>| | | |</p>
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<tr>
<td>9.</td>
<td>Describe the conditions necessary for seed germination.</td>
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<tr>
<td>10.</td>
<td>List the types of fruits and explain fruit and seed dispersal.</td>
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<td>11.</td>
<td>Describe plant hormones and their functions.</td>
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<td>12.</td>
<td>Explain transport system in plants.</td>
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<tr>
<td>13.</td>
<td>Discuss the process of excretion in plants.</td>
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<tr>
<td>14.</td>
<td>Describe the process of plant growth and development.</td>
<td></td>
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<tr>
<td>15.</td>
<td>Explain the process of gaseous exchange in plants.</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td><strong>Leaf classification and arrangement on stem</strong>.</td>
<td></td>
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<tr>
<td>7.</td>
<td><strong>Germination:</strong> types (epigeal and hypogeal) - conditions necessary for germination.</td>
<td></td>
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<tr>
<td>6.</td>
<td>Drawing and labeling cross section of monocot and dicot stems and roots.</td>
<td></td>
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<tr>
<td>7.</td>
<td>Explaining the types of pollination and listing agents of pollination.</td>
<td></td>
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<tr>
<td>8.</td>
<td>Observing the process of transpiration through experiments.</td>
<td></td>
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<tr>
<td>9.</td>
<td><strong>Field Trip</strong> Collecting and classifying different kinds of leaves.</td>
<td></td>
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<tr>
<td>5.</td>
<td><strong>Class work</strong> Examining sections of stems and roots, showing different stages of primary and secondary growth.</td>
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</tbody>
</table>

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**C. Other Resources/Supplementary Readings**

Bob McDuell, *Senior High Integrated Science*

Links:
- [www.dictionary.com](http://www.dictionary.com)
- [www.khanacademy.com](http://www.khanacademy.com)
- [www.biomanbio.com](http://www.biomanbio.com)
- [www.biologyjunction.com](http://www.biologyjunction.com)
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- [www.planeta42.com](http://www.planeta42.com)
- [www.saps.org](http://www.saps.org)
- [www.thoughtco.com](http://www.thoughtco.com)

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**5.** Martin Barker & David Darch 2nd edition, 2016
| 8. Reproduction in flowering plants |
| 9. Kinds of fruits and dispersal of fruits and seeds – (agents of dispersal) |

| 10. Plant Hormones and Plant growth |
| a) Primary and secondary growth in plants |
| b) Measurement of growth in plants |
| c) Nastic and Tactic Movements in plants |

| 11. Transport system in vascular plants |
| a) Movement of water and minerals through plants |
| b) Movement of organic materials from leaves to roots |

| 12 EXCRETION IN PLANTS |
| a) Excretory product of plants: water, carbon(IV) oxide, oxygen, Alkaloids, tannis, resins, acids, gums |

| 13. Pressure flow hypothesis and cytoplasmic streaming of translocation |

| 14. Transpiration: advantages and disadvantages |

(Pearson, 2009) charts on plant tissues (ground vascular tissues and dermal tissues) Charts on the cross section of decoct stem and monocot stem Microscope and slides Specimens Whistle plant with roots, stem leaves & flowers empty plastic jars/cans Cups Soil Dried seed Variety of fruits
15. Environmental factors affecting transpiration

16. Physiological factors affecting the rise of water in xylem: root pressure, transpiration, cohesion-tension mechanism, adhesion, water potential gradient

17. Gaseous exchange
a) concentration gradient
b) structure and function of stomata
c) structure and function of lenticels

18. Explanation of metabolic equations

d) \[ \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O} + \text{Heat energy} \]
e) \[ \text{C}_6\text{H}_{12}\text{O}_6 \rightarrow 2\text{C}_2\text{H}_5\text{OH} + 2\text{CO}_2 + \text{Heat} \]

19. Types of respiration compared
f) facultative aerobic
g) facultative anaerobic
## OUTCOMES

Learners are able to recognize that viruses and bacteria are causative agents of diseases such as polio, mumps, measles, Ebola, tuberculosis, common cold, some sexually transmitted infections (HIV/AIDS, Herpes) syphilis, gonorrhea etc, while some bacteria are useful to human.

Learners are able to appreciate preventive measures to avoid risky sexual behavior.

Describe the structure of a bacteria cell as observed under a microscope.

Draw and label a typical bacteria cell.

## OBJECTIVES

Upon completion of these topics, learners will:

1. List the characteristics of viruses.
2. Classify viruses based on nucleic acid (DNA & RNA).
3. Explain the life cycle of a virus.
4. List some viral diseases and organisms the attack, modes of transmission and methods of prevention.
5. Describe bacteria of various kinds.
7. List and describe some common bacterial diseases and symptoms.

## CONTENTS

<table>
<thead>
<tr>
<th>1. Virus: Definition</th>
<th>Inclusive and differentiated learning</th>
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<tbody>
<tr>
<td>a) General characteristics</td>
<td>Individual work/Mixed group presentation (gender, ability &amp; style)</td>
</tr>
<tr>
<td>b) Composition of viral Structure</td>
<td>1. Listing and discussing viruses and bacteria that cause diseases.</td>
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<table>
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<tr>
<th>2. Classification: DNA viruses RNA viruses</th>
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|---------------------------------------------|---|

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<th>4. Life cycle of a virus</th>
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</thead>
<tbody>
<tr>
<td>a) Lytic Cycle</td>
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<td>b) Lysogenic Cycle</td>
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</table>

<table>
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<tr>
<th>5. Sexually transmitted Infections (STIs): modes of transmission and prevention</th>
<th></th>
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</thead>
</table>

| 6. Structure of bacteriophage | |

## ACTIVITIES/ LAB WORKS

|-----------------|-----------------------------------------------|

<table>
<thead>
<tr>
<th>A. Primary Text</th>
<th>Baffour Asante-Owusu, et al. Senior High Biology (Longman, 2009)</th>
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<tr>
<th>B. Secondary Texts</th>
<th>Sue Hocking, et al. OCR Biology (OCR/Heinemann, 2008)</th>
</tr>
</thead>
</table>

| C. Other | Bob McDuell, Senior High Integrated Science (Pearson, 2009) |

## MATERIALS/RESOURCES

<table>
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<tr>
<th>EXPECTED COMPETENCIES</th>
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<td>Effective communication skills</td>
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<td>Analytical and research skills</td>
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<tr>
<td>Research and problem skills</td>
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<tr>
<td>Organizational ability</td>
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<tr>
<td>Digital skills</td>
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<tr>
<td>Creativity and innovation skills</td>
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## COMPETENCIES/ASSESSMENT

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<tr>
<td>to be used to test for competencies, select relevant options.</td>
</tr>
</tbody>
</table>

| Quizzes |
| Class works |
| assignments, attendance |
| class participation |
| Individual presentations, |
| Lab works |
| Test |

## EXPECTED COMPETENCIES

- Effective communication skills
- Analytical and research skills
- Research and problem skills
- Organizational ability
- Digital skills
- Creativity and innovation skills

