



South Sudan



Secondary Biology 2

Teacher's Guide



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South Sudan

SECONDARY
2

Biology

Teacher's Guide Book 2



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Book organisation

This teacher's guide is organised into two main sections.

Part 1 is the general introduction section detailing information on competence-based curriculum and pedagogical issues.

The main elements of Part are:

- **Background information** to the new curriculum - It gives a brief overview of the general requirements of the new South Sudan competence-based curriculum including the guiding principles, the competences the learners are expected to acquire and cross cutting issues to be addressed during learning.
- **Basic requirements for an effective Biology lesson** - It highlights the teacher's and learner's roles for effective teaching and learning of Biology, teaching and learning resources and grouping learners for learning and teaching methods.

Part 2 provides a unit -to - unit guide to the teacher on how to facilitate learners to acquire the knowledge, skills and attitudes envisaged in each unit. This part is therefore structured into units.

The main elements of each unit guide are:

- **Unit heading**
- **Learning outcome**
- **Contribution to learner's competencies:** The section explains how the unit will facilitate the learner to acquire the specified competencies.
- **Cross cutting issues to be addressed:** The section outlines the specific cross cutting issues that will be addresses through infusion as the learners do activities and interact with concepts planned for the unit This is meant to make you conscious and be on the lookout for suitable opportunities throughout the teaching and learning process in the entire unit to address the cited cross cutting issues. Note that a unit may not necessarily

address all the cross cutting issues outlined in the curriculum.

- **Teaching methodologies**

The section lists down the main teaching and learning methods that the teacher can employ in the unit.

- **Background information**

This section outlines key knowledge, skills, attitudes and values that learners need to have acquired earlier that will facilitate easier acquisition of the new knowledge, skills, attitudes and values envisaged in the unit. It also guides the teacher on how to find out that the learners possess them before they start learning the concepts in the unit, and how to help learners in case they do not possess them.

- **Suggested teaching and learning activities**

This section provides you with guidance on how to facilitate learners to learn by doing the activities outlined in the learner's book. It also guides you on how to assess the process of learning.

Background information on the new curriculum

The aim of the South Sudan Competence-based Curriculum is to develop in the learners competencies that will enable them interact with the environment in more practical ways.

It clearly defines the knowledge, skills and attitudes that the learner should acquire by doing the specified learning activities.

Learning competences to be attained

Competencies are statements of characteristics that learners should demonstrate, which indicate they have the ability to do something to the required level of performance.

Competencies to be incorporated:

1. Critical and creative thinking

Biology lessons and activities facilitate learners to acquire these competencies by giving them opportunities to:

- Plan and carry out investigations, using a range of sources to find information.

- Sort and analyse information and come to conclusions.
- Suggest and develop solutions to problems, using their imaginations to create new approaches.
- Evaluate different suggested solutions.

2. Communication

Biology lessons and activities facilitate learners to acquire these competencies by giving them opportunities to:

- Read and comprehend critically a variety of types and forms of texts during research activities.
- Write reports on scientific investigations and activities.
- Speak clearly and communicate ideas and Biology related information coherently.
- Listen and comprehend scientific facts presented by fellow classmates, group members, teachers and resources persons.
- Use a range of media, technologies and languages to communicate messages, ideas and opinions.

3. Cooperation

Biology lessons and activities facilitate learners to acquire these competencies by giving them opportunities to:

- Work collaboratively towards common objectives when doing activities.
- Be tolerant of others and respectful of differing views, when working together in groups.
- Adapt behaviour to suit different situations.
- Negotiate, respect others' rights and responsibilities and use strategies to resolve disputes and conflicts.
- Contribute to environmental sustainability.

4. Culture and heritage

Biology lessons and activities facilitate learners to acquire these competencies by allowing them to:

- Take pride in identifying the diverse nature of the South Sudan society.
- Build understanding of the South Sudan heritage in relation to the rest of the world.

- Appreciate and contribute to the development of the South Sudan culture
- Value diversity and respect people of different races, religion, communities, cultures and those with disabilities.

Cross-cutting issues to be addressed during learning

These are issues that are of high national priority and hence have been incorporated in the learning process. The three cross-cutting issues should be addressed through the teaching and learning process are:

1. Environment and sustainability

A well-conserved environment is obviously key to our health and survival. It is therefore important for you to make use of the opportunities that arise in the process of teaching and learning Biology through activities to sensitise learners on the importance of conserving the environment. One way is by ensuring that the learners always dispose off the waste materials at the end of an activity in ways that do not pollute the environment.

1. Peace education

Peace is critical for a society to flourish and for every individual to focus on personal and national development.

You need to be in the fore front in educating your learners on the need for peace, for example by encouraging group work in the learners activities and showing them ways of solving interpersonal problems peacefully that occasionally arise during interactions and discussions.

1. Life skills

Learners need to progressively acquire some skills, abilities and behaviors that will help them to effectively deal with the events and challenges of every day life. Such skills include First Aid, communication skills, conflict resolution, basic ICT skills among others. You should as much as possible facilitate the learners to acquire these skills whenever an opportunity arises in the lesson execution.

