



NCDC
NATIONAL CURRICULUM
DEVELOPMENT CENTRE



ACCELERATED EDUCATION PROGRAMME

BIOLOGY

SYLLABUS



NCDC

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© National Curriculum Development Centre (2019)

Published by

National Curriculum Development Centre

P.O. Box 7002,
Kampala- Uganda
www.ncdc.go.ug

ISBN:

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Foreword

Education is a fundamental tool for protection of conflict and disaster affected children and youths from harm and exploitation. This is a crucial part of UNESCO's advocacy messages. Under appropriate conditions of security, provision of education can help protect children and youth from recruitment into fighting forces, forced labour, prostitution, drug abuse and other criminal activities. In post-conflict settings, education contributes to the reintegration into society of former soldiers and other children and youths associated with fighting forces.

The National Curriculum Development Centre (NCDC), in collaboration with War Child Canada, embraced Accelerated Education Programme (AEP) that focuses on providing relevant and appropriate education to learners in refugee camps and the host communities of secondary school age (ages 16-45+) in Adjumani District. The programme will help them to acquire the necessary competencies that will enable them to 'catch-up' and re-join learners of the same (or near) age group in the formal education programme.

AEP subjects were selected based on the Ugandan regulation which states that learners must study the seven core subjects, i.e. Mathematics, English, Physics, Chemistry, Biology, History and Geography. So AEP learners shall take all the core subjects. In addition, learners shall take: Religious Education which will help to address the prevalence of early marriages for the girl-child, cases of indiscipline and moral modelling of the learners; Personal Social and Health Education/Physical Education which will help the learners to develop physically, learn to live together, develop talents and become emotionally balanced; Guidance and Counselling in which teachers will be trained on integration of guidance and counselling services in the delivery of the education curriculum.

This Programme will equip teachers and other stakeholders in schools and the communities with relevant information, values and skills that will enable them to effectively facilitate the teaching and learning processes.

We recommend AEP to you and trust that the materials will be valuable in your endeavour to meet the educational needs of the refugee learners and other beneficiaries from the host communities.

Hon. Janet Kataaha Museveni
FIRST LADY AND MINISTER OF EDUCATION AND SPORTS

Acknowledgement

National Curriculum Development Centre (NCDC) would like to express its gratitude to all those who, in one way or another, contributed and worked tirelessly towards the development of this Accelerated Education Programme (AEP) Syllabus. Special thanks go to War Child Canada - Uganda for the financial support, their guidance in overseeing and taking timely decisions whenever necessary during the development and production of this AEP Biology Syllabus.

We also express our gratitude to NCDC Subject Specialists and panel members for their professional guidance and technical assistance.

Furthermore, NCDC recognises the work of the editors who worked with the writers throughout the development of this Syllabus.

NCDC takes responsibility for any shortcomings that might be identified in this syllabus and welcomes suggestions for addressing the inadequacies. Such comments and suggestions may be communicated to NCDC through: P.O. Box7002, Kampala or e-mail admin@ncdc.org.ug or www.ncdc.org.ug.

Grace K. Baguma

DIRECTOR

NATIONAL CURRICULUM DEVELOPMENT CENTRE

Introduction to Accelerated Education Programme

Worldwide, substantial alternative schooling programmes are developed to meet the basic education needs of under-reached children. Of recent, it has been increasingly recognized that the goals of Education for All cannot be achieved unless more attention is paid to educating out-of-school children (UNESCO, Global Monitoring Report, 2008). Indeed, the UNESCO Global Monitoring Report 2010 'Reaching the Marginalized' focused on this issue. In a bid to help developing countries achieve the Millennium Development Goals, there should be initiatives to incorporate elements of accelerated learning to achieve SDG 4.

The Accelerated Education Programme (AEP) in Uganda is a form of curriculum option which combines the stronger features of earlier mainstreaming approaches into the new design to raise the success rates for refugee community learners. The AEP secondary school tier is a bigger stride to address the education gap within refugee communities not only in Uganda but also other neighbouring countries. Benchmarking the Primary AEP programmes, the Secondary Education Programme intends to infer the entire process of education and its cognitive, emotional, and social components.

The Accelerated Learning Programme at Secondary school level focuses on completing learning in a shorter period of time, of two years. The AEP is complementary both in providing an alternative route and in matching its curriculum to the 'official' curriculum, thus allowing learners to return to formal schooling at some stage. The programme intends to promote access to education in an accelerated timeframe for disadvantaged groups, out of school and over-age children, and youths who missed out or had their education interrupted due to poverty, violence, conflict, and crisis. The goal of this programme is to provide learners with competencies equivalent to those in the formal system in an accelerated timeframe, with learners either transitioning back into the mainstream education or exiting with some competencies required for work.

Ideally, teaching AEP calls for a methodology that is interactive and learner-centred, incorporating other aspects of multiple-intelligence learning. Because teaching and learning are accelerated, and the curriculum content is compressed and condensed, the four 'P' elements are at the core of the accelerated learning cycle; processes, psychological,

physiological, and physical. These core elements provide the physical and psychological space in which the learner can learn more effectively.

It is intentional to include alternative subjects in this programme e.g. life skills, peace education, environment, HIV and AIDS which are responsive to the context. Learners of AEP need alternative supporting knowledge and life skills to survive in the challenging world. It is equally important to note that this conception of accelerated learning requires an extremely well-resourced classroom and exceptionally well-trained teachers. The expanded learning time from the norm is because the teaching methodology is interactive and learner centred.

It is our hope that AEP will register considerable success in meeting the educational needs of these underserved populations, not only in terms of access and equity but also in being able to return to school and completion, and most importantly in getting measurable learning outcomes.

The aim of this AEP Biology syllabus

This Biology Teaching Syllabus is aimed at providing the teacher with guidance required to teach Biology to learners who will not go through the normal four years of Ordinary Level classes. It is meant to cover the most critical aspects of Biology without affecting its standards. It will adequately prepare learners for Uganda Certificate of Education (UCE). However, the creativity of the classroom teacher is important in this case.

Rationale for teaching Biology

The aims of teaching Biology are to:

1. provide, through well-designed studies of experimental and practical science, a worthwhile educational experience for all learners, and to enable them to acquire sufficient scientific knowledge and understanding that prepares them for the challenges of the 21st century.
2. enable learners become confident citizens in a technological world, able to take or develop an informed interest in scientific matters.
3. enable learners to recognize the usefulness, and limitations, of Biology and to appreciate its applicability in other disciplines and in everyday life.
4. enable learners to be suitably prepared for studies beyond the O level.

5. encourage efficient and safety practices both during experimental work and in society.
6. develop attitudes relevant to science in general and Biology in particular such as concern for accuracy and precision, objectivity, integrity, enquiry, inventiveness and innovativeness.
7. promote awareness that the study and practice of Biology are co-operative and cumulative activities, that are subject to social, economic, technological, ethical and cultural influences, justifications and limitations.
8. stimulate interest in and care for the environment and proper utilisation of resources with respect to Uganda.

Content Structure

The Accelerated Education Programme for Biology is divided into twelve (12) topics which will be taught in two years. The topics and the respective sub-topics for the two years are indicated in the table below.

LEVEL 1	LEVEL 2
<p>I. Diversity of Living Things</p> <ol style="list-style-type: none"> 1. Introduction to Biology 2. Plant and animal cells 3. Classification 4. Features of flowering plants <p>II. Soil</p> <ol style="list-style-type: none"> 1. Soil composition 2. Physical properties of soil 3. Soil erosion, conservation and the nitrogen cycle <p>III. Nutrition in Animals and Plants</p> <ol style="list-style-type: none"> 1. Nutrient compounds 2. Nutrition in animals 3. Nutrition in green plants <p>IV. Transport</p> <ol style="list-style-type: none"> 1. Movement into and out of 	<p>VI. Excretion and Homeostasis</p> <p>VII. Coordination in Plants and Animals</p> <ol style="list-style-type: none"> 1. Reception and response in plants 2. Chemical and nervous coordination in humans 3. Receptor organs in a mammals <p>VIII. Locomotion in humans</p> <p>IX. Growth and Development in Plants and Animals</p> <ol style="list-style-type: none"> 1. Growth in plants 2. Development in animals <p>X. Reproduction in plants and animals</p> <ol style="list-style-type: none"> 1. Asexual reproduction in plants 2. Sexual reproduction in humans

LEVEL 1	LEVEL 2
cells 2. Transport in animals 3. Transport in plants V. Respiration 1. Gaseous exchange 2. Cellular respiration	3. Sexual reproduction in plants XI. Genetics and Evolution 1. Mitosis and meiosis and their importance 2. Genetics and monohybrid inheritance 3. Co-dominance and incomplete dominance 4. Sex determination and hereditary diseases 5. Mutation, variation and evolution XII. Inter-relationships 1. Introduction to ecology 2. Food chains and food webs 3. Associations in organs 4. Humans and natural environment

NOTE:

Throughout this Biology Syllabus, emphasis must be put on:

a) Knowledge:

- i) Knowledge of terminology
- ii) Knowledge of specific facts
- iii) Familiarity with experiments suggested in the syllabus

b) Comprehension or understanding:

Ability to:

- i) explain standard phenomena from principles and models and to describe standard experiments met with before.
- ii) translate between various forms of information presentation.
- iii) draw conclusions from experimental procedures.

c) Application and higher abilities (skills, values and attitudes)

Ability to:

- i) analyze presented information.