## ASSESSMENT STRATEGIES

- Quizzes
- Class works
- Assignments, attendance
- Class participation
- Individual presentations
- Lab works
- Test
| 9. | Distinguish between **autotrophic** and **heterotrophic** nutrition; and **aerobic**, **anaerobic** and **facultative** respiration. | 7. Bacteria  
a) definition  
b) General Characteristic  
c) Classification and shape  
d) Composition Structure  
8. Common bacterial Diseases: tuberculosis, tetanus, streptococcus  
9. Sexually transmitted Infections (STIs):  
a) modes of transmission and prevention | HIV testing and support.  
5. Diagramming the life cycle of bactriophage.  
6. Group discussion on the causes and Preventive measure in controlling STIs. |
| --- | --- | --- | --- |
| | | | • Chart of HIV trend in Liberia  
• Prepared slides of bacteria  
• Charts for the shape and types of bacteria  
• Microscope  
• Prepared slides of bacteria  
• Charts of shapes and types of bacteria |
| | | | Links:  
**www.dictionary.com**  
**www.khanacademy.com**  
**www.biomanbio.com**  
**biologyjunction.com**  
**www.rankred.com**  
**www.planeta42.com**  
**www.saps.org**  
**www.thoughtco.com** |
# SEMESTER: ONE

**GRADE:** 11  
**PERIOD:** II  
**TOPIC:** NUTRITION AND FOOD PRESERVATION

<table>
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<th>OBJECTIVES</th>
<th>CONTENTS</th>
<th>ACTIVITIES/ LAB WORKS</th>
<th>MATERIALS/ RESOURCES</th>
<th>COMPETENCIES/ ASSESSMENT</th>
</tr>
</thead>
</table>
| Learners are able to realize that different types of food contain nutrients that are required for the production of energy to support life processes. | Upon completion of this topic, learners will be able to:  
1. Explain the process of nutrition and state why living things need nutrients  
2. Outline and classify the types of nutrients found in food  
3. Classify food into groups  
4. Demonstrate the presence of various nutrients found in food  
5. Explain the concept of a balance diet  
6. Explain the concept of malnutrition  
7. Determine the dental formula of a mammal (amount and arrangement of teeth)  
8. Explain the importance of dental care in humans  
9. Name and discuss various methods of preserving and storing food | 1. Nutrition - Definition and types:  
   a) Autotrophic nutrition  
   b) Heterotrophic nutrition  
   c) Holozoic nutrition  
2. Food and nutrients (carbohydrates, lipids, proteins, vitamins, mineral salts and water)  
3. Balance diet  
4. Malnutrition  
5. Teeth and dental formulae  
6. Dental care  
7. Food Poisoning and its Prevention  
8. Methods and importance of food preservation:  
   a) drying  
   b) salting  
   c) smoking  
   d) parboiling | Differentiated learning  
   Mixed group presentation (gender & ability)  
1. Classifying the nutrients found in different types of food | • Primary Text  
   Baffour Asante-Owusu, et al.  
   *Senior High Biology* (Longman, 2009)  
• Secondary Texts  
   Sue Hocking, et al.  
   *OCR Biology* (OCR/Heinemann, 2008).  
   Doris Koto, et al.,  
   Senior Secondary Guide  
   *Senior secondary guide Biology* (star study guide series)  
   Martin Barker & David Darch, 2nd edition, 2016 | • Expected Competencies  
   • Effective communication skills  
   • Analytical and research skills  
   • Research and problem skills  
   • Organizational ability  
   • Digital skills  
   • Creativity and innovation skills  

**EXPECTED COMPETENCIES**  

- Effective communication skills  
- Analytical and research skills  
- Research and problem skills  
- Organizational ability  
- Digital skills  
- Creativity and innovation skills  

**ASSESSMENT STRATEGIES**  

to be used to test for competencies. select relevant options:  
- Quizzes  
- Class works  
- assignments, attendance  
- class participation  
- Individual presentations,  
- Lab works  
- Test
10. Explain methods of preserving food using local resources
11. Explain other methods of food preservation in West Africa
12. Explain the biological basis for preserving and storing food

- e) dehydration
g) refrigeration
h) frying
i) use of oil
j) heating

2. Using preservative methods on samples of food and comparing them with other food stuffs that have not been preserved

<table>
<thead>
<tr>
<th>Materials</th>
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<tbody>
<tr>
<td>Cassava</td>
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<td>Potatoe</td>
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<tr>
<td>Iodine</td>
</tr>
<tr>
<td>Potassium</td>
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<td>Filter paper</td>
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<tr>
<td>Ethyl alcohol</td>
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<tr>
<td>Egg albumin</td>
</tr>
<tr>
<td>Milk</td>
</tr>
<tr>
<td>Copper (II) sulphate</td>
</tr>
<tr>
<td>Syringe</td>
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<tr>
<td>Droppers</td>
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<tr>
<td>Orange juice</td>
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<tr>
<td>Lemon juice</td>
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<tr>
<td>Grapefruit juice</td>
</tr>
<tr>
<td>Diclorophenolindophenol (DCPIP) dye</td>
</tr>
<tr>
<td>Ascorbic acid</td>
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<tr>
<td>Pipette</td>
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<tr>
<td>Sodium hydroxide solution</td>
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<tr>
<td>Filter paper</td>
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<tr>
<td>Distill water</td>
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<tr>
<td>Groundnuts, fish, milk and pawpaw</td>
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<tr>
<td>Mortar and pestle</td>
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<tr>
<td>Specimens of various food stuffs</td>
</tr>
<tr>
<td>Salt</td>
</tr>
<tr>
<td>Incubator</td>
</tr>
<tr>
<td>Fire wood</td>
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<tr>
<td>Locally made dryer</td>
</tr>
<tr>
<td>Charcoal</td>
</tr>
<tr>
<td>Coal pot</td>
</tr>
<tr>
<td>Pot</td>
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<tr>
<td>Palm oil</td>
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vitamin C