Teacher's role and basic skills for effective Biology lesson

The teacher is the most important resource for an effective Biology lesson.

Some key roles of a Biology teacher

- Organising the classroom to create a suitable learning environment.
- Preparing appropriate materials for learning activities.
- Engaging learners in a variety of learning activities.

- Encouraging and accepting learners' autonomy and initiative.
- Allowing learners' responses to drive lessons and shift instructional strategies.
- Familiarising themselves with learners' understanding of concepts before sharing their own understanding of those concepts.
- Encouraging learners to engage in dialogue, both with you and one another.
- Engaging learners in experiences that pose contradictions to their initial hypotheses and then encouraging discussions.
- Providing time for learners to construct relationships and create metaphors.
- Using a variety of teaching and assessment methods.
- Adjusting instructions to the level of the learners.
- Nurturing learners' natural curiosity.
- Motivating learners to make them ready for learning.
- Coordinate learners' activities so that the desired outcomes can be achieved.
- Assessing learners' activities and suggest solutions to their problems.
- Assist learners to consolidate their activities by summarising the key points learnt.

(b) Key skills of a Biology teacher:

- Creativity and innovation.
- Makes connections or relations with other subjects.
- A high level of knowledge of the content.
- Effective disciplining skills to adequately manage the classroom.
- Good communicator.
- Guidance and counselling.

Learners' role in learning Biology

Learning takes place only when the learner acquires the intended knowledge, skills and attitudes. As such, learning is a highly personal and individual process. Thus, a learner must be actively engaged in the learning exercise.

For active participation in learning, the learner should:

- Raise questions about what is observed.
- Suggest solutions to the problems observed.
- Take part in planning investigations with appropriate controls to answer

specific questions.

- Carry out investigations to search for answers with the help of materials in search of patterns and relationships while looking for solutions to problems.
- Working collaboratively with others, communicating their own ideas and considering others' ideas.
- Expressing themselves using appropriate Biology terms and representations in writing and talk.
- Engaging in lively public discussions in defense of their work and explanations.
- Applying their learning in real-life contexts.
- Reflecting critically about the processes and outcomes of their inquiries.

Teaching and learning resources

These refer to things that the teacher requires during the teaching process. They include:

- The classroom
- Textbooks
- Wall charts and wall maps
- Materials and apparatus
- Various tools and equipment
- Biology models
- Resource persons
- Firms such as hydroelectric power stations, engineering firms among others

(a) Classroom as a learning environment

A classroom generally refers to the place where learning takes place. Learners learn from everything that happens around them, such as the things that they hear, see, touch, taste, smell and manipulate.

Classroom organization

It is important you make the classroom an attractive and stimulating environment. This can be done by:

- Carefully arranging the furniture in the classroom in an organised way to allow free movement of learners and you.

- Putting up learning and teaching aids on the walls. Examples are wall charts, pictures and photographs.
- Displaying teaching models.
- Providing objects of examination for example cover slides.
- Having a display corner in the classroom where learners display their work.
- Setting a corner for storing materials so as not to obstruct learners or distract them.
- Spreading out the learners evenly so that they do not interfere with one another's activities.
- Setting up the materials or experiments for the series of lessons or activities going on for a number of days or weeks in a location where they do not interfere with other daily activities.
- Organising the sitting arrangement such that learners face the lighted areas of the room.
- Choosing the most appropriate location for you and the chalkboard such that they are visible to all learners and that you have a good view of all learners in the class.

b) Apparatus and materials

For learners to study Biology through the activity method, a number of materials and apparatus are required. The important role played by materials in learning has been felt for centuries. This is noted for instance in the old Chinese proverb that says:

When I hear, I forget,

When I see, I remember.

When I do I understand.

Since Biology is a highly practical subject, materials help you to convey your points, information or develop skills simply and clearly and to achieve desired results much faster.

Some of the materials that you require for activities and investigations can be collected from the local environment.

Many others can be improvised while some have to be purchased. Whether collected, improvised or purchased, there are certain materials that are valuable to have around almost all the time.

These include:

i) Biology kit

A Biology kit is a special box containing materials, apparatus and equipment necessary to conduct an array of experiments. The content of the kit depends on the curriculum requirements per level. Most Biology kits are commercially available and target particular levels of learners. However, you are encouraged to come up with a kit based on the syllabus requirements.

ii) Models

A model refers to a three-dimensional representation of an object and is usually much smaller than the object. Several models are available commercially in shops. Examples of Biology models include models of body parts, animals among others. These models can be purchased by schools for use during Biology activities.

iii) Resource persons

A resource person refers to anybody with better knowledge on a given field. Examples include health practitioners such as doctors, nurses and laboratory technologists, agricultural extension officers, environmental specialists among others. Depending on the topic under discussion organise to invite a resource person in that area to talk to learners about the topic. The learners should be encouraged to ask as many questions as possible to help clarify areas where they have problems on.

iv) Improvisation

If each learner is to have a chance of experimenting, cheap resources must be made available. Complicated apparatus may not always be available in most schools. Such sophisticated equipment made by commercial manufacturers are usually expensive and majority of schools cannot afford them. You are therefore advised to improvise using locally available materials as much as possible.

vi) Scheduling learning activities and venues

Some of the activities suggested in the learner's book need good planning and scheduling in order to get accurate results. The teacher should therefore think ahead while making the scheme of work so that the prevailing weather pattern and the most appropriate timing are considered.