- ii) synthesize ideas from presented data or otherwise.
- iii) apply laws and generalizations already learnt to everyday life and new situations.
- iv) devise experiments to test hypotheses and statements of models.
- v) devise projects in which the products employ Biology principles.
- vi) exercise evaluative judgment on suitability and results of scientific procedures.

d) Practical skills

Acquisition of the following abilities:

- i) Application of knowledge/theory to practical situations
- ii) Stating appropriate experimental title or heading
- iii) Manipulation of the apparatus and performing experiments
- iv) Making and recording observations accurately in column tables
- v) Presentation of data in an appropriate form especially graphical, with properly labelled axes and using suitable scales
- vi) Drawing conclusions from observations made
- vii) Assessing suitability of procedure, experiment and observations made in support of the conclusion

How to Use the Syllabus

This AEP Biology Teaching Syllabus has the following features:

a) Competency

This is a general statement of what a learner can exhibit/do as a result of learning all the concepts within each sub-topic. It is stated at the top of the table for each sub-topic in the detailed syllabus.

b) Learning Outcomes

These are the expected behaviours which a learner will exhibit after the study of the sub-topic. ***The teacher must ensure that all the outcomes are achieved.*** They have been provided to help the teacher clarify content and scope. Where a higher outcome is stated, lower outcomes are implied. The teacher should use learning outcomes to plan his/her teaching strategies. Learning outcomes also guide in evaluation at the

end of the teaching and learning process. The Biology for AEP has some learning outcomes that are followed by information in brackets to guide the teacher on the boundaries of the scope for that particular learning outcome.

c) Duration

This has been provided for each sub-topic. Each period is one hour. The duration is meant to guide the teacher in planning so as to cover all the content appropriately. However, the number of periods should allow for flexibility in order to cater for remedial teaching and carrying out practical activities where possible.

d) Suggested Learning Activities

These provide the teacher with guidance for example, on the tasks which the learners must accomplish to achieve the learning outcomes. However, these are not the only activities since other tasks as may be suggested by the teacher must be used. The teacher should use appropriate strategy e.g. individual or group work for learners to carry out the activities effectively. Teachers should also encourage learners to use a variety of resources such as library and ICT.

e) Sample Assessment Strategies

These are meant to test the level of understanding for each sub-topic. However, other assessment strategies as suggested by the teacher and textbooks appropriate to the sub-topic should be used to assess the learners' achievement. The sample assessment strategies are not meant to be spot work for end of cycle examination but rather to assist the teacher in formative assessment. Some of this assessment is done by observation and can be used to assess attributes like teamwork, confidence, scientific literacy, communication, leadership and organizational skills of learners.

f) Hints to the teacher

These further clarify the scope and depth of coverage for some sub-topics. They should be taken seriously to avoid leaving out content or giving content beyond the scope of the learners.

Detailed Syllabus

Level 1

Topic 1: Diversity of Living things

Duration: 21 Hours

Competency

By the end of the topic the learner should be able to identify and appreciate the diversity of animals, plants and microorganisms, become familiar with the importance of organisms in the environment and be able to conserve and protect living organisms.

Sub-topic 1: Introduction to Biology

Duration: 3 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
The learner should be able to: <ol style="list-style-type: none"> define Biology. identify and define processes that are characteristic of all living organisms. distinguish the branches of Biology. recognize the importance of Biology in everyday life. 	<ol style="list-style-type: none"> Guide learners to a study area outside the classroom, learners observe the plants and animals and identify characteristics/life processes that show the organism is living. Learners observe plants and animals in the school compound and write down any differences in their life processes 	Observe learners ability to mention similarities and differences between a moving car and a living organism. Learners create a table for the differences between a moving car and a living organism.

Hint to the Teacher

- Mention the life process (characteristic of living things) and its importance ONLY*
- The following branches of biology (botany, zoology, physiology) should be given at this level.*

References

- Omoding, S. &Matovu, D. (2007). *New Biology Students' Book.S.1 & S.2*, Pg. 1-4. Pearson, Longman.
- Mackean, D. G. (1984). *Introduction to Biology*, Pg. 9. Third Tropical Edition; London, John Murray.

Sub-topic 2: Animal and Plant Cells

Duration: 3Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
The learner should be able to: a. define a cell. b. compare the parts of animal and plant cells. c. discuss the functions of the parts of plant and animal cells. d. differentiate the levels of cellular organisation. e. relate the structure of specialised cells to their functions.	i) Learner observes prepared slides of a plant and animal cell. Identify similarities and differences ii) Learner draws and labels the animal and plant cell as seen under a light microscope. iii) In groups, learners do research and play out a short drama skit on the functions of the parts in a plant and animal cell.	Task the learners to suggest organ systems that need to work together when a person is: a. Dancing b. Eating c. Writing a story

Hint to the Teacher

- The parts of the cells should be limited to cell membrane, cell wall, chloroplast, cytoplasm, nucleus and cell vacuole*
- Develop and use simple models of plant and animal cells using locally available materials*

References

- Omoding S. & Matovu D. (2007). New Biology Students' Book, S.1 & S.2. Pearson, Longman.
- Mackean D. G. (1984). Introduction to Biology. Third tropical edition; John Murray London.

Sub-topic 3: Classification

Duration: 9 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
<p>The learner should be able to:</p> <ol style="list-style-type: none"> categorize the taxonomic levels of organisms. identify the five kingdoms of living organisms construct a flow chart and dichotomous key using objects or items in their surrounding environment identify the common characteristics of kingdom monera & fungi. discuss the harmful and beneficial aspects of organisms in kingdom's monera and fungi. identify the characteristics and give examples of organisms in phyla Arthropoda (Class insecta and arachnida ONLY). describe the external features 	<ol style="list-style-type: none"> Learners use an analogy of population sizes at different political administration levels in Uganda e.g. district, county, sub-county etc. to compare with the number of organisms in a Kingdom, Phylum, Class, Order, Family, Genus and Species. The learners match the biological hierarchy with the “equivalent” in the political administration level. In groups, learners discuss, design using scientific process skills and carry out an experiment to demonstrate the production of yoghurt and bread. Learners make a report at the end of the experiment that includes the following: title, question, prediction, materials, procedure, record and analysis of results and conclusion. Groups 	<ol style="list-style-type: none"> Learner highlights features he/she would use to compare a fish and a reptile. Learner creates a table to show the comparison between a fish and a reptile Learners explore through conversation the ways man uses insects for benefit. Learners make a presentation about what they know about use of insects or insect products at home or elsewhere <i>(Teacher encourages learners to be creative in their presentations)</i> Teacher provides learner with a constructed dichotomous key. Tasks learner to identify a

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
<p>(antennae, mouth parts, wings, legs) of a cockroach, housefly, worker bee, butterfly and soldier termite.</p> <p>h. discuss the harmful and beneficial aspects of a cockroach, housefly, mosquito, worker bee, butterfly and soldier termite.</p> <p>i. identify the characteristics and give examples of organisms in phyla Chordata (Class pisces, amphibia, reptilia, aves and mammalia).</p> <p>j. construct and use a dichotomous key to identify animal.</p> <p>k. identify the characteristics and give examples of organisms in division Angiospermae and Gymnospermae only.</p>	<p>present their work to the rest of the class.</p> <p>iii) Learners use a hand lens to observe a cockroach, housefly, mosquito, bee, butterfly and termite paying specific attention to the following structures:</p> <ul style="list-style-type: none"> • Head (mouth parts and antennae) • Thorax (wings and legs) <p>a) Create a suitable table and record his/her observations descriptively for each of the insects provided</p> <p>b) Draw and label of the insects provided</p> <p>c) Construct a dichotomous key for any four of the following insects (cockroach, housefly, mosquito, bee, butterfly and termite)</p>	<p>particular organism based on the dichotomous key</p>