Links:
www.dictionary.com
www.khanacademy.com
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www.biologyjunction.com
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<tr>
<td>Learners are able to campaign for the proper disposal of non-biodegradable substances (plastics) into the environment and the maintenance of soil fertility for proper yield of food and cash crops</td>
<td>Upon completion of these topics, learners will: 1. Define Soil and state the composition of soil 2. State the effects of erosion and the overuse of soil on soil fertility 3. Explain the processes of soil conservation, maintenance, and renewal of soil fertility 4. Explain the advantages and disadvantages of the slash and burn methods in farming 5. Distinguish between habitat and niche</td>
<td>1. Soil:  a. formation and composition  b. types of soil  c. soil fertility  d. erosion: causes and prevention  e. conservation  f. maintenance  g. renewal of soil fertility  2. Weathering  (a) Physical weathering  (b) Chemical weathering</td>
<td>Differentiated learning  Mixed group presentation (gender &amp; ability)  1. Explaining of soil formation  2. Lab Work:  a) Collecting, observing and classifying soil types  b) Listing and discussing the composition of soil  c) Demonstrating the presence of air in the soil (moisture content)  d) Food chains and food webs  e) Diagramming and discussing – water, carbon, nitrogen, etc.</td>
<td>A. Primary Text  Baffour Asante-Owusu, et al. Senior High Biology (Longman, 2009)  B. Secondary Texts  • Sue Hocking, et al. OCR Biology (OCR/Heinemann, 2008).  • Doris Koto, et al., Senior Secondary Guide – Biology (Pearson, 2000)  Senior Secondary Guide  C. Other Resources/Supplementary</td>
<td>EXPECTED COMPETENCIES  • Effective communication skills  • Analytical and research skills  • Research and problem skills  • Organizational ability  • Digital skills  • Creativity and innovation skills  ASSESSMENT STRATEGIES to be used to test for competencies. Select relevant options:  • Quizzes  • Class works  • Assignments, attendance  • Class participation  • Individual presentations,  • Lab works  • Test</td>
</tr>
</tbody>
</table>
6. Describe the concept of ecological succession

7. Define and calculate (population growth, doubling time & percentage growth rate, death & birth rates and explain the concept of population diversity)

8. Describe inter-specific and intra-specific interactions among organisms

9. Discuss the ecosystem (food chains, food webs, pyramids of numbers, pyramid of energy)

10. Define the productivity of an ecosystem and distinguish between gross primary productivity and net primary productivity

11. Discuss energy flow through the trophic levels, the water cycle, the carbon dioxide cycle, the nitrogen cycle, the phosphorus cycle and the sulfur cycle

(c) decomposers
(d) Food chains and webs

Conservation of nature
(a) soil conservation
(b) forest conservation
(c) wildlife conservation
(d) oil conservation
(e) mineral conservation

9. Biocycles in nature
(a) the water cycle
(b) the carbon cycle
(c) the nitrogen cycle
(d) the phosphorus cycle
(e) the sulfur cycle

10. Organisms habitat and niche

11. population:
(a) population density
(b) population growth rate
c) doubling time
d) percent growth rate
e) birth rate, death rate
(f) immigration, emigration, density– dependent and density independent factors

11. Ecological succession: (a) primary and secondary successions
(b) pioneer and climax communities

phosphorus and sulfur cycles.

3. Field Trip:
(a) Observing and discussing the effects of erosion on soil fertility
(b) Digging in the school yard/dump sites to observe non-biodegradable substances (plastic and metallic materials)

c. Listing food and cash crops in Liberia and considering the type of soil for cultivation
d. Discussing the various inter-specific interactions between species
e. Taking field trips to visit ecosystems such as ponds and forest regions

Readings
• Bob McDuell, Senior High Integrated Science (Pearson, 2009)
• Samples of different types of soil
• Empty cups and jars
• Plastic materials
• Shovel
• Charts of inter-specific interactions
• Diagrams of trophic levels
• Charts of biocycles

Links:
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www.biomanbio.com
www.biologyjunction.com
www.rankred.com
www.planeta42.com
www.saps.org
• www.thoughtco.com
| 12. | Distinguish between immigration and emigration | | | |
### SEMESTER: TWO

**GRADE: 11**  
**PERIOD: IV**  
**TOPIC :** CELL GROWTH AND DIVISION (MITOSIS AND MEIOSIS); REPRODUCTION

<table>
<thead>
<tr>
<th>OUTCOMES</th>
<th>OBJECTIVES</th>
<th>CONTENTS</th>
<th>ACTIVITIES/ LAB WORKS</th>
<th>MATERIALS/ RESOURCES</th>
<th>COMPETENCIES/ ASSESSMENT</th>
</tr>
</thead>
</table>
| Learners are able to accept that reproduction is a characteristic of living things and it begins with cell division | Upon completion of the topic, learners will: 1. Describe the stages of the cell cycle 2. List and diagram the phases of mitosis and meiosis 3. Distinguish mitosis and meiosis and explain the importance of meiosis in sexual reproduction 4. Distinguish between asexual and sexual reproduction 5. List and explain some forms of asexual reproduction in plants and animals 6. Discuss reproduction and parenting in humans (sexuality) 7. Recognize sexual decisions that has impact on the Family | 1. **Cell growth & Division**  
a) Cell cycle  
b) Phases of Mitosis  
c) Meiosis  
2. **Reproduction**  
   Types of Reproduction  
i) Asexual: fission, budding, vegetative propagation, cloning  
   ii) Sexual: Conjugation, formation of male and female gametes (meiosis), fusion of gametes (fertilization) | 1. Drawing and labeling stages of mitosis and meiosis  
2. Distinguishing mitosis and meiosis  
3. Explaining gametes formation  
4. Explaining terms such as gametes, diploid, haploid | A. **Primary Text**  
B. **Secondary Texts**  
C. **Other Resources/Supplementary Readings**  
   - Bob McDuell, *Senior High Integrated Science* (Pearson, 2009) | **EXPECTED COMPETENCIES**  
   - Effective communication skills  
   - Analytical and research skills  
   - Research and problem skills  
   - Organizational ability  
   - Digital skills  
   - Creativity and innovation skills |
| Responsibilities of parenting | ✓ What are the roles of each parent in child rearing  
  Risk of teenage parenting | | | | **ASSESSMENT STRATEGIES** to be used to test for competencies. Select relevant options:  
   - Quizzes  
   - Class works  
   - assignments, attendance  
   - class participation  
   - Individual presentations  
   - Lab works  
   - Test |
| LAB | 5. Examining thin slices of onion root tip to study the stages of mitosis under the microscope | | | | |
8. Initiate advocacy on substance abuse and SBV

<table>
<thead>
<tr>
<th>Sexual Decisions and Impact on the Family</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Making healthy decision on sexual issues</td>
</tr>
<tr>
<td>✓ Impact of these decisions on the family</td>
</tr>
<tr>
<td>a) reproductive health and rights</td>
</tr>
<tr>
<td>b) infertility cycles of sexuality</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Role plays: To prevent teenage parenting.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A girl/boy effectively refusing to have sex</td>
</tr>
<tr>
<td>2. A girl/boy discouraging another from joining a group of peers who take alcohol to avoid risky situations against early sex</td>
</tr>
<tr>
<td>3. Steps in the correct use of condoms. Do this several times to ensure the students understand the steps.</td>
</tr>
</tbody>
</table>

Consequences of sexual decision making

Decision making about sex Reproductive health and rights

Advocacy

Role of youth in stopping substance abuse
Role of the youth in stopping SBV

| Scalpels |
| Charts of mitosis and meiosis Methylene blue (chemical) |
| Razor blades |
| Dropper |
| Beakers |
| Posters and charts |

| Links: |
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| www.biologyjunction.com |
| www.rankred.com |
| www.planeta42.com |
| www.saps.org |
| www.thoughtco.com |

Role plays: To prevent teenage parenting.