Grouping learners for learning activities

Most of the Biology activities suggested in the Learner's book are carried out in groups and therefore the teacher should place 2 or 3 desks against each other and then have a group of learners sitting around those desks.

In certain activities, the teacher may wish to carry out a demonstration. In this case, the learners should be sitting or standing in a semicircle, or arranged

around an empty shape of letter “U” such that each learner can see what you are doing clearly and without obstruction or pushing. If the learners are involved in individual work, each learner can work on the floor or on the desk or a portion of the desk if they are sharing. In this case, they need not face each other.

Grouping learners for learning has increasingly become popular in recent years. In fact, the shift from knowledge-based to competence curriculum will make grouping the norm in the teaching process.

Learning grouping can be formed based one or a number of the following considerations:

- Similar ability grouping.
- Mixed ability grouping.
- Similar interests grouping.
- Common needs grouping.
- Friendship grouping.
- Sex-based grouping.

Grouping learners in a Biology class has several advantages. They include:

- The individual learner’s progress and needs can easily be observed.
- The teacher-learner relationship is enhanced.
- A teacher can easily attend to the needs and problems of a small group.

Materials that were inadequate for individual work can now be easily shared.

- Learners can learn from one another.
- Cooperation among learners can easily be developed.
- Many learners accept correction from the teacher more readily and without feeling humiliated when they are in a small group rather than the whole class.
- Learners’ creativity, responsibility and leadership skills can easily be developed.
- Learners can work at their own pace.

The type of “grouping” that a teacher may choose may be dictated by:

- The topic or task to be tackled.
- The materials available.
- Ability of learners in the class (fast, average, slow).

Class size

There is no method or approach to teaching that is appropriate to all lessons. A teacher should, therefore, choose wisely the method to use or a combination of methods depending on the nature of the topic or subtopic at hand.

Teaching methods

There are a variety of possible methods in which a teacher can help the learners to learn. These include:

- a) Direct exposition
- b) Discovery or practical activity
- c) Group, class or pair discussion
- d) Project method
- e) Educational visit or field trips
- f) Teacher demonstration
- g) Experimentation or research

The particular technique that you may choose to use is influenced by several factors such as the:

- Particular group of learners in the class.
- Skills, attitudes and knowledge to be learned.
- Learning and teaching aids available.
- Local environment.
- Teacher's personal preference
- Prevailing weather condition.
- Requirements of Biology syllabus

(a) Direct exposition

This is the traditional way of teaching whereby the teacher explains something while the learners listen. After the teacher has finished, the learners may ask questions. However, in a competence-based curriculum, this technique should be used very minimally.

(b) Guided Discovery

In this technique, encourage learners to find out answers to problems by themselves. You do this by:

- Giving learners specific tasks to do.

- Giving learners materials to work with.
- Asking structured

or guided questions that lead learners to the desired outcome. Sometimes learners are given a problem to solve and then left to work in an open-ended manner until they find out for themselves.

This is the most preferred method of teaching in the implementation of Competency- Based curriculum.

(c) Group or class discussion or pair work

In this technique, you and learners interact through question and answer sessions most of the time. Carefully select your questions so that learners are prompted to think and express their ideas freely, but along a desired line of thought. The method leads learners from the known to unknown in a logical sequence; and works well with small groups. The method boosts confidence in learners and improves interpersonal and communication skills.

The main disadvantage of this method is that some learners maybe shy or afraid to air their opinions freely in front of you or their peers. It may give them more confident learners a chance to dominate the others.

(d) Project method

In this approach, you organize and guide a group of learners or the whole class to undertake a comprehensive study of something in real life over a period of time such as a week or several weeks.

Learners using the project method of studying encounter real life problems, which cannot be realistically brought into a normal classroom situation. A project captures learners' enthusiasm, stimulates their initiative and encourages independent enquiry. If you are using the project method, ensure that the learners understand the problem to be solved and then provide them with the necessary materials and guidance to enable them carry out the study.

The main disadvantage of this method is that if a project is not closely supervised, learners easily get distracted and therefore lose track of the main objective of their study. Studying by the project method does not work well with learners who have little or no initiative.