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
a. identify the characteristics of viruses. b. give examples of diseases caused by viruses in plants and animals.	d) Develop and perform a short drama skit on transmission and prevention of any of the following viruses; HIV, Ebola, Hepatitis, Cassava mosaic	Learners are tasked to find out why there is no cure for diseases caused by viruses

Hints to the Teacher

1. *The characteristics of monera should be limited to cell structure (No drawings and types of monera required)*
2. *For the insects, relate the structure of the mouth parts, wings and legs to their function*
3. *Create/ research about simple activities that can be used to introduce the concepts of scientific method and dichotomous keys*
4. *Guidelines to making good biological drawings should be regularly emphasized*

References

1. Hayward, G. (2000). Secondary Biology. Macmillan Publishers.
2. Olong, S. J et al (2013). Secondary Biology Student's Book 1. MK publishers.
3. Omoding, S. & Matovu, D. (2007). New Biology students' book S.1 & S.2. Pearson, Longman.
4. Mackean, D. G. (1984). Introduction to Biology. Third Tropical Edition; London, John Murray.

Sub-topic 4: Features of Flowering Plants

Duration: 6 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
<p>The learner should be able to:</p> <ol style="list-style-type: none"> describe and outline the functions of the external structures of a typical flowering plant (root, leaf, stem, leaf node, internode, bud, flower and fruit). compare a monocotyledonous plant with a dicotyledonous plants. explain how modified roots, stems and leaves are suited for their function. classify the different types of fruits (schizocarp, legume, cypsela, caryopsis, berry and drupe). construct and use a dichotomous key to identify leaves and fruits. 	<ol style="list-style-type: none"> Learners draw and label the parts of a whole mature dicotyledonous plant Provide learners with an entire herbaceous dicotyledonous and monocotyledonous plant. In groups, learners compare the structural features (root system, leaf venation, leaf shape, leaf stalk and flower colour). Learners record and present their observations. Guide learners on how to construct a dichotomous key for any four different leaves. 	<p>Learners group with reasons the following plant parts which we use as foods into roots, leaves, stems and fruits: cabbage, water melon, bamboo shoot, sugar cane, Irish potato, pumpkin, carrot, spinach, onion, lettuce, tomato, groundnuts, cassava, sweet potato, maize, yam, garlic.</p>

References

1. Hayward, G. (2000) Secondary Biology. Macmillan publishers.
2. Olong. S. J et al (2013). Secondary Biology Student's Book 1. MK Publishers.
3. Omoding, S. &Matovu D. (2007). New Biology Students' Book S.1 & S.2. Pearson, Longman.
4. Mackean, D. G. (1984). Introduction to Biology. Third Tropical Edition; London, John Murray.

Topic 2: Soil

Duration: 9 Hours

Competency

By the end of the topic the learner should be able to describe soil components and properties relating them to their contribution to life of living organisms, and the need to conserve soil.

Sub-topic 1: Soil Composition

Duration: 4 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
The learner should be able to: <ol style="list-style-type: none"> describe soil (clay, sand and loam soil) and state their importance. identify soil constituents and mention their functions. demonstrate the presence and determine the percentage of air in a soil sample. 	In groups, learners observe three different soil samples (clay, sand and loam) and record their observations based on the following characteristics: <ul style="list-style-type: none"> The ability of soil particles to stick together The size of particles in each soil sample The texture of each soil sample 	Learners design, perform and report on a simple experiment to show that soil is a water filter.

Sub-topic 2: Physical Properties of Soil

Duration: 2 Periods

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
The learner should be able to: <ol style="list-style-type: none"> demonstrate retention, drainage, capillarity in different soil 	Task the learners to design, perform and report on experiments to show: <ul style="list-style-type: none"> retention drainage 	

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
<p>samples.</p> <p>b. relate physical properties of soil to plant growth in various environments.</p>	<ul style="list-style-type: none"> capillarity in loam, clay and sandy soils. The report for each experiment should follow scientific method. 	

Hint to the Teacher

The soil samples used for experiments should be as pure as possible

References

- Hayward, G. (2000). Secondary Biology, Macmillan publishers.
- Mackean D. G. (1984). Introduction to Biology. Third Tropical Edition; London, John Murray.
- Olong, S. J. et al (2013). Secondary Biology Student's Book 2. MK Publishers.
- Omoding, S. and Matovu, D. (2007). New Biology Students' Book S.1 & S.2. Pearson, Longman.

Sub-topic 3: Soil Erosion, Conservation and the Nitrogen Cycle

Duration: 3 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
<p>The learner should be able to:</p> <p>a. define the term soil erosion.</p> <p>b. explain the causes of soil erosion (sheet, rill and gully).</p> <p>c. describe methods of soil conservation.</p>	<p>In groups, learners do research and write a report on the different methods used to maintain soil fertility and to conserve soil in the following regions of Uganda</p> <ul style="list-style-type: none"> Lake Victoria basin Kigezi highlands <p>The groups present their reports to the rest of the class.</p>	<p>Guide learners to identify the causes of soil erosion in the Karamoja region and how they can be controlled.</p>

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
d. describe the nitrogen cycle and relate its importance to plants and animals.	Learners design and explain a crop rotation schedule for four seasons on a piece of land	
<p>Hint to the Teacher <i>Soil conservation should include maintenance of soil fertility, prevention and control of soil erosion.</i></p>		
<p>References</p> <ol style="list-style-type: none"> 1. Samuel Omoding and Dorothy Matovu (2007). New Biology Students' Book S.1 & S.2, Pg. 120-128. Pearson, Longman. 2. Mackean, D. G. (1984). Introduction to Biology. Third Tropical Edition; Pg. 78-81. London, John Murray. 		

Topic 3: Nutrition in Animals and Plants

Duration: 23 Hours

Competency

By the end of the topic the learner should be able to appreciate that nutrition is a means of an organism getting nutrients for provision of energy, proper functioning and growth.

Sub-topic 1: Nutrient Compounds

Duration: 8 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
<p>The learner should be able to:</p> <ol style="list-style-type: none"> understand the meaning of the term nutrition. describe the types of nutrition perform food tests for carbohydrates, lipids/fats, protein and vitamin C. identify the food nutrients, their sources, uses, nutrient deficiency causes, symptoms and prevention (Goitre, Rickets, Anaemia, Kwashakior, Scurvy, Marasmus) in humans. explain the concept of a balanced diet in relation to age, sex and an individual's 	<ol style="list-style-type: none"> Learners in groups or individually, carry out experiments on a potato extract, egg albumen, and ground nut extract and lemon juice to determine what main food nutrients they contain. Guide learners to design a balanced diet for a one-year-old baby. In groups, learners discuss the causes and symptoms of the following conditions: Goitre, Rickets, Anaemia, Kwashakior, Scurvy, Marasmus. Learners carry out culture experiments to find out the deficiencies associated with major plant mineral 	<p>Task learners to design and perform an experiment to compare growth of a plant in distilled water and pond water. Learners write a report.</p>

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
activity. f. identify the essential plant mineral nutrients (N, P, K, Mg, Ca, S, Mg), their roles and their deficiencies.	nutrients.	
References <ol style="list-style-type: none"> Samuel Omoding and Dorothy Matovu (2007). New Biology students' book S.1 & S.2, Pg. 156-168. Pearson, Longman. Mackean, D. G. (1984). Introduction to Biology Pg. 82 - 85. Third Tropical Edition; London, John Murray. 		

Sub-topic 2: Nutrition in Animals

Sub-topic 1: Enzymes

Duration: 3 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
The learner should be able to: <ol style="list-style-type: none"> define an enzyme. discuss the properties of enzymes. conduct experiments on and explain the factors that affect enzyme activity (pH and temperature). 	<ol style="list-style-type: none"> In groups learners, use scientific process skills to design and carry out an experiment to determine the effect of one factor (pH and temperature) on enzymes. Learners enter raw data on enzyme activity into MS excel, plot, present and interpret graphs. 	Learner enters raw data on the effect of temperature/pH on enzyme activity into MS excel, plot, present and the interpret graph.

References

1. Samuel Omoding and Dorothy Matovu (2007). New Biology Students' Book S.1 & S.2, Pg. 156-168. Pearson, Longman.
2. Mackean, D. G. (1984). Introduction to Biology. Third Tropical Edition. Pg. 85 – 86. London, John Murray.