1. A girl/boy effectively refusing to have sex
2. A girl/boy discouraging another from joining a group of peers who take alcohol to avoid risky situations against early sex
3. Steps in the correct use of condoms. Do this several times to ensure the students understand the steps.

Two girls sharing the challenges they have experienced with their family planning and how they have overcome them.

Role play showing young people refusing to have sex before completing high school.

Sharing experiences on making sexual decisions (e.g. waiting to have sex when they are older with a person they love and have known for a long time, using contraceptives, condom, absenteeism, delay child bearing, etc.)

Discussion: sexual decisions and impact on individual and family.

Skit on negative and positive decision making about sex

Role play of parental influence in decision making (Negative and Positive)

Role Play of the importance of reproductive health rights and how they empower teenagers to make the right decisions about their sexuality.
| Draw on posters, write poems, compose songs, prepare speeches, plan a peaceful demonstration, plan a radio interview… against drug abuse and School Based Violence. | Involve other young people in the school. Fill the school with activities and drawings and writings against drug abuse and School Based Violence. Organize a hot line, where victims can call for help and advice. | Involve local NGOs |
**SEMESTER: TWO**

**GRADE: 11**  
**PERIOD: V**  
**TOPIC: GENETICS (NUCLEIC ACIDS, PROTEIN SYNTHESIS, and HEREDITY), SEXUALITY AND EVOLUTION**

<table>
<thead>
<tr>
<th>OUTCOMES</th>
<th>OBJECTIVES</th>
<th>CONTENTS</th>
<th>ACTIVITIES/LAB WORKS</th>
<th>MATERIALS RESOURCES</th>
<th>COMPETENCIES/ASSESSMENT</th>
</tr>
</thead>
</table>
| Learners are able to acquire the concept that DNA and RNA are the Principal transmitters of genetic characteristics, gene interaction, and genetic variation.  
Learners are able to accept that traits are inherited from parents, through the DNA and that genetic disorders are inherited. Therefore, it is important to do medical examination when selecting a partner. | Upon completion of these topics, learners will:  
1. Explain the term nucleic acids and name the types of nucleic acids  
2. Describe the double helix model of DNA structure  
3. Outline the process of DNA replication and RNA transcription  
4. Explain the process of protein synthesis  
5. Explain the meaning of genetics,  
6. Explain the types of nucleic acids and their structures  
7. Explain hereditary traits  
8. Differentiate learning | 1. The types of nucleic acids and their structures  
a) DNA  
b) RNA  
Types of RNA  
2. Structures of nucleotides and Complementary based pairing  
3. DNA replication and RNA transcription  
4. Stages of protein synthesis  
5. The importance of protein synthesis  
6. Genetics and Heredity:  
a) principles of genetics  
b) Mendel’s experiment with garden peas;  
c) Genetic terms: phenotype, genotype, alleles, hybrid, homozygous, heterozygous, monohybrid, dihybrid, genes (dominant and recessive)  
7. Hereditary Traits:  
  |  
A. Primary Text  
B. Secondary Texts  
Senior Secondary Guide  
C. Other Resources/Supplementary Readings  
• Bob McDuell, *Senior High Integrated Science* (Pearson, 2009)  
• Integrated Science for SHS – (Pearson)  
  |  
A. Differentiated learning  
B. Mixed group presentation (gender & ability)  
C. Using DNA model to demonstrate the process of DNA replication  
D. Using charts to explain the process of RNA transcription  
E. Using chart to demonstrate the process of protein synthesis  
F. Describing Mendel’s contributions to  
 | EXPECTED COMPETENCES  
- Effective communication skills  
- Analytical and research skills  
- Research and problem skills  
- Organizational ability  
- Digital skills  
- Creativity and innovation skills  
ASSESSMENT STRATEGIES to be used to test for competencies, select relevant options.  
- Quizzes  
- Class works  
- Assignments, attendance  
- Class participation  
- Individual presentations,  
- Lab works  
- Test |
<table>
<thead>
<tr>
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<th>heredity, and sexuality</th>
<th>principles of heredity</th>
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<tbody>
<tr>
<td>6.</td>
<td>Describe how trait are passed from parents to offspring</td>
<td>5. Describing Mendel’s experiments and results</td>
</tr>
<tr>
<td>7.</td>
<td>Explain Mendel’s contributions to the understanding of the principles of heredity</td>
<td>6. Solving monohybrid and dihybrid problems using punnett square and stating the importance of the punnett square</td>
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<td>9.</td>
<td>Discuss linkage and sex-linked characters</td>
<td>8. Outlining similarity and differences among different species of vertebrates.</td>
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<tr>
<td>10.</td>
<td>Discuss: Darwin’s and Lamarck’s theories of evolution, factors affecting evolution and three sources of evolution with evidence</td>
<td>10. Sexuality: sex determination (X and Y chromosomes)</td>
</tr>
<tr>
<td>11.</td>
<td>List the various types of blood group, and state the type of blood needed for transfusion to</td>
<td>11. Variation:</td>
</tr>
<tr>
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<td>hemophilia, mental disorder, sickle cell, color blindness, baldness, ear lobes, etc.</td>
<td>a) continuous variation</td>
</tr>
<tr>
<td></td>
<td>a) Influence of environment on heredity</td>
<td>b) discontinuous variations</td>
</tr>
<tr>
<td></td>
<td>b) Development of traits: Intelligence</td>
<td>c) independent assortment</td>
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<td></td>
<td><strong>8. The ABO blood grouping and rhesus factor</strong></td>
<td>a) crossing over</td>
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<td><strong>9. Evolution and natural selection (Darwin’s Theory)</strong></td>
<td>b) independent assortment</td>
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<td><strong>10. Sexuality: sex determination (X and Y chromosomes)</strong></td>
<td>a) random fusion of gametes</td>
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<td><strong>11. Variation:</strong></td>
<td>12. Sources of variation:</td>
</tr>
<tr>
<td></td>
<td>a) continuous variation</td>
<td>a) crossing over</td>
</tr>
<tr>
<td></td>
<td>b) discontinuous variations</td>
<td>b) independent assortment</td>
</tr>
<tr>
<td></td>
<td>c) independent assortment</td>
<td>a) random fusion of gametes</td>
</tr>
<tr>
<td></td>
<td>13. Causes of variation:</td>
<td>13. Causes of variation:</td>
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<tr>
<td></td>
<td>a) genetic factors</td>
<td>a) genetic factors</td>
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<td></td>
<td>b) Environmental factors</td>
<td>b) Environmental factors</td>
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- www.biologyjunction.com
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- www.planeta42.com
- www.saps.org
- www.thoughtco.com
| Specific Blood Groups | 17. **Evidence of evolution:**
|                      | EX; fossil records |
|                      | 18. **Theories of evolution**
|                      | a) Lamark’s theory |
|                      | b) Charles Darwin’s theory |
## Grade: 11 
### Period: VI 
### Topic: **Vertebrates**: (Fishes, Amphibians and Reptiles)