(e) Educational visits and trips/nature walks

This is a lesson conducted outside the school compound during which you and the learners visit a place relevant to their unit of study. An educational visit/ or nature walk enables learners to view their surroundings with a broader outlook that cannot be acquired in a classroom setting. It also allows them

to learn practically through first- hand experience. In all “educational visit or nature walk lessons”, learners are likely to be highly motivated and you should exploit this in ensuring effective learning. However, educational visits are time consuming and require a lot of prior preparation for them to succeed. They can also be expensive to undertake especially when learners have to travel far from the school.

(f) Demonstration lessons

In a demonstration, you or a laboratory technician show the learners an experiment, an activity or a procedure to be followed when investigating or explaining a particular problem. The learners gather around you where each learner can observe what you are doing. It is necessary to involve the learners in a demonstration, for example by:

- Asking a few learners to assist you in setting up the activity.
- Requesting them to make observations.
- Asking them questions as you progress with the demonstration.

This will help to prevent the demonstration from becoming too teacher-centred.

When is a demonstration necessary?

You may have to use a demonstration, for example when:

- The experiment or procedure is too advanced for learners to perform.
- The experiment or procedure is dangerous.
- The apparatus and materials involved are delicate for learners to handle.

Refer to learner's book page 1 to 23

Learn about	Key inquiry questions
<p>Learners should understand the process of photosynthesis, the different stages of photosynthetic reactions, the chemical equations and know the products and by-products, and the factors affecting the rate of photosynthesis. They should understand the equation for photosynthesis.</p> <p>Learners should investigate the anatomy (internal) structure of plant leaves and know leaf adaptations for photosynthesis and the structure and functions of the stem and root systems. They should investigate the role of stomata in getting rid of water vapour and exchange of gases, and how plants get rid of other waste products.</p> <p>They should test for the presence of starch in leaves and design experiment to investigate limiting factors including carbon dioxide, water and light and whether chlorophyll is necessary.</p> <p>They should understand about trace and macro elements and, and the essential elements and their roles in plants, as well as effects of their deficiency.</p>	<ul style="list-style-type: none"> • How is photosynthesis important to plants? • How would you describe the stages of photosynthetic reactions? • Why photosynthesis must occur only under specific conditions? • How is the rate of photosynthesis affected by limiting factors? • How do the products of photosynthesis contribute to the environment and agriculture? • How would you investigate whether carbon dioxide is necessary or needed during the process of photosynthesis? • How would you test for the presence of starch in the leaf? • How would you design an experiment to investigate whether oxygen is produced during photosynthesis?

Learning outcomes		
Knowledge and understanding	Skills	Attitudes
<ul style="list-style-type: none"> Understand photosynthesis and plant nutrition, the importance of photosynthesis to all living things 	<ul style="list-style-type: none"> Carry out investigations to find out about the factors that limit photosynthesis Design simple experiment to test for the presence of starch in the leaf Investigate whether chlorophyll is necessary for the process of photosynthesis to occur 	<ul style="list-style-type: none"> Appreciate the process of photosynthesis and how it forms part of a cycle Value the role of green plants in nature and its contribution to agriculture and food production
<p>Contribution to the competencies:</p> <p>Critical thinking: students will be inspired to think critically how the process of photosynthesis is accomplished: using inorganic chemicals and photons from the sun to build organic compounds</p> <p>Co-operation and communication: working in groups</p>		
<p>Links to other subjects:</p> <p>Chemistry: equations using elemental symbols O_2, CO_2, H_2O etc.</p> <p>Physics: use of energy in form of photons</p> <p>Environment and sustainability: photosynthesis</p>		

Assessment opportunity

Opportunities for all three forms of assessment are indicated for each of the activities.

- Observation
- Conversation
- Product

Learning outline

This unit is about photosynthesis and plant nutrition. Remember learners at this level have learnt about the cell. Take advantage of this and link what they learn to what they are about to learn which is photosynthesis and plant nutrition. The concept in this unit is to enable learners to know the importance photosynthesis, importance of plant nutrition and also to be able to relate plant nutrition to animal nutrition.

Let learners understand that when they continue and further their education in this area, they may become botanists, nutritionists, and also environmentalists. Give an example of a well established professional in one of the field related to this topic to motivate learners more.

Using the student textbook

Text and pictures have been used extensively in the Student's Book. Read the text with your learners and guide your learners in studying the pictures as a way of monitoring and ensuring your learners are developing their reading skills and picture interpretation skills. That way you will be 'modelling' reading and will help their development in the two areas mentioned above.

Learners should be encouraged to read along with you or copy you where phrases are more complex. Alternatively, you can group learners around fast and fluent learners who can read and pronounce the words correctly in order to help slow learners learn the right pace to read text with and how to pronounce words correctly. This will also ensure that you control the pace with which fast learners are reading the text with as a way of ensuring slow learners move along well during the lessons.

It is helpful to have some key words on flashcards around the learning space if possible so that learners can familiarise themselves with them and their spellings as well. Learners could develop this collection as they progress through the other units in Student's Book.