Sub-topic 2: Structure of Teeth, Function and Care

Duration: 3 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
The learner: <ol style="list-style-type: none"> relate the structures of different types of teeth to their functions. describe the different arrangement of teeth in different organisms. describe the care for teeth in humans. 	Learners observe a molar, canine, pre-molar and incisor tooth <ul style="list-style-type: none"> identify and state one unique feature of each tooth provided. explain three adaptations of each tooth to its function. makes a drawing of each tooth. 	Learners construct a model of a lower human jaw showing the arrangement of the different types of teeth.
<h3>Hint to the Teacher</h3> <p><i>Arrangement of teeth on the jaws in man, cow, sheep and dog ONLY.</i></p>		
<h3>References</h3> <ol style="list-style-type: none"> 1. Samuel Omoding and Dorothy Matovu (2007). New Biology Students' book S.1 & S.2, Pg. 181-184. Pearson Longman. 2. Mackean, D. G. (1984). Introduction to Biology. Third Tropical Edition; Pg. 125 – 127. London, John Murray. 		

Sub-topic 3: Digestion in Animals

Duration: 4 Hours

<p>a. describe the process of digestion in man and state its products.</p> <p>b. explain how the end products of digestion are absorbed, assimilated and stored.</p> <p>c. mention the key features/characteristics of ruminants.</p>	<p>i) Learners design and carry out an experiment to demonstrate the breakdown of starch</p> <p>ii) Learners simulate process of digestion and its products using labelled cards with names of parts of the alimentary canal and the associated organs</p>	<p>1. Guide learners to discuss what happens if the food a person eats contains more energy than one's body needs.</p> <p>2. Learners do research and write a report on the role of caecum in non-ruminants and stomach in ruminants</p> <p>3. Compare ruminants and non-ruminants</p>
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Hints to the Teacher

1. *Restricted to only Man and goat or cattle*
2. *Functions of the liver and skin should be those related to digestion*

References

1. Samuel Omoding and Dorothy Matovu (2007). New Biology Students' book S.1 & S.2, Pg. 184-190, Pearson, Longman.
2. Mackean, D. G. (1984). Introduction to Biology. Third Tropical Edition. Pg. 85 – 92, London, John Murray.

Sub-topic 3: Nutrition in Green Plants

Duration: 5 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
<p>The learner should be able to:</p> <p>a. describe the process of photosynthesis.</p>	<p>i) In groups, learners discuss, design using scientific process skills and carry out experiments on photosynthesis.</p>	<p>Learners do a research and write a report on how a plant with non-green</p>

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
b. perform and explain experiments on photosynthesis. (Conditions and its products). c. explain the adaptations of a leaf to carry out the process of photosynthesis.	(Conditions and its products). ii) Learners make a write up of the experiment that includes the following: question, prediction, materials, procedure, record /analysis of results and conclusion. Groups present their work to the rest of the class.	leaves makes its food.
<p>Hint to the Teacher <i>Adaptations related to the internal structure of a leaf are not required.</i></p>		
<p>References</p> <ol style="list-style-type: none"> 1. Samuel Omoding and Dorothy Matovu (2007). New Biology Students' Book S.1 & S.2, Pg. 138-147. Pearson, Longman. 2. Mackean, D. G. (1984). Introduction to Biology. Third Tropical Edition; Pg. 48 – 51. London; John Murray. 		

Topic 4: Transport

Duration: 17 Hours

Competency

By the end of the topic the learner should be able to understand and appreciate the mechanisms by which materials move within an organism.

Sub-topic: 1 Movement into and out of Cells

Duration: 3 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
<p>The learner should be able to:</p> <p>a. investigate the processes by which materials move into and out of cells (Diffusion, osmosis and active transport).</p> <p>b. explain the importance of diffusion, osmosis and active transport.</p>	<p>In groups, learners use scientific process skills to design and carry out an experiment to show the effect of solute concentration and water on raw potatoes. Learners make a report at the end of the experiment that includes the following: question, prediction, materials, procedure, record /analysis of results and conclusion. Groups present their work to the rest of the class.</p>	<p>Design and carry out an experiment to demonstrate diffusion/osmosis in a raw unshelled egg</p>

Hint to the Teacher

Cover the basic principles of diffusion, osmosis and active transport ONLY.

References

1. Samuel Omoding and Dorothy Matovu (2007). New Biology Students' Book S.1 & S.2, Pg. 199-209. Pearson Longman.
2. Mackean, D. G. (1984). Introduction to Biology, Pg. 60 – 61. Third Tropical Edition; London, John Murray.

Sub-topic 2: Transport in Animals

Duration: 11 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
<p>The learner should be able to:</p> <ol style="list-style-type: none"> determine the surface area to volume ratio. explain the need for a transport system. identify the structures involved in transport of materials. 	<p>Learners use cardboard cubes of different dimensions to calculate the surface area to volume ratios of the cubes. Explain the biological significance of calculated ratios.</p>	<p>Learners create an analogy comparing transport systems in school setting and transport in man.</p>
<ol style="list-style-type: none"> describe the structure of the heart and how it functions. relate the structure of arteries, veins and capillaries to their functions. identify the components of blood and state their function. describe the process of blood clotting. explain the causes and prevention of diseases associated with the heart (high blood pressure and coronary heart disease/heart attack). 	<ol style="list-style-type: none"> Task learners to design a model to illustrate blood flow/circulation in the human body using locally available materials Learners dramatize the process of formation of a blood clot using labelled cards 	<p>Learners develop an awareness campaign for the community about lifestyle changes in relation to heart health.</p>
<ol style="list-style-type: none"> explain the importance of knowledge of blood groups for blood transfusion. 	<p>Learners listen to a talk from a blood bank/health worker, find out and write shorts notes on the importance of blood transfusion and the</p>	

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
b. recall the meaning of the term immunity. c. describe the types of immunity. d. explain how immunity is weakened by HIV infection.	possible risks involved.	
Hint to the Teacher <i>The details of different types and structure of white blood cells not required</i> <i>The details of different types and structure of white blood cells not required</i>		
References <ol style="list-style-type: none"> Samuel Omoding and Dorothy Matovu (2007). New Biology Students' Book S.1 & S.2, Pg. 210- 230. Pearson, Longman. Mackean, D. G.(1984). Introduction to Biology. Third Tropical Edition. Pg. 93 –101. London, John Murray. 		

Sub-topic 3: Transport in Plants

Duration: 3 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
The learner should be able to: a. describe the process of transpiration. b. explain the factors that affect the rate of transpiration.	Assign learners in groups to use scientific process skills to design and carry out experiments to show how wind, temperature and light intensity affect the rate of transpiration.	Research and report on how plants are adapted to live in different habitats.
Hint to the Teacher <i>No drawing of potometer required.</i>		

References

1. Samuel Omoding and Dorothy Matovu (2007). New Biology Students' Book. S.1 & S.2, Pg. 239- 245. Pearson, Longman.
2. Mackean, D. G. (1984). Introduction to Biology, Pg. 66 -70. Third Tropical Edition. London, John Murray.

Topic 5: Respiration

Duration: 10 Hours

Competencies

By the end of the topic the learner should be able to:

- i) understand how organism exchange gases with their respiratory medium.
- ii) understand the processes by which food is broken down to release energy needed for chemical processes.

Sub-topic 1 Gaseous Exchange

Duration: 5 Hours

Learning Outcomes	Suggested Learning Activities	Sample Assessment Strategy
<p>The learner should be able to:</p> <ol style="list-style-type: none"> a. explain how gaseous exchange surface is adapted to its function. b. describe the structure of the gill. c. describe the structure of the human lung. d. describe the mechanism of gaseous exchange in mammals. e. conduct experiments on mechanism of breathing. f. conduct an experiment to analyze the components of inhaled and exhaled air. g. demonstrate how 	<ol style="list-style-type: none"> i) Provide groups of learners with a single gill from a fish. The learners observe and draw the structure of the gill. ii) Learners in pairs, discuss and present how the structure of the gill is suitable for gaseous exchange iii) Learners, draw and label the structure of the human respiratory system iv) Guide learners to use models to explain the mechanism of gaseous exchange in human <p>In groups, learners design a poster to discourage people smoking tobacco. Groups present their posters to the rest of the class.</p>	<p>Debate: "The most suitable medium for gas exchange, Air or Water?"</p> <p>Task learners to discuss the circumstances under which artificial respiration is or can applied.</p>

Learning Outcomes	Suggested Learning Activities	Sample Assessment Strategy
to carry out artificial respiration. h. mention the causes, symptoms and prevention of tuberculosis.		
<p>Hint to the Teacher <i>Mechanism of gaseous exchange in fish is not required.</i></p>		
<p>References</p> <ol style="list-style-type: none"> <li data-bbox="243 681 1193 757">1. Fullick, A., Omoding, S. &Matovu, D. (2007). New Biology Students'Book S.3 & S.4, Pg. 1- 10. Pearson, Longman. <li data-bbox="243 763 1135 833">2. Mackean, D. G. (1984). Introduction to Biology Pg. 101 -105. Third Tropical Edition. London, John Murray. 		