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Objectives</th>
<th>Contents</th>
<th>Activities/Lab Works</th>
<th>Materials Resources</th>
<th>Competencies/Assessment</th>
</tr>
</thead>
</table>
| Learners are able to realize the economic importance of fishes, amphibians and reptiles | Upon completion of this topic, learners will:  
1. Explain the general characteristics of the phylum Chordata (Vertebrates)  
2. Describe the differences between vertebrates and invertebrates  
3. List the general characteristics of the fish and explain the differences among the three groups (jawless, cartilaginous and bony)  
4. Discuss the economic importance of fishes  
5. List the general characteristics of amphibians  
6. Describe the external & internal features of the amphibians using a frog  
7. Differentiate the structural differences between frog and toad | **1. Vertebrates:**  
- general characteristics of Vertebrates: Fishes  
  a) general characteristics of fishes  
  i. Jawless fish  
  ii. Cartilaginous fish  
  iii. Bony fish  
  b) differences amongst the three groups of fishes  
  c) Adaptation, locomotion, respiration and economics importance.  
 **2. Amphibians:**  
- general characteristics  
  a) External & internal features of a frog.  
  b) Life cycle  
 **3. Reptiles:**  
- general characteristics | **differentiated learning**  
Mixed group presentation (gender & ability)  
**LAB**  
1. Identifying and describing the internal and external structures of a fish  
2. Collecting and dissecting fish and frog to study the external and internal structures  
3. Collecting and dissecting a lizard and studying the external and internal structures  
3. Drawing and labeling the amniotes egg and highlighting | **A. Primary Text**  
**B. Secondary Texts**  
Senior Secondary Guide  
**C. Other Resources/Supplementary Readings**  
- Bob McDuell, *Senior High Integrated Science* (Pearson, 2009)  
- Integrated Science for SHS – (Pearson)  
- Live frog, fish and lizard  
- Dissecting sets  
- Dissecting tray  
**EXPECTED COMPETENCIES**  
- Effective communication skills  
- Analytical and research skills  
- Research and problem skills  
- Organizational ability  
- Digital skills  
- Creativity and innovation skills  
**ASSESSMENT STRATEGIES** to: be used to test for competencies. Select relevant options.  
- Quizzes  
- Class works  
- Assignments, attendance  
- Class participation  
- Individual presentations,  
- Lab works  
- Test |
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<td>8.</td>
<td>List the general characteristics of reptiles.</td>
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<tr>
<td>9.</td>
<td>Describe the external and internal features of reptiles using a lizard.</td>
<td></td>
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<tr>
<td>10.</td>
<td>Explain the success of reptiles on land as opposed to amphibians.</td>
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</table>

b) **external & internal features of lizard**

<p>| | | | |</p>
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<tbody>
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<td>internal fertilization and the amniotic egg</td>
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<td></td>
<td>the extraembryonic membranes.</td>
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</tbody>
</table>

• Biological charts of shark, fish, various amphibians and reptiles
• Gloves
• Pins
• Scissors
• Razor blades
• Water

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- www.planeta42.com
- www.saps.org
- www.thoughtco.com
# Outcomes

Learners are able to:

1. Distinguish between mammals and birds;
2. Describe the control mechanism of human body
3. Explain the control mechanisms of body temperature in mammals

# Objectives

Upon completion of this topic, learners will:

1. Discuss the general characteristics of birds and mammals
2. Relate the adaptations of birds to flight
3. Describe the external and internal features of birds
4. Classify mammals on the basis of class, structure, and types of reproduction
5. Explain the control mechanisms of body temperature in mammals

# Contents

### 1. Birds:

- a) general characteristics
- b) external and internal features (structural adaptation)
- c) types of birds (flight and flightless)
- d) adaptation to flight
- e) types of feathers

### 2. Mammals:

- a) general characteristics
- b) classes of mammals
- c) features of each class
- d) structure of a typical mammanlian molar tooth
- e) dentition and dental formulae

# Activities

### Inclusive and differentiated learning

#### Class Discussion:

- Listing and describing the general characteristics of birds;
- Internal and external features of birds

- Listing the general characteristics of mammals
- Describing control mechanisms of the body temperature in mammals

#### Assignment:

- Describing features of each class of mammals
- a) Drawing and labeling a typical mammanlian molar tooth
- b) Writing dental formulae of rabbit, dog and man

#### LAB

- Dissecting a bird to observe the internal and external features.

# Materials

### A. Primary Text


### B. Secondary Texts


### C. Other Resources/Supplementary Readings

- Bob McDuell, *Senior High Integrated Science* (Pearson, 2009)
- *Integrated Science for SHS –* (Pearson)
- Charts of birds and mammals
- Live bird (chicken)
- Live mammal (rat, cat, dog.
- Chicken eggs
- Preserved specimen of birds and mammals

# Competency/Assessment

Expected competencies:

- Effective communication skills
- Analytical and research skills
- Research and problem skills
- Organizational ability
- Digital skills
- Creativity and innovation skills

Assessment strategies to be used to test for competencies. Select relevant options:

- Quizzes
- Class works
- Assignments, attendance
- Class participation
- Individual presentations,
- Lab works
- Test
| 3. Control mechanisms of body temperature in mammals | b. Drawing and labeling the three types of feather
c. Examining and drawing the contents of a chicken egg | Links:  
www.dictionary.com  
www.khanacademy.com  
www.biomanbio.com  
www.biologyjunction.com  
www.rankred.com  
www.planeta42.com  
www.saps.org  
www.thoughtco.com |
### SEMESTER ONE