The student competencies

This unit presents many opportunities for:

1. Co-operation

Encourage learners to work as a team through group discussions. Allow learners to freely interact with one another. Let them associate with one's culture and abilities through resources sharing and exchange of ideas. The principle of co-operation should be listening to understand but not listening to respond. All learners to be given equal opportunities irrespective of their abilities. Ensure every learner enjoys the sense of work regardless of their skin colour or physical fitness.

2. Communication

During group discussion, encourage learners to discuss in English. This way will build on the command for the language as well as ability to participate in other discussions. Ask them questions and give them a chance to attempt answering in the simplest way possible. This way, they will build on their confidence and soon develop the love and passion for the subject. Allow some room for learners to make mistakes and then correct them in nice way lest they will feel demoralized.

3. Critical and creative thinking

Introduce the unit by posing general questions to the learners they try to look for the answers to these questions, you will make them develop a thinking culture as they try to relate the unit with the questions given to them. These questions should however trigger the idea of what they should expect from the unit. Present photographs and make learners discuss the activities in those photograph, they give out their findings, and you will be building a thinking habit in them.

4. Culture and identity

Make learners to research on ways in which they can use the knowledge acquired from the unit in improving the living conditions of their communities. The greatness of a nation lays in the ability of its people to integrate skills and knowledge with national development and growth. Learners should know that knowledge and culture are mutually inclusive.

Cross cutting issues

1. Environmental awareness and sustainability

Learners should be encouraged to plant more trees. Learners should not uproot the whole plant in case they need part of a plant for the practical. Encourage learners to apply knowledge acquired about photosynthesis and essential elements should be used in real life situation.

1.1 Photosynthesis

Refer to learner's book page 2

Activity 1.1 Testing starch

This activity involves reviewing what learners learnt in the previous lessons. Give learners time to read the procedure required in testing research and also to identify the apparatus required for the experiment. This will allow learners to familiarise more with the experiment. Group learners based on their abilities (slow learners and gifted learners). Ask learners various questions while they do experiment to test their understanding. Each and every learner to participate during the activity. Learners to write a report on the starch test on leaves adequately describing the method(s) and likely outcome of the test for green leaves.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they able to do the activity correctly?

Conversation

Talk to learners as they are discussing study questions. Are they able to give facts during discussion?

Product

Are learners able to answer study questions correctly?

Activity 1.2: Is light needed for photosynthesis?

Refer to learner's book page 4

The lesson involves both inside class discussion and also making observation outside the class. You will engage learners in the general observation of a growing plant

under normal conditions. Learners will be required to take notes of the observable features in normal plant. Learners in-group to report their observation.

Introduce the unit by reminding learners of what they learnt in senior one about plant cell. Try and bring out the relation on plant cell to what you are about to teach. Ask learners to identify the plants that human feeds on and others that are fed on by animals. This is to enable them appreciate the importance of plants to animals. Ask the learners to form group of four and organize them to collect all plant materials within the immediate environment. Let them come up with conditions necessary for photosynthesis to occur in plants. With the plants collected and the materials provided, give learners time to carry out activity 1.1 of learner's book.

Encourage each member of group to participate in practical activity. This nature's teamwork. Let the learners write the summary of the practical as they do study questions of learners book. Learners to use the observation from experiment/ activities to answer the question in learner's book. Explain its details by giving products of each stage. Refer to learner's book for guidance.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they following the correct procedure?

Conversation

Talk to learners as they are discussing study questions. Are they able to give facts during discussion?

Product

Are learners able to answer study questions correctly?

Activity 1.3: Is carbon dioxide needed for photosynthesis?

Refer to learner's book page 5

This lesson involves practical work. As a teacher it is your role to make sure all the materials required for the practical are available.

Allow learners to do practical with the materials provided. Follow keenly as they do the activity. Remember that learners are allowed to make mistakes, mistakes are part of learning. Let them do the study question as you explain details of the practical by referring to learner's book.

To further test their understanding on this topic, ask learners to imagine that they are leaves applying for a job in photosynthesis company. Learners should create their “resume”, explaining their job qualifications and describing how they will efficiently get the job done. While checking their work ensure that the resume has descriptions with key vocabulary such as stomata, water, carbon dioxide, light, energy, chlorophyll and chloroplast.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they coming up with the correct steps?

Conversation

Talk to learners as they are discussing study questions. Are they able to give facts during discussion?

Product

Check if learners are able to answer study questions correctly.

Activity 1.4: To determine whether chlorophyll is necessary for photosynthesis

Refer to learner’s book page 6

This is a discussion lesson that involves practical activity and assessment of learning outcomes. The learners have to be provided with reference materials to support the teaching method. Provide the materials for activity 1.3 in learner’s book. Learners to organize themselves in pairs and do the practical activity with the materials provided. Follow keenly as they do the activity. Encourage each member of group to participate in practical activity. This nature’s team work. Let the learners write the summary of the practical. Learners to use the observation from experiment/ activities to answer the study question of learner’s book.

Remember that learners are allowed to make mistakes, mistakes are part of learning. Explain details of the practical by referring to learner’s book.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they coming up with the correct steps?