Level 2

Sub-topic 2: Cellular Respiration

Duration: 5 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
The learner should be able to: a. recall the term respiration b. identify the types of respiration. c. describe the process of aerobic respiration. d. describe anaerobic respiration. e. demonstrate aerobic respiration in germinating seeds. f. demonstrate fermentation in yeast.	i) Use scientific process skills to design and carry out experiments to show release of energy, production of carbon dioxide and water, and use of oxygen during aerobic respiration. ii) Task learners in groups to use scientific process skills to design and carry out experiments to show: <ul style="list-style-type: none"> • fermentation using yeast. • anaerobic respiration in germinating seeds. iii) Learners discuss and write short notes of applications of anaerobic respiration in everyday life	Learners justify why athletes are given glucose instead of cassava immediately after a race. Learners investigate the applications of anaerobic respiration in everyday life
g. describe the carbon cycle	Learners debate the following motion: “Plants and animals can live and survive entirely independent of each other” (Basing their arguments on scientific facts)	Learners research and report on the causes and effects of accumulation/high levels carbon dioxide in the atmosphere

Hint to the Teacher

1. *Word and chemical equations be given where necessary*
2. *Mention be given to global warming/greenhouse effect when describing the carbon cycle*

References

1. Fullick, A., Omoding, S., and Matovu, D. (2007). New Biology Students' Book S.3 & S.4, Pg. 23-29. Pearson, Longman.
2. Mackean, D, G. (1984). Introduction to Biology Pg. 45 -48. Third Tropical Edition ,London, John Murray.

Topic 6: Excretion and Homeostasis

Duration: 5 Hours

Competency

By the end of the topic learners will be able to understand how living organisms eliminate waste products from their bodies and also maintain a constant internal environment.

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
<p>The learner should be able to:</p> <ol style="list-style-type: none"> recall the term excretion. name the excretory organs and their waste products describe the excretory functions of the skin. illustrate the parts of the urinary system. describe the role of the kidney in removing waste products. define homeostasis. describe how the liver regulates blood sugar level in the human body. describe how the skin regulates body temperature. 	<ol style="list-style-type: none"> Learners imagine a scenario of an athlete after completing a marathon. In groups, learners explain the changes in the athlete due to excretion. In groups, learners demonstrate simple experiments that show the excretory functions of the skin Learners use locally available materials to simulate how the kidney removes waste products from the body. Provide learners with graph/charts showing changes in the levels of blood sugar and temperature in humans. Learners study, interpret and 	<p>Learners differentiate between an excretory product and an unwanted waste material from the human body</p> <p>Determine the learners ability to distinguish the excretory function of the skin from its other functions</p> <p>Guide the learners to develop a plan to manage human wastes like urine for a healthy environment at school. Learners write and present their plan</p> <ol style="list-style-type: none"> Learners research and make a report on: <ol style="list-style-type: none"> <i>Diabetes mellitus</i> <i>Diabetes inspidus</i> Guide learners to

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
	discuss the graphs/charts	develop a meal plan for a person suffering from <i>Diabetes mellitus</i>
<p>Hint to the Teacher</p> <ol style="list-style-type: none"> 1. <i>Internal structure of the skin, kidney and details of urine formation are NOT required.</i> 2. <i>Positive and negative feedback mechanisms not required.</i> 		
<p>References</p> <ol style="list-style-type: none"> 1. Fullick, A., Omoding, S., and Matovu, D. (2007). New Biology Students' Book S.3 and S.4, Pg. 32-38, 41-44, 47-49. Pearson, Longman. 2. Hayward, G. (2000). Secondary Biology, Pg. 193-200. Macmillan Publishers. 3. Mackean, D. G. (1984). Introduction to Biology. Third Tropical Edition, Pg. 106 -111. London, John Murray. 4. Olong, S. J et al (2013). Secondary Biology Student's Book 3, Pg. 45-50, 59-63, 72-75. MK Publishers. 		

Topic 7: Co-ordination in Plants and Animals

Duration: 17 Hours

Competency

By the end of the topic the learner should be able to understand how living organisms respond to stimuli (changes) in the environment and how their behaviour is influenced by the environment.

Sub-topic 1: Reception and Response in Plants

Duration: 3 Hours

Learning Outcomes	Suggested Learning Activities	Sample Assessment Strategy
The learner should be able to: <ol style="list-style-type: none"> define the terms stimulus, response and irritability. relate different types of stimuli to their receptor organs. define the term tropism. demonstrate experiments on tropic responses. explain phototropism, geotropism and hydrotropism. 	Guide learners to use scientific process skills to carry out and report on experiments to demonstrate phototropism and geotropism	Task learners to highlight the role of tropic responses in ensuring plant survival

References

1. Fullick, A., Omoding, S. and Matovu, D. (2007). New Biology Students' book S.3 & S.4, Pg. 89-95. Pearson, Longman.
2. Hayward, G. (2000). Secondary Biology. Pg. 221-231. Macmillan Publishers.
3. Mackean, D. G. (1984). Introduction to Biology. Third Tropical Edition;Pg. 41 -44. London, John Murray.
4. Olong, S. J. et al (2013). Secondary Biology Student's Book 3, Pg. 81-89. MK Publishers.

Sub-topic 2: Chemical and Nervous Coordination in Humans

Duration: 7 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategies
<p>The learner should be able to:</p> <ol style="list-style-type: none"> define a hormone and a gland. identify the endocrine glands, the hormones they secrete, the target organs and the effects of the hormones in the human body. role of hormones in secondary sexual characteristics define a neuron/nerve cell. describe the structure and function of different types of nerve cells. define a receptor and effector giving examples of each. describe the flow of the nerve impulse from receptor to effector. identify the parts of the brain (cerebrum, cerebellum and medulla oblongata) and state the role of 	<ol style="list-style-type: none"> In a role play, learners pick cards with different labels of the different names of endocrine glands, secretion of the glands and simulate the movement of the hormones from the glands to the target tissue or gland giving descriptions of their effects Learners dramatize the movement of the nerve impulse from receptor to effector Create an Analogy showing the similarity between the CNS and the post office mailing system. In groups, learners fill in the analogy chart by : <ul style="list-style-type: none"> Identifying the main parts of the CNS Stating the function of each part 	<p>In groups, learners discuss the role of hormones in the regulation of reproductive and sexual functioning in puberty boys and girls particularly secondary sexual characteristics</p> <p>Task learners to identify the effectors and receptors found in the human body</p> <p>Learners develop a scenario that can clearly depict a voluntary or involuntary action</p>

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategies
each part. i. describe the structure and state the functions of the spinal cord. Describe the path of a reflex action j. describe using examples simple and conditioned reflexes.	iv) Identifying the analogous part of the post office system that corresponds to each of the parts of the CNS mentioned and gives a reason v) Learners discuss the conditioned reflexes they have experienced or observed in their day to day life.	

Hint to the Teacher

If the learners have little or no knowledge about the post office system, review the system with them.

References

1. Fullick, A., Omoding S., &Matovu D. (2007) New Biology students' book S.3 & S.4, Pg. 60-66, 77-78, 85-89 Pearson, Longman.
2. Hayward, G. (2000) Secondary Biology, Pg. 222-241, 257-263. Macmillan publishers.
3. Mackean, D. G. (1984). Introduction to Biology Pg. 137 -145. Third Tropical Edition; London, John Murray.
4. Olong, S. J. et al (2013). Secondary Biology Student's Book 3. Pg. 98-127. MK Publishers.