**TOPIC**: SKELETAL, MUSCULAR AND REPRODUCTIVE SYSTEMS

<table>
<thead>
<tr>
<th>OUTCOMES</th>
<th>OBJECTIVES</th>
<th>CONTENTS</th>
<th>ACTIVITIES</th>
<th>MATERIALS RESOURCES</th>
<th>COMPETENCIES/ASSESSMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Learners are able to:</strong> summarize the importance of bones and muscles in the body for movement and coordination</td>
<td>Upon completion of these topics, learners will:</td>
<td>1. <strong>Division of the human body</strong> &lt;br&gt; a) (head, neck, trunk and appendages) &lt;br&gt; b) Body cavities</td>
<td>1. Discussion of cells, tissues, and organs of the skeletal and muscular systems</td>
<td><strong>A. Primary Text</strong>&lt;br&gt;Baffour Asante-Owusu, et al. <em>Senior High Biology</em> (Longman, 2009)</td>
<td><strong>EXPECTED COMPETENCIES</strong> &lt;br&gt;- Effective communication skills &lt;br&gt;- Analytical and research skills &lt;br&gt;- Research and problem skills &lt;br&gt;- Organizational ability &lt;br&gt;- Digital skills &lt;br&gt;- Creativity and innovation skills</td>
</tr>
<tr>
<td>Consider appropriate preventive measures to prevent STIs that affects the reproductive and systems</td>
<td>2. <strong>Skeletal system:</strong> &lt;br&gt;a) composition: bones, cartilage, ligaments and tendons &lt;br&gt;b) Regions: &lt;br&gt;i) axial skeleton &lt;br&gt;ii) appendicular skeleton &lt;br&gt;c) Functions of the skeleton/bones &lt;br&gt;d) Types of joints, functions and locations</td>
<td>2. Drawing and labeling the skeletal and muscular systems</td>
<td><strong>B. Secondary Texts</strong>&lt;br&gt;□ Sue Hocking, et al. <em>OCR Biology</em> (OCR/Heinemann, 2008). □ Doris Koto, et al., <em>Senior Secondary Guide – Biology</em> (Pearson, 2000) Senior Secondary Guide</td>
<td><strong>ASSESSMENT STRATEGIES to be used to test for competencies. Select relevant options:</strong>&lt;br&gt;- Quizzes&lt;br&gt;- Class works&lt;br&gt;- assignments, attendance&lt;br&gt;- class participation&lt;br&gt;- Individual presentations,&lt;br&gt;- Lab works&lt;br&gt;- Test</td>
<td></td>
</tr>
<tr>
<td>discuss the emotions that accompany adolescence sexual developments which will facilitate the way to abstinence or prevention of STIs and</td>
<td>3. <strong>Muscular system:</strong> &lt;br&gt;a) types and functions of Muscles</td>
<td>3. Examining and studying bone cells under the microscope</td>
<td><strong>C. Other Resources/Supplementary Readings</strong>&lt;br&gt;• Bob McDuell, <em>Senior High Integrated Science</em> (Pearson, 2009)</td>
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<tr>
<td></td>
<td>4. <strong>Reproductive System</strong> &lt;br&gt;a) Adolescence development &lt;br&gt;b) Gamete formation: &lt;br&gt;i) oogenesis &lt;br&gt;ii) spermatogenesis</td>
<td>4. Listing the bones of the skeletal system</td>
<td></td>
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<td></td>
<td>5. Male and female reproductive organs</td>
<td>5. Explaining types and functions of muscle</td>
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<td></td>
<td>6. Sperm and egg</td>
<td>6. Listing the effects of Sexually Transmitted Infections (STIs) and substances abuse on the human system and their methods of prevention</td>
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<td></td>
<td>7. Describing the stages of adolescence</td>
<td>7. Describing the stages of adolescence</td>
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<td>Question</td>
<td>Answer</td>
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<td>8. Draw the male and female reproductive organs</td>
<td>Models and charts of oogenesis and spermatogenesis by use of models and diagrams</td>
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<tr>
<td>9. Explain the process of gamete formation</td>
<td>Charts of the male and female reproductive organs</td>
<td></td>
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<tr>
<td>10. Describe the structures and functions of a sperm cell</td>
<td>Chart of the menstrual cycle</td>
<td></td>
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<tr>
<td>11. Explain the menstrual cycle</td>
<td>Chart showing stages of fetal development from the zygote (fertilized egg)</td>
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<tr>
<td>12. Explain the reproductive health consequences of Gender Based Violence</td>
<td>• Chart of family planning methods</td>
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<td>13. Discuss the benefits of family planning and various methods used</td>
<td>Links:</td>
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</table>
### OUTCOMES
Discuss the role of the digestive system and outline the nutritional benefits of eating a balanced diet of locally available food.

Appreciate the roles of the circulatory and the lymphatic systems in the process of transporting nutrients and the defense mechanism of the body respectively.

### OBJECTIVES
Upon completion of these topics, learners will:

1. Define digestion, state the processes and list the organs that are involved.
2. State the functions of enzyme in the process of digestion
3. Explain nutrition, the classes of food and their specific importance to the body
4. List the components of blood and describe their functions and the process of blood clotting
5. Discuss the heart, the blood and blood vessels.
6. Discuss the lymphatic system and its functions

### CONTENTS

#### 1. Digestive system:
- a) nutrition – classes of food and their specific uses
- b) Alimentary canal:
  - a) mouth
  - b) esophagus
  - c) stomach
  - d) intestines,
  - e) Accessory Organs exocrine glands (salivary and pancreatic glands, teeth and tongue)
  - f) liver & functions

#### 3. Circulatory system
- a) heart
- b) blood vessels
- c) blood cells and plasma
- b) types of circulations (systematic and pulmonary)

#### 4. Blood types and Rh Factor

#### 5. Effects of substance

### ACTIVITIES
1. Stating the functions of digestive enzymes
2. Describing absorption through the villi and hepatic portal veins
3. Listing and describing classes of food and their importance
4. Discussing the effects of malnutrition on growth and development, and on the immune system

### MATERIALS RESOURCES

#### A. Primary Text

#### B. Secondary Texts

#### C. Other
- Bob McDuell, *Senior High Integrated Science* (Pearson, 2009)
- *Integrated Science for SHS* –– (Pearson)
- Charts of:
  - a) Circulatory system and Lymphatic System
  - b) Heart
  - c) Blood vessels

### COMPETENCIES/ASSESSMENT

#### EXPECTED COMPETENCIES
- Effective communication skills
- Analytical and research skills
- Research and problem skills
- Organizational ability
- Digital skills
- Creativity and innovation skills

#### ASSESSMENT STRATEGIES
to be used to test for competencies. Select relevant options:
- Quizzes
- Class works
- assignments,
- attendance
- class participation
- Individual presentations,
- Lab works
- Test
<table>
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<tr>
<th>S. No.</th>
<th>Topic</th>
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<tr>
<td>6.</td>
<td><strong>Lymphatic system:</strong> &lt;br&gt; a) lymph &lt;br&gt; b) lymphatic vessels &lt;br&gt; c) lymph node &lt;br&gt; d) lymphocytes (T-cells and B-cells)</td>
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<td>7.</td>
<td>Describe the structure and functions of lymph nodes</td>
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<td>8.</td>
<td>Outline and give the function of other lymphoid organs (tonsils, spleen, thymus)</td>
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<td>Stating the functions of the liver in digestion</td>
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<td>Discussing the effects of alcohol &amp; drugs on the organs of these systems</td>
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<td>Describing the composition of the blood and its functions</td>
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<td>Explaining the process of blood clotting</td>
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<td>Listing the various blood groups and discuss the Rh factor</td>
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<td>Drawing and labeling the heart and liver</td>
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<td>Studying charts of the lymphatic system</td>
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<td></td>
<td>Drawing and labeling the lymphatic system</td>
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<td>d) Digestive system &lt;br&gt; e) Mouth, teeth, tongue &lt;br&gt; f) Esophagus &lt;br&gt; g) Stomach &lt;br&gt; h) Intestine</td>
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SEMESTER: TWO

GRADE: 12
PERIOD: IV

TOPICS: EXCRETORY and RESPIRATORY SYSTEMS; CELLULAR RESPIRATION (GLYCOLYSIS AND KREB CYCLE)