Conversation

Talk to learners as they are discussing study questions. Are they able to give facts during discussion?

Product

Are learners able to answer study questions correctly?

1.2 Importance of photosynthesis

Activity 1.5: Importance of photosynthesis

Refer to learner's book page 8

The lesson should help learner to appreciate the importance of plant nutrition to animals and surrounding. This activity is about debate and advertisement through creation of posters by learners. As a teacher role-play the judge, choose the opposers, proposers and speaker. Let each side to choose their debaters. Allow them to draft their main points that they will use in debating. Learners can do this by designing different posters for their points. As the judge, let your judgment be based on the strong points. Correct learners after debating by giving facts about importance of photosynthesis by referring to learner's book.

Assessment opportunities

Observation

Listen to learners as they debate.

Conversation

Talk to learners as you give direction on what to do since you will be chairing the debate?

Product

Are debaters points aligned with the motion?

Answers to check your progress 1.1

Refer to learner's book page 8

1. Dark stage occurs in stroma whereas light stage occurs in grana. Refer to learners book page 2 for the diagram
2. This is to be presented as an essay. Refer to learner's book page 6 for details.

3. This can be presented in an essay way or by the use of food webs and food chains.
4. Count if the words are less than a hundred and check on the main points.

1.3 Leaf as an organ for photosynthesis

Activity 1.6 Observing the transverse section of a leaf

Refer to learner's book page 9

The lesson involves practical activity. You will engage learners in hands on activities and analysis. You are therefore required to provide all materials in advance for practical. The class is to be organised in groups for the teaching method suggested.

You may ask learners general questions about the leaf. Organise the learners to groups and provide learners with materials required for the practical activity. Learners to carry out investigations by following steps on learners book. Let the learners observe the results and make inferences on the results. Let the learners answer the few study questions given after the activity.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they able to do the activity?

Conversation

Talk to learners as they are discussing study questions. Are they able to give facts during discussion?

Product

Are learners able to answer study questions correctly?

Activity 1.7 Identification of external and internal features of plant leaves for adaptation to photosynthesis

Refer to learner's book page 11

It is a practical lesson that will involve practical hands on activities. Learners are therefore required to collect materials for study. Engage learners in observation of plant materials (leaves) in groups. This will stimulate learning.

Introduce lesson by asking general questions about the leaf. Provide all the material for activity. Ensure both girls and boys are involved. Learners to be guided on use

of microscope e.g. low power and high power objective lens. Guided the learners in identifying different layers of cells in a leaf and their role in photosynthesis. Learners also observe external features of a leaf and relate them to photosynthesis. Let the learner draw and label the features. You should consolidate the major points as a summary to the activity

Assessment opportunities

Observation

Observe learners as they do the activity. Are they able to do the activity?

Conversation

Talk to learners as they are discussing study questions. Are they able to give facts during discussion?

Product

Check on study questions attempted learners. Did they answer them correctly?

Answers to check your progress 1.2

Refer to learner's book page 12

1. True, false, true, false
2. Refer to learners book page 9
3.
 - Leaves have broad lamina and are flat in shape to present a larger surface area to facilitate faster absorption of carbon dioxide.
 - To prevent excessive loss of water by transpiration and also allows light to pass through and reach photosynthetic cells.
 - To receive maximum sunlight for the process of photosynthesis.

1.4 Factors affecting rate of photosynthesis

Refer to learner's book page 13

Activity 1.8: What is the relation of light intensity to the rate of photosynthesis?

This is practical lesson involving apparatus and live plants obtained from water. Learners to be involved in collection of water plants to enable them understand

the habitat for the plants to be collected.

Introduce the lesson by asking learners why the water plant is used in activity and not terrestrial plant. Learners organized in working groups of six with gender taken into account in-group formation. Learners to set up the experiment from the materials provided. Learners provided with learning materials and worksheet to record and answer question related to the outcome of activities.

Remind learners that making mistakes is part of learning and therefore they should not fear making mistakes. Allow learners to ask questions for clarification as you summarise on main points. Refer to learner's book for further clarification.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they coming up with the correct steps?

Conversation

Talk to learners as they are doing the activity. Ask some questions that are not part of the study questions?

Product

Are learners able to answer study questions correctly?

Activity 9: Do carbon dioxide concentration has effects on the rate of photosynthesis?

Refer to learner's book page 15

This is practical lesson involving apparatus and live plants obtained from water.

Learners to be involved in collection of water plants to enable them understand the habitat for the plants to be collected.

Learners to organize themselves in working groups of 4 with gender taken into account in group formation. Learners provided with learning materials and worksheet to record and answer question related to the outcome of activities. Learners to be guided on setting up of experiment by following steps indicated on learners book. Learners to answer questions on the observation made at each level until final step. As a teacher, give a summary of main points using learners book as learners take notes.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they coming up with the correct steps?

Conversation

Talk to learners as they are discussing study questions. Are they able to give facts during discussion?