Sub-topic 1: Substance and Drugs Use or Abuse

Duration: 3 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
a. define a substance and a drug. b. distinguish between substance/drug use and abuse. c. name the common substances and drugs abused in Uganda d. describe the physiological, social and economic effects of substance and drug abuse. e. describe how to prevent and control substance and drug abuse.	i) In groups, discuss the physiological, social and economic effects of drug abuse (Alcohol, cigarettes, marijuana, kuber, khat, shisha, petrol/glue) ii) Learners discuss reasons why young people are involved in alcohol, drug and substance abuse.	Learners design strategies for a campaign on the prevention and control of drug abuse in schools and refugee settlement areas

Sub- topic 3: Receptor Organs in Mammals

Duration: 4 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
The learner should be able to: a. describe the structure and state the function of each part of the human eye. b. describe accommodation in the eye. c. name eye defects, their causes and how they are corrected (long and short sightedness).	Take learners to visit a health facility and do research on short and long sightedness. Learners write and present a report. Learners draw the structure and state functions of the parts of a human ear	Learners relate the knowledge of physics in understanding how some receptor organs work.

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
d. describe the structure and state the functions of the parts of the human ear.		
<p>Hint to the Teacher <i>Describing how hearing and balance takes place is not required.</i></p>		
<p>References</p> <ol style="list-style-type: none"> 1. Fullick, A., Omoding, S. and Matovu, D. (2007). New Biology Students' Book S.3 & S.4, Pg. 69-75. Pearson, Longman. 2. Hayward, G. (2000). Secondary Biology. Pg. 241-256. Macmillan Publishers. 3. Mackean, D. G. (1984). Introduction to Biology, Pg. 130 –135. Third Tropical Edition; London John Murray. 4. Olong, S. J. et al (2013). Secondary Biology Student's Book 3, Pg. 129-141. MK Publishers. 		

Topic 8: Locomotion in Humans

Duration: 6 Hours

Competency

By the end of the topic the learner should be able to understand mechanisms by which organisms move in search of food, protection, mates and suitable conditions.

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
<p>The learner should be able to:</p> <ol style="list-style-type: none"> recall the term locomotion. state the need for locomotion. name the types of skeletons and the organisms in which they are found. write the functions of the human skeleton. define a joint and give examples. describe how the muscles of the arm in humans operate. 	<ol style="list-style-type: none"> Learners observe any living organism moving and record the structures it is using to move. Learners propose reasons why organisms move from one place to another. Provide learners with a model of the human skeleton. Learners: <ul style="list-style-type: none"> Identify the two divisions of the skeleton. Name the bones that form the appendicular and axial skeleton. Identify the regions of the axial skeleton. Learners in pairs, observe a classmate moving the fore arm up and down (bending the arm at 	<ul style="list-style-type: none"> Learners identify the structures for locomotion in water, on land and in air. Task learners to explain how vertebrae are adapted for their functions. Learners relate the knowledge of physics in understanding how movement is brought about in humans. Learners use locally available materials to develop a model of a human leg and demonstrate how it works.

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
	the elbow). Learners: <ul style="list-style-type: none"> • Identify the set of muscles that bring about movement • How do the muscles work to bring about movement Which one raises the lower arm and which one lowers it?	
<p>Hint to the Teacher <i>Movement on insects, birds and fish not necessary.</i></p>		
<p>References</p> <ol style="list-style-type: none"> 1. Fullick, A., Omoding, S., and Matovu, D. (2007). New Biology Students' Book S.3 & S.4, Pg. 113-122, Pearson, Longman. 2. Hayward, G. (2000). Secondary Biology, Pg. 264-274. Macmillan Publishers. 3. Mackean, D. G. (1984). Introduction to Biology, Pg. 119 –124. Third Tropical Edition; London John Murray. 4. Olong, S. J. et al (2013). Secondary Biology Student's Book 3, Pg. 159-174. MK Publishers. 		

Topic 9: Growth and Development in Plants and Animals

Duration: 13 Hours

Competency

By the end of the topic the learner should be able to understand processes by which living organisms increase in size and change in form, becoming more complex as they grow.

Sub-topic 1: Growth in Plants

Duration: 8 Hours

Learning Outcomes	Suggested Learning Activities	Sample Assessment Strategy
<p>The learner should be able to:</p> <ol style="list-style-type: none"> distinguish between growth and development. recall the term germination describe the types of seed germination. explain the importance of each of the factors / conditions necessary for seed germination. conduct experiments on conditions necessary for seed germination. define seed dormancy. explain why seeds fail to germinate even when the necessary conditions are available. explain how seed dormancy can be broken. 	<ol style="list-style-type: none"> In groups, learners discuss and derive the meaning of the terms growth and development. Guide learners to use scientific process skills to design, carry out and report on an experiment to show that air, water and temperature are necessary for germination. Take learners to an agricultural facility/demonstration farm to do research and report on causes, importance and breaking of seed dormancy 	<p>Project: In groups, learners plant a set of bean and maize seeds, from the time of germination monitor and record the changes in length every week for 10 weeks. Represent the data collected in form of a graph and interpret and explain it.</p>

References

1. Fullick, A., Omoding, S., and Matovu, D. (2007). New Biology Students' Book S.3 and S.4, Pg. 103-107. Pearson, Longman.
2. Hayward, G. (2000). Secondary Biology, Pg. 317-322. Macmillan Publishers.
3. Mackean, D, G. (1984). Introduction to Biology, Pg. 37 –41. Third Tropical Edition; London, John Murray.
4. Olong, S. J. et al (2013). Secondary Biology Student's Book 4, Pg. 13-19. MK Publishers.

Sub-topic 2: Development in Animals

Duration: 5 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
a. define the term metamorphosis. b. describe the stages of development in a housefly and a cockroach. c. compare complete and incomplete metamorphosis. d. describe the developmental stages of a child (0 to 5 years) and significant features of behavior at each stage. e. describe the physical, physiological, psychological (emotional) and behaviour changes	i) Learners in groups observe charts showing the life cycles of a butterfly and cockroach, compare complete and incomplete metamorphosis, write down their findings. ii) In groups, learners discuss the following: <ul style="list-style-type: none"> • The physical and physiological changes that occur in humans during puberty • The psychological (emotional) and behavior changes in adolescents • The myths associated sex, ejaculation, 	<ul style="list-style-type: none"> • Learners use locally available materials to demonstrate complete metamorphosis in a named insect. • Learners develop a guidance talk on the physical, physiological, psychological and behavior changes in adolescents highlighting the challenges and myths.

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
<p>associated with adolescence and puberty and highlights the associated myths.</p> <p>f. identify various features related to the process of aging.</p>	<p>menstruation and pregnancy</p> <p>ii) As a class, act a play to address the theme “ways of dealing with physical, physiological, psychological and behavior changes that occur during puberty”.</p>	

References

1. Olong.S.J et al (2013). Secondary Biology Student’s Book 4, Pg. 36-38. MK publishers.
2. Omoding S., &Matovu D. (2007) New Biology students’ book S.1 & S.2, Pg. 82-88, Pearson Longman.
3. Mackean D, G. (1984). Introduction to Biology, Pg. 154–156. Third Tropical Edition;London, John Murray.

Topic 10: Reproduction in Plants and Animals

Duration: 23 Hours

Competency

By the end of the topic the learner should be able to understand the mechanism by which living organisms produce their off-springs and sustain their life on earth.

Sub-topic 1: Asexual Reproduction in Plants (Vegetative Reproduction)

Duration: 4 Hours

Learning Outcomes	Suggested Learning Activities	Sample Assessment Strategy
<p>The learner should be able to:</p> <ol style="list-style-type: none"> define asexual reproduction define vegetative reproduction identify plant structures used in vegetative reproduction. mention the advantages and disadvantages of vegetative reproduction describe the procedures used in budding, layering and grafting to produce new plants. 	<ol style="list-style-type: none"> Take the learners on a field to study and observe various plants; identify possible parts that can be used to get new plants of the same kind. Learners report findings in a table form and draw the parts identified. In groups, learners discuss the crops in Uganda that are grown by vegetative reproduction on large scale Brain storm on advantages and disadvantages of vegetative propagation in plants 	<p>Project:</p> <p>In groups, learners grow plants in school by layering (straw berries), stem cutting (Cassava), and grafting (Citrus)</p>

References

1. Fullick A., Omoding S., &Matovu D. (2007) New Biology students' book S.3 & S.4, Pg. 136-140, Pearson Longman.
2. Hayward.G. (2000) Secondary Biology, Pg. 282-286. Macmillan publishers.
3. Mackean D, G. (1984) Introduction to Biology Third tropical edition, Pg. 23–27, John Murray London.
4. Olong.S.J et al (2013). Secondary Biology Student's Book 4, Pg. 57-68. MK publishers.