<table>
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<tr>
<th>OUTCOMES</th>
<th>OBJECTIVES</th>
<th>CONTENT</th>
<th>ACTIVITIES</th>
<th>MATERIALS/ RESOURCES</th>
<th>COMPETENCIES/ ASSESSMENT</th>
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<tbody>
<tr>
<td>Take appropriate steps to prevent damage to the excretory and respiratory organs.</td>
<td>Upon completion of these topics, learners will: 1. Describe the excretory system and state the functions of all associated organs. 2. List the tissues and organs involved in the mechanism of breathing. 3. Explain homeostasis in relation to the excretory system. 4. Explain the effects of substance abuse and STIs on the excretory and respiratory systems. 5. State the characteristics of the types of respiration.</td>
<td>1. Excretory system: organs a) kidneys b) urinary bladder c) urethra d) skin, liver, lungs e) large intestine 2. Respiratory system: Organs a) lungs b) pharynx c) larynx d) alveoli e) bronchi f) bronchioles 3. Effects of substance abuse and STIs on the organs of the two systems. 4. Respiration (Gaseous Exchange) a) internal &amp; external b) phases (inspiration and expiration)</td>
<td>1. Explaining the process of excretion 2. Explain the process of urination 3. Describing the functions of tissues and organs in both external &amp; internal respiration 4. Describing the lungs and the air passage ways</td>
<td>A. Primary Text Baffour Asante-Owusu, et al. Senior High Biology (Longman, 2009) B. Secondary Texts Senior secondary guide Biology (star study guide series) Martin Barker &amp; David Darch 2nd edition, 2016 • Sue Hocking, et al. OCR Biology (OCR/Heinemann, 2008). • Doris Koto, et al., Senior Secondary Guide – Biology (Pearson, 2000) Senior Secondary Guide 2016 edition, M. Barker et D. Darch</td>
<td>EXPECTED COMPETENCIES • Effective communication skills • Analytical and research skills • Research and problem skills • Organizational ability • Digital skills • Creativity and innovation skills ASSESSMENT STRATEGIES to be used to test for competencies, select relevant options: • Quizzes • Class works • assignments, • attendance • class participation</td>
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</table>
6. Distinguish between aerobic and anaerobic respiration

7. Discuss cellular respiration citing the major stages sequentially noting the main events (Glycolysis, Krebs cycle and electron transport chain)

8. Discuss anaerobic respiration in the muscle and its importance in fermentation using yeast/fruits for (alcohol production)

9. Discuss the significance of phosphorylation in glycolysis

10. Identify the final products of glycolysis

11. Outline the fate of pyruvate after Glycolysis

12. Distinguish oxidation and reduction with regards to oxygen, hydrogen and electrons

13. Distinguish between decarboxylation reactions and dehydrogenation reactions

14. Reactions of the Krebs cycle (tricarboxylic acid – TCA cycle/cirtic acid cycle):
   a) decarboxylation
   b) dehydrogenation

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<tr>
<th>(Cellular Respiration)</th>
<th>C. Other Resources/Supplementary Readings</th>
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<tr>
<td>a) Aerobic respiration</td>
<td>Bob McDuell, <em>Senior High Integrated Science</em> (Pearson, 2009)</td>
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<tr>
<td>b) Anaerobic respiration</td>
<td>Charts/poster on kidneys, lungs, skin, and urinary organs</td>
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<td>c) Energy release</td>
<td>Palm wine</td>
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<td></td>
<td>Grape fruits</td>
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<td>Plastic gallons</td>
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<td>Knife</td>
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| 8. The formation of ATP, a phosphorylated nucleotide |
| 9. Coenzymes and respiration |
| 10. Nicotinamide adenine dinucleotide (NAD) and dehydrogenase enzymes |
| 11. Pyruvate and its fate |
| 12. Alcoholic fermentation (yeast and fruits) |
| 13. Anaerobic respiration in muscles and Oxygen debt |

Lab Obtaining palm wine and placing it in a plastic gallon to observe alcoholic fermentation

Demonstrate Artificial resuscitation

Vigorous exercise exemplifying respiration

Video/pictures showing the organs affected by substance abuse and STIs

C. Other Resources/Supplementary Readings
- Bob McDuell, *Senior High Integrated Science* (Pearson, 2009)
- Charts/poster on kidneys, lungs, skin, and urinary organs
- Palm wine
- Grape fruits
- Plastic gallons
- Knife
- Strainer
- Large container (pan)

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- Individual presentations,
- Lab works
- Test
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<td>14.</td>
<td>Interpret the balanced chemical equation for respiration ($C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$)</td>
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<td>15.</td>
<td>Identify the three types of electron carriers located in the inner membrane of the mitochondria (flavoproteins, quinones and cytochromes)</td>
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</table>
| 16. | **Electron transport chain (Etc) and ATP synthesis:**
   | a) flavoproteins | b) quinones | c) oxidative phosphorylation |
   | b) cytochromes |   |   |
## OUTCOMES

1. Distinguish the functions of the nervous and endocrine systems
2. Describe the structure and functions of a nerve cell (neuron) and the brain
3. Classify the neurons of the nervous system
4. Draw the nervous system and list the major parts
5. Describe the structure and functions of the spinal cord
6. Differentiate the various regions of the spinal cord in relation to their function
7. Compare the central and peripheral nervous systems

## OBJECTIVES

1. The nervous system
   a) Composition: - central nervous system
   - Peripheral nervous system
2. The nervous system
   a) Neurons: structure and types of neurons
   b) function of sensory and motor
   Brain structure and function of parts of the brain
3. Generation and transmission of nerve impulses:
4. Listing and describing parts of the nervous system
5. Examining and explaining models of the brain and spinal cord
6. Identifying various parts of the brain and spinal cord by drawing and labeling the parts of the brain and spinal cord
7. Describing the peripheral nervous system
8. Describing the structures and functions of the eye and ear
9. Explaining nervous actions

## CONTENTS

- A. Primary Text
- B. Secondary Texts
- C. Other Resources/Supplementary Readings
  - Bob McDuell, *Senior High Integrated Science* (Pearson, 2009)

## MATERIALS/RESOURCES

- Primary Text
- Secondary Texts
- Other Resources/Supplementary Readings

## COMPETENCIES/ASSESSMENT

- **EXPECTED COMPETENCIES**
  - Effective communication skills
  - Analytical and research skills
  - Research and problem skills
  - Organizational ability
  - Digital skills
  - Creativity and innovation skills