Product

Are learners able to answer study questions correctly?

1.5 Essential elements

Activity 1.10: Essential elements

Refer to learner's book page 16

This activity involves fieldwork. Do a pre-visit to the farm before the actual fieldwork day, this is mainly to familiarise with the area and the resource person. Also seek permission from the right authority in advance before the actual day of study. Learners to prepare early and also to be equipped with the learning materials that they will need for the study. Encourage learners to fully utilize the resource person during the trip by asking questions and also taking part in demonstration where they will be required to do so. Learners to do further research after the field trip.

Assessment opportunities

Observation

Listen to the conversation about the essential elements to see if learners are relevant.

Conversation

Ask learners about essential elements that they know of.

Product

Are learners able to name different essential elements?

Activity 1.11: Role of phosphorus in plants

This activity is all about designing adverts. Provide all the materials required for this activity in advance. As a teacher you are required to award marks based on the design and also the correct information on the adverts. Encourage learners to design more adverts of that type at their free time.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they coming up with the correct adverts?

Conversation

Talk to learners as they are doing the activity.

Product

Does the designed advert have the required information? What about the design outlook?

Activity 1.12: Magnesium

This activity is about the learner role-playing a radio presenter. It tests learner's confidence and creativity. Provide all the materials needed for this activity and the platform where this activity will be performed. Chair their presentation and award marks based on the points given, creativity and design.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they able to do a presentation?

Conversation

Talk to learners as they are doing the activity. Inform them on what you expect.

Product

Are learners able to convey the right information from their presentation?

Activity 1.13: What are macronutrients in plants?

Refer to learner's book page 17

Just before learners start doing their presentation. Give them a brief explanation of what macronutrients are and also what you expect from the activity. Provide all the materials needed for this activity and the platform where this activity will be performed. Chair their presentation and award marks based on the points given, creativity and design.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they able to present?

Conversation

Talk to learners as they are doing the activity. Inform them on what you expect.

Product

Are learners able to convey the right information from their presentation?

Answers to check your progress 1.3

Refer to learner's book page 22

1. Learners to create a table and fill it. Refer to learners book from page 17 to 21 for correct points.
2. a) Nitrogen b) Phosphorus
3. I will check if the leaves are yellow green or pale green, if there is early leaf fall and also if there are die back.
4. Refer to learner's book page 19.
5. All organisms must take in matter from their environment in order to survive. There are 92 naturally occurring elements on Earth. Living things animals being one of them need only a minority of them. For example, humans require about 21 different elements to be healthy. Almost all of the mass of our bodies comes from just six of those elements (carbon, hydrogen, oxygen, nitrogen, phosphorus and calcium). These are the elements used to construct the carbohydrates, nucleic acids, proteins, and other molecules that make up our cells and carry out their chemistry. Other elements critical to our health are needed in very small amounts. Therefore knowledge acquired in learning essential elements in plants can be borrowed.

6. Plant require essential elements for growth in absence of essential elements,plants is unable to compete for normal life cycle.

7. A sample puzzle.

C	A	L	S	I	U	M	M	I	O
O		I	R	O	N	L	P	N	Z
P	O	S	P	H	O	R	U	S	J
P	Z	I	N	C	M	J	O	K	N
E	P	O	T	A	S	S	I	U	M
N	I	T	R	O	G	E	N	Q	F

UNIT
2

Nutrition in animals

Refer to learner's book page 24 to 37

Learn about	Key inquiry questions
<p>Learners should investigate in groups, using first and second hand sources, the different types of animal nutrition (holozoic, saprophytic and parasitic) as well as the adaptive features associated with particular method of feeding and adaptation mechanisms in animals of different kinds e.g. insects, birds, mammals, fishes etc.</p> <p>They should learn about holozoic organisms as the taking in of complex substances and converting them into simpler forms, and how unicellular organisms and most of the free living animals, including humans, exhibit this type of nutrition.</p> <p>Learners should understand about dentition in mammals generally and in humans specifically, and investigate through close observation and recording, the types of teeth and their use by cows, dogs, cats and/or sheep jaws and how the structure relates to their food. They should, observe and investigate the anatomy of feeding organs in insects, birds, and other mammals.</p> <p>Learners should know about the economic importance of parasites and saprophytes in relation to humans, domestic animals and plants and how changes in the availability of their food can control their activity.</p>	<ul style="list-style-type: none">• How do animals obtain food from their environments?• Why do animals have different adaptations for feeding?• How would you explain the existence of different types of nutrition in animals?• Why are parasites and saprophytes economically important?• How can a study of fossil remains help us to understand and predict the food available to eat?• How will changes in climate affect an animal population?