Sub-topic 2: Sexual Reproduction in Plants

Duration: 4 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
<p>The learner should be able to:</p> <ol style="list-style-type: none"> define the term pollination. name types of pollination. list the agents of pollination. differentiate between cross and self-pollination identify the characteristics of insect and wind pollinated flowers. describe the process of fertilization. explain the formation of fruit and seeds. explain how a fruit differs from a seed. explain the 	<p>Learners as individuals or in groups:</p> <ol style="list-style-type: none"> Basing on the structure of the flower and the fact that pollination has to do with pollen grains, they discuss and formulate the meaning of the term pollination. Basing on definition pollination, discuss where the pollen grains come from to get to the stigma and hence identify and differentiate the types of pollination. Are provided with typical cross and self-pollinated flowers .With the help of leading questions they derive the factors that promote self and cross pollination. Discuss and suggest what 	<p>Learners relate the role of insects in plant reproduction.</p>

economic importance of flowers.	would transfer pollen from the anther to the stigma and hence helped to identify the agents and methods of pollination.	
<p>References</p> <ol style="list-style-type: none"> 1. Fullick, A., Omoding, S., and Matovu, D. (2007). New Biology Students' Book S.3 & S.4, Pg. 143-146. Pearson Longman. 2. Hayward, G. (2000). Secondary Biology. Pg. 287-293. Macmillan Publishers. 3. Mackean, D. G. (1984). Introduction to Biology, Pg. 31 -34. Third Tropical Edition; London, John Murray. 4. Olong, S.J. et al (2013). Secondary Biology Student's Book 4, Pg. 118-125. MK Publishers. 		
<p>Sub-topic 1: Fruit Dispersal Duration: 3 Hours</p>		
<ol style="list-style-type: none"> a. define fruit and seed dispersal. b. describe modes of fruit and seed dispersal c. list the agents of fruit and seed dispersal. d. explain how fruits and seeds are adapted to their methods of dispersal. e. justify the importance of fruit and seed dispersal. 	<ol style="list-style-type: none"> i) Demonstrate the structural and functional difference between fruits and seeds. ii) Draw sections of selected common fruits and describe how their structures are modified for dispersal and giving reasons, name the agent(s) that disperse that fruit. 	
<p>References</p> <ol style="list-style-type: none"> 1. Hayward, G. (2000). Secondary Biology. Pg. 294-295. Macmillan Publishers. 2. Mackean, D. G. (1984). Introduction to Biology. Third tropical edition, Pg. 36, London, John Murray. 3. Olong, S.J. et al (2013). Secondary Biology Student's Book 4, Pg. 132-137. MK Publishers. 4. Omoding, S., & Matovu, D. (2007). New Biology Students' Book S.1 & S.2, Pg. 75-79; Pearson, Longman. 		

Sub-topic 3: Sexual Reproduction in Humans

Duration: 11 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
<p>The learner should be able to:</p> <ol style="list-style-type: none"> illustrate male and female reproductive system in humans and state the functions of each part. compare male and female gametes explain the changes that take place during the menstrual cycle. describe the process of fertilization of an ovum and the developments of the zygote up to birth. describe the role of the placenta during pregnancy. explain the importance of a pregnant woman visiting a doctor regularly (antenatal medical visits). explain the health risks/complications associated with early/teenage pregnancy and 	<ol style="list-style-type: none"> Learners look at a chart(s) of human (male and female) reproductive systems, draw and teachers helps them to label and give functions of each part. Learners are provided with graphs showing variation of LH and FSH, oestrogen and progesterone and thickening of uterine wall with time in days. Use the graphs to discuss and explain the events of the female menstrual cycle. Write an article, of not more than 200 words, highlighting the following: <ul style="list-style-type: none"> The dangers associated with early/teenage pregnancy and abortion Ways on how to avoid early and unwanted pregnancies. Visit a health facility, research about and write a report on the common birth control methods used in Uganda, the biological principle they employ and their 	<p>Learners create awareness campaign about the dangers associated with abortion.</p>

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
abortion. h. describe the care (breast feeding, balanced diet, immunization and hygiene) for the baby after birth. i. identify the common birth control methods in Uganda and give the biological principle they employ and their effectiveness. (Note: The ONLY method recommended for young people is abstinence)	effectiveness.	
References <ol style="list-style-type: none"> 1. Fullick, A., Omoding, S., & Matovu, D. (2007). New Biology Students' Book S.3 & S.4, Pg. 156-166, Pearson, Longman. 2. Hayward, G. (2000). Secondary Biology, Pg. 299-319, Macmillan Publishers. 3. Mackean, D. G. (1984). Introduction to Biology, Pg. 112-118. Third Tropical Edition; London, John Murray. 4. Olong, S.J. et al (2013). Secondary Biology Student's Book 4, Pg. 81-103. MK Publishers. 		
Sub-topic 1: Sexually Transmitted Infections Duration: 4 Hours		
a. identify common abnormalities associated with reproductive systems	i) Learners as individuals or in groups: a. Gather information and report on menstrual and erectile abnormalities in	Task learners to justify the need to fight the

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
<p>b. state the causes and explains the mode of transmission of named STIs (Syphilis, Gonorrhoea, Candida, Human Papilloma Virus (HPV), Hepatitis B and HIV and AIDS).</p> <p>c. describe signs and symptoms of each named STI.</p> <p>d. cite the preventive measures for the named STI's. identify the challenges faced by People Living with HIV and AIDS and how to overcome them.</p>	<p>young people and the possible medical remedies</p> <p>b. Listen to a talk about common STIs from a health worker and write a report that includes the following:</p> <ul style="list-style-type: none"> • Causes and mode of transmission • Signs and symptoms • Preventive measures <p>ii) Create a theme and write a transcript of a play about AIDS.</p>	<p>stigma against people living with HIV and AIDS</p>
<p>Hint to the Teacher <i>Some abnormalities of sexual organs are not due to sexually transmitted infections.</i> <i>The ONLY preventive method recommended for young people is abstinence.</i></p>		
<p>References</p> <ol style="list-style-type: none"> 1. Hayward, G. (2000). Secondary Biology, Pg. 311-313. Macmillan Publishers. 2. Olong, S.J.et al (2013). Secondary Biology Student's Book 4, Pg. 104-110. MK Publishers. 		

Topic 11: Genetics and Evolution

Duration: 15 Hours

Competency

By the end of the topic the learner should be able to understand the role of cell division in living organisms and how variation occurs among various species.

Sub-topic 1: Mitosis and Meiosis and Their Importance

Duration: 2 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
The learner should be able to: a. define the process of mitosis b. define the process of meiosis. c. explain the significance of both types of cell division.	Basing on the definitions of mitosis and meiosis, learners discuss the significance of both processes.	Demonstrating stages of meiosis by using locally available materials
Hint to the Teacher <i>Details of the stages of mitosis and meiosis not required</i>		
<ol style="list-style-type: none"> 1. Fullick, A., Omoding, S., &Matovu, D. (2007). New Biology Students' Book S.3 & S.4, Pg. 99, 171 Pearson, Longman. 2. Hayward, G. (2000) Secondary Biology, Pg. 280. 297-8 Macmillan publishers. 3. Mackean, D. G. (1984). Introduction to Biology Third tropical edition, Pg. 177-180, 186-7.London,John Murray. 4. Olong, S.J. et al (2013). Secondary Biology Student's Book 4, Pg. 139-149. MK Publishers. 		

Sub-topic 2: Genetics and Monohybrid Inheritance

Duration: 5 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
<p>The learner should be able to:</p> <ol style="list-style-type: none"> define genetics. define the common terms used in genetics explain Mendel's Monohybrid ratio. work out Mendel's Monohybrid ratio. (Use crosses NOT Punnett square). explain the mechanism of heredity. explain the terms dominance, recessive, homozygous, heterozygous, phenotype and genotype, hybrid, test cross. 	<p>Learners develop an activity using coloured beads to show monohybrid inheritance and show the working for a monohybrid cross in plants and animals.</p> <p>Observe traits of classmates, take records in a data table and make a bar graph to show common traits in the group.</p>	<p>Task learners to develop a game to show monohybrid inheritance</p>
<p>References</p> <ol style="list-style-type: none"> Fullick, A., Omoding, S., and Matovu D. (2007). New Biology Students' Book, S.3 & S.4, Pg. 173-180. Pearson, Longman. Hayward, G. (2000). Secondary Biology. Pg. 407-412. Macmillan Publishers. Mackean, D. G. (1984). Introduction to Biology. Third Tropical Edition;Pg.192 -196;London,John Murray. Olong, S.J. et al (2013). Secondary Biology Student's Book 4, Pg. 150-156. MK Publishers. 		