- **ASSESSMENT STRATEGIES**
  to be used to test for competencies. Select relevant options:
  - Quizzes
  - Class works
  - Assignments
  - Attendance
  - Class participation
  - Individual presentations
  - Lab works
  - Test
<table>
<thead>
<tr>
<th><strong>Peripheral Nervous Systems in Relation to Their</strong></th>
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<tr>
<td>8. Differentiate between voluntary and involuntary actions</td>
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<tr>
<td>9. Discuss the causes and effects of substance abuse on the nervous system</td>
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<tr>
<td>10. Advocate for GBV, rape, sexual harassment, and intergenerational sex</td>
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<tr>
<td>11. Explain the effects of some STIs on the nervous system</td>
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<td>12. Describe the structures and functions of the eye and ear</td>
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<td>13. Distinguish and state the functions of exocrine glands and endocrine glands</td>
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<td>14. Explain the regulation of the nervous system, endocrine system, eye &amp; ear</td>
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<td>5. Types of Nervous Actions</td>
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<tr>
<td>a) Voluntary and Involuntary Actions</td>
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<tr>
<td>b) Reflex and reflex arc</td>
</tr>
<tr>
<td>6. Autonomic nervous system: functions and importance</td>
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<tr>
<td>7. Structure &amp; function of eye and ear</td>
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<td>8. GBV, Rape, Sexual harassment and Intergenerational sex among young people in the school</td>
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<tr>
<td>9. <strong>CONTINUUM:</strong> Drawing on posters, writing poems, composing songs, preparing speeches, planning a peaceful demonstration, planning a radio interview against drug abuse, GBV and Intergenerational sex among young people in the school</td>
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<tr>
<td>Organizing a hot line, where victims can call for help and advice</td>
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<td>Involving local NGOs</td>
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<td>10. Explaining the causes and corrections of eye defects</td>
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<td>11. Drawing, labeling and discussing, the skin as a sense organ</td>
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<td>12. Drawing and labeling a typical motor neuron</td>
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<th>Description</th>
<th>Intergenerational sex (age difference/statutory age)</th>
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<tr>
<td>hormone secretion through negative feedback</td>
<td>9. Effects of STIs on the organs of the nervous system</td>
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<tr>
<td>Describe the two basic mechanisms of hormones action</td>
<td>10. Substance abuse: causes, effects and prevention</td>
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<td><strong>9. Endocrine system</strong></td>
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<tr>
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<td>a) glands</td>
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<td>b) Hormones</td>
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<td>12. The role of other organs as endocrine glands a) testes  b) ovaries  c) liver  d) kidneys  e) stomach  Hormone deficiency diseases</td>
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<td>13. Examining the model and chart of mammalian eye</td>
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<td>14. Drawing and labeling the eye to show its external and internal structures</td>
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<tr>
<td></td>
<td>15. Examining model and charts of the mammalian ear and identifying the parts</td>
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<td>16. Drawing and labeling the ear to show its external and internal features</td>
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**SEMESTER: TWO**

**GRADE: 12**  
**PERIOD: VI**  
**TOPIC: ECOLOGY (NATURAL RESOURCES AND POLLUTION) AND HEALTH**

**LEARNING OBJECTIVES**

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<tr>
<th>OUTCOMES</th>
<th>OBJECTIVES</th>
<th>CONTENTS</th>
<th>ACTIVITIES</th>
<th>MATERIALS/ RESOURCES</th>
<th>COMPETENCIES/ ASSESSMENT</th>
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</table>
| Appreciate the importance of conservation of natural resources and the concept that natural resources contribute towards the wealth of a nation | Upon the completion of this topic, learners will be able to:  
1. Explain the concept of natural resources  
2. Discuss the importance of natural resources | 1. Definition of natural resources  
   a) Renewable Natural Resource  
   Nonrenewable Natural Resources  
2. Definition and examples of the flow of renewable resources | 1. Group Work  
   (mixed group based on gender and ability) on the importance of conservation or natural resources | A. Primary Text  
   Bafour Asante-Owusu, et al. Senior High Biology (Longman, 2009)  
   B. Secondary Texts  
   • Sue Hocking, et al. OCR Biology (OCR/Heinemann, 2008).  
   Senior Secondary Guide  
   Senior secondary guide Biology (star study guide series)  
   C. Other Resources/Supplementary Readings  
   • Bob McDuell, Senior High Integrated Science (Pearson, 2009)  
   • Charts of various kinds of natural resources  
   • Samples of natural resources  
   • Beaker  
   • Contaminated water  
   • Microscope | EXPECTED COMPETENCIES  
   • Effective communication skills  
   • Analytical and research skills  
   • Research and problem skills  
   • Organizational ability  
   • Digital skills  
   • Patriotism  
   • Creativity and innovation skills |
| Realize that renewable natural resources are regenerated, unlike the non-renewable natural resources which can be exhausted if not used wisely. | Distinguish between renewable and non-renewable natural resources  
4. Explain methods of conserving natural resources  
5. Explain preserving the ecosystem as an approach to natural resource management  
6. Explain the term pollution and discuss the causes, effects and control methods of pollution | 2. Field trips - viewing sites of natural resources such as rain forests, gold mines, diamond mines, rivers, lakes, ocean/beach, coal mine, iron ore, rubber factory, petroleum refinery, etc. |  |
| Accept the concept that pollution is harmful to the environment and organisms | Accept the concept that pollution is harmful to the environment and organisms (Realize that immunization prevents people against diseases.) | 3. Field trips - To observe:  
   a) solar radiation,  
   b) tides  
   c) Winds, etc. |  |
| | | 4. Field trips to Water sewage treatment plant |  |
| | | 5. Discussing different methods of sewage |  |

**EXPECTED COMPETENCIES**
- Effective communication skills
- Analytical and research skills
- Research and problem skills
- Organizational ability
- Digital skills
- Patriotism
- Creativity and innovation skills

**ASSESSMENT STRATEGIES**
- Quizzes
- Class works
- Assignments
- Attendance
- Class participation
Accept the concept that drug abuse is harmful to the well-being of people.

| 8. | Immunization as a means of preventing human diseases |
| 9. | State the importance of personal health as well as community health |
| 10. | Define and the term sewage disposal and discuss methods of sewage disposal |
| 11. | Identify economic uses of sewage |
| 12. | Discuss sources of water, modes of contamination and methods of purification |

### 10. Drug abuse

#### 11. Community hygiene

#### 12. Sewage and Sewage disposal:
- a) definitions of sewage and sewage disposal
  - i) methods of sewage disposal
  - k) ii) economic uses of sewage

#### 13. Water:
- a) Sources
- b) mode of contamination/pollution
- c) methods of purification

#### 14. Refuse collection and disposal

### 7. Discussing uses of sewage

### 8. LAB-Purifying water by boiling, chlorination and sand filtration (pumping water through sand filter to remove particles greater than 0.002mm diameter).

### 9. Testing water for contaminants

### 10. Filtering contaminated water using clean cloth

### 11. Practicing first aid exercises on partners

### 12. Observing nitrogen-fixing bacteria under microscope

### 13. Estimating the alcohol content of various drinks

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Pipette
- Methylene blue
- Thermometer
- Flask
- Stopper
- Alcohol
- Gauze mat
- Tripod
- Bunsen burner
- Gas light
- Clean cloth
- Funnel
- Porcelain filter
- Soil
- Rocks
- Coal and coal pot
- Petroleum product (kerosene, fuel oil)
- Sand
- Wood
- Chlorine

Charts on water purification system
Charts on sewage disposal
Fertilizers

| Presentations, |
| Lab works |
| Test |

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