Sub-topic 1: Co-dominance and Incomplete Dominance

Duration: 2 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
The learner should be able to: a. define with examples co-dominance (blood group AB, roan colour in cattle) and incomplete dominance (pink coloured flowers). b. explain the role/importance of heredity in producing the desired varieties of plants and animals.	Learners observe pictures of organisms that show co-dominance and incomplete dominance, with the teacher's guidance they formulate their own understanding of the two terms.	Learners create a poem on genetically modified food.
References <ol style="list-style-type: none"> 1. Fullick, A., Omoding S., &Matovu D. (2007) New Biology students' book S.3 & S.4, Pg. 173-180, Pearson Longman. 2. Hayward, G. (2000) Secondary Biology, Pg. 407-412. Macmillan publishers. 3. Mackean, D . G. (1984) Introduction to Biology Third tropical edition, Pg. 192 –196, John Murray London. 4. Olong, S.J et al (2013). Secondary Biology Student's Book 4, Pg. 150-156. MK Publishers. 		

Sub-topic 3: Sex Determination and Hereditary Diseases

Duration: 3 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
The learner should be able to: a. name the types of chromosomes in the sex cells (gametes) of	Learners in groups, research, discuss and explain sex determination and sex linkage using relevant	Guide learners to write a research report on common genetic/chromosomal disorders in Uganda

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
males and females. b. demonstrate sex determination in humans. c. define giving examples sex linkage in man. d. illustrate sex linkage in man (colour-blindness, haemophilia, baldness). e. describe the named heredity diseases/conditions (sickle anaemia, albinism).	examples	
References <ol style="list-style-type: none"> 1. Fullick, A., Omoding, S., &Matovu, D. (2007). New Biology Students' Book S.3 & S.4, Pg. 181-190, Pearson, Longman. 2. Hayward, G. (2000). Secondary Biology, Pg. 415-416. Macmillan Publishers. 3. Mackean, D. G. (1984). Introduction to Biology. Third Tropical Edition, Pg. 188–190. London,John Murray. 4. Olong, S.J. et al (2013). Secondary Biology Student's Book 4, Pg. 166-173. MK Publishers. 		

Sub-topic 4: Mutation, Variation and Evolution

Duration: 3 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
The learner should be able to: a. define the term variation. b. link types of variation	Learners visit a homestead that keeps livestock; they observe one species of animals (e.g. chicken only) looking for any similarities	Learners act out a drama skit on the theme: "survival for

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
with appropriate examples. c. mention the causes of variation. d. define evolution. e. explain natural selection and state the factors that favour its occurrence.	or differences in their external appearance. Learners record their observations and give explanations for the variations.	the fittest” (The message should be based on scientific facts)
References <ol style="list-style-type: none"> 1. Fullick, A., Omoding, S., and Matovu, D. (2007). New Biology Students’ Book S.3 & S.4, Pg. 195-206, Pearson, Longman. 2. Hayward, G. (2000). Secondary Biology. Pg. 421-2, 432-437. Macmillan Publishers. 3. Mackean, D. G. (1984). Introduction to Biology. Third Tropical Edition;Pg.197, 201–207.London,John Murray. 4. Olong, S.J.et al (2013). Secondary Biology Student’s Book 4, Pg. 179-193. MK Publishers. 		

Topic 12: Inter-Relationships

Duration: 15Hours

Competency

By the end of the topic the learner should be able to understand how living organisms relate to one another and how human activities affect the environment.

Sub-topic 1: Introduction to Ecology

Duration: 3 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
<p>The learner should be able to:</p> <ol style="list-style-type: none"> define ecology/interrelationships. definegiving examples from their experience the terms; population, producer, consumer, decomposer, community, habitat, niche, prey, predator, carrying capacity and ecosystem. state the different types of ecosystems. 	<p>In groups, look at a map showing the main physical features of East Africa and identify at least five ecosystems, stating their distinguishing features.</p>	<p>Learners study a given ecosystem and classify the organisms in it as living or non-living and describe how they relate with each other.</p>

Sub-topic 2: Food Chains and Food Webs

Duration: 3 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
<p>The learner should be able to:</p> <ol style="list-style-type: none"> define the terms a food chain and food web. 	<ol style="list-style-type: none"> Take learners on a field visit and <ul style="list-style-type: none"> Observe the organisms in a 	<p>Learners design a schematic diagram of a freshwater</p>

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
b. illustrate using examples a food chain and food web. c. state the various trophic levels in a food chain. d. construct and describe a pyramid of numbers.	habitat in or around their school. <ul style="list-style-type: none"> • Note which organism eats what. • Develop food chains and a food web. • Identify the trophic levels of the organisms observed. ii) Learners are provided with data showing numbers of organisms found in a grass land ecosystem. <ul style="list-style-type: none"> • Categorize the organisms under producers, primary consumers and secondary consumers. • Calculate the sum of organisms under each trophic level • Use the numbers to construct a pyramid of numbers. • Explain the appearance of pyramid. 	pond ecosystem. Learners explain why an ecosystem will be destabilized one trophic level is disturbed.
a. state factors that enable plants and animals to colonize new areas. b. explain what succession means.	Learners carry out an activity to demonstrate secondary succession in the school compound. They record their findings, write and present a report.	
Hint <i>Pyramids of biomass and energy not necessary.</i>		

Sub-topic3: Associations in Organisms

Duration: 5 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
<p>The learner should be able to:</p> <p>a. define the following terms symbiotic/mutualism, commensalism, parasitism, saprophytism and give examples.</p> <p>b. list types of parasites.</p> <p>c. state the characteristics and adaptations of parasites.</p> <p>d. state the causes, mode of transmission, signs and symptoms and control measures of malaria, bilharzia, taeniasis and river blindness.</p>	<p>i) Learners write an 8-12 line poem about a parasitic relationship between two species. Draw a picture below the poem to show the relationship.</p> <p>ii) Learners carry out a role play to show how parasites are adapted to their mode of life.</p>	<p>Guide learners identify the misconceptions in feeding relationships</p>
<p>e. list signs of presence of tomato blight fungus</p> <p>f. explain how the tomato blight is controlled</p>	<p>Learners observe a tomato plant infected by tomato blight fungus and record the signs.</p>	
<p>References:</p> <ol style="list-style-type: none"> 1. Fullick, A., Omoding, S., &Matovu, D. (2007). New Biology Students' Book S.3 & S.4, Pg. 210-228, and 236-8. Pearson, Longman. 2. Hayward, G. (2000) Secondary Biology, Pg. 330-352. Macmillan publishers. 3. Mackean, D. G. (1984). Introduction to Biology, Pg. 208-219. Third Tropical Edition;London,John Murray. 4. Olong, S.J. et al (2013). Secondary Biology Student's Book 4, Pg. 195-214. 226-7, 228- 244. MK Publishers. 		

Sub-topic 4: Humans and Natural Environment

Duration: 4 Hours

Learning Outcomes	Suggested Teaching and Learning Activities	Sample Assessment Strategy
<p>The learner should be able to:</p> <ol style="list-style-type: none"> name the natural resources in Uganda. elaborate the human activities that adversely affect the natural environment. define pollution state the types of pollution (air, water and soil). describe the effects of pollutants on the environment. describe conservation methods for natural resources. explore the methods of pollution control. 	<ol style="list-style-type: none"> In groups, learners discuss and propose human activities that have affected the natural resources and suggest ways of conserving Uganda's natural resources. Learners observe the dumping site for garbage in the school and giving examples, categorize the garbage as follows: <ol style="list-style-type: none"> Can rot or decompose, biodegradable Cannot rot/decompose/non-biodegradable In groups, learners discuss ways in which the categories of garbage would be re-used or recycled. 	<p>Project: Learners identify three major pollutants at school or in the refugee settlement. Develop an awareness campaign including posters on how the pollutants can be re-used/recycled.</p>
<p>References</p> <ol style="list-style-type: none"> Fullick, A., Omoding, S., and Matovu, D. (2007). New Biology Students' Book S.3 & S.4, Pg. 244-250, 236-8 Pearson, Longman. Hayward, G. (2000). Secondary Biology, Pg. 385-397. Macmillan publishers. Olong, S.J.et al (2013). Secondary Biology Student's Book 4, Pg. 246-257. MK Publishers. 		



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