Learning outcomes		
Knowledge and understanding	Skills	Attitudes
<ul style="list-style-type: none"> • Understand animal nutrition • Understand how animals have adapted feeding methods to the food available and how a change in food available can change animal population 	<ul style="list-style-type: none"> • Observation and recording by drawing and annotation • Ability to investigate the anatomy of feeding organs in insects, birds and mammals in the laboratory and relate this to what they eat 	<ul style="list-style-type: none"> • Become curious about feeding methods of different groups of animals
<p>Contribution to the competencies:</p> <p>Creative and critical thinking: as they explore different anatomical features of feeding organs learners will think deeply and imaginatively about what they are learning.</p> <p>Communication: definitely as they work together and/or individually with specimen in the laboratory, asking questions, and listening to one another's views in reciprocity, communication among them is both improved and strengthened</p> <p>Co-operation: joint work during practical anatomy classes leads to creative cooperation and reflective team work</p>		
<p>Links to other subjects:</p> <p>Biology: Ecology, Agriculture and Anatomy</p> <p>Chemistry: use of chemicals for preserving specimen in laboratory, use of reagents</p>		

Assessment opportunities

Opportunities for all three forms of assessment are indicated for each of the activities.

- Observation
- Conversation
- Product

Learning outline

This unit introduces students to the concept of nutrition. It describes the feeding mechanisms of different animals and insects, how the animals are adapted to the

feeding mechanisms and also the anatomy and physiology of the human digestive system-its structure and basic components.The nutritional status animals and human beings is a concern not only for quality of life, but also for economics. From this unit the learner will be able be curious about feeding methods of different groups of animals ant through this acquire the skills of investigating the anatomy of feeding of insect, human beings and other animals.

Using the student textbook

There are both words and pictures in the textbooks, and as your learners are developing their reading skills, it is important to read the text with them. That way you will modeling reading and will help their development. Learners should be encouraged to read along with you or copy you where phrases are more complex. Phrases in the text nook are relatively short, but where there is more read, these passages should be broken down into shorter phrases. Encourage learners to ask questions to clarify their understanding and enable more able learners to respond to these questions where appropriate.

It is helpful to have some keywords on posters or boards around the learning space if possible so that they get used to seeing them and become familiar with spellings. Learners could develop this collection as they progress thought the unit.

The student competencies

This unit presents many opportunities for critical and creative thinking: interpreting pictures and giving reasons and explanations; comparing nutrition in different animals; giving reasons for adaptation for different feeding mechanism; identifying and classifying through scientific investigation.

Learners are asked to work in pairs and groups, so there are continuous opportunities for co-operation and teamwork. This unit provides good opportunities to create roles in groups so that for example there is a writer, questioner, presenter and group leader.

In their discussions and presentations in groups or as a whole class, there are many opportunities for good communication. It is important in senior three that the teacher continues to model communication clearly, describing where appropriate features of good communication such as clarity, active listening, correct use grammar and pace.

The subject matter will also deepen their understanding South Sudan culture animals that are native to South Sudan. Make learners to research on ways in which they can use the knowledge acquired from the unit in improving the living conditions of their communities. The greatness of a nation lays in the ability of its people to integrate skills and knowledge with national development and growth. Learners should know that knowledge and culture are mutually inclusive

Cross-cutting issues to be incorporated

1. Environmental sustainability

Emphasize to the learners that environment is made up of both living and nonliving organisms. Nutrition intersects with the health of individuals, communities, and the ecosystems that sustain us. Healthy food is not only defined by the quantity and quality of the food we eat, but that it must come from a food system that conserves and renews natural resources, advances social justice and animal welfare, builds community wealth, and fulfills the food and nutrition needs of all eaters now and into the future.

Learners should be given the opportunity to consider how sustainable development is the kind of development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Learners should consider this within the context of the local environment, reflecting upon benefits of protecting the environment near to where they live.

2. Peace and values of education

Throughout the unit, learners are actively involved in discussing issues as a group. Learners should be made aware of the need to accommodate everyone's ideas and opinions. Through the discussions they will at times agree or disagree on issues at hand. They should be made to embrace the views of others and treat them as a learning process. Any form of intolerance should be highly condemned.

3. Life skills

A well maintained atmosphere equals a fulfilling life. Learners should be sensitized on the need to conserve our environment. They should actively participate in activities such as: National tree planting day, National cleaning day. Learners should be made to understand the need to embrace one another regardless of their cultural background or nationality. Involve them in activities that fosters coherence, respect, gender inclusivity and patriotism

Links to other subjects

This unit provides an opportunity to develop data handling skills in mathematics including presenting data in a table. Learners are still developing their English skills so as a focus on accurate use of vocabulary should permeate through this learning.

2.1 Forms of nutrition in animals

Activity 2.1: Forms of nutrition

Refer to learner's book page 25

This unit requires learners to observe different animals within their Payam. As a teacher you are required to be equipped with knowledge about animals in different Payams within South Sudan, do research where you don't understand. Introduce this unit by guiding learners through 'brain teaser' of learners book. This will give learners a rough idea of what they are about to learn. Learners then to observe different animals within their Payams and compare form of nutrition with that of human beings. Give learners correct information based on your research and also with the help of learner's book.

Assessment opportunities

Observation

Observe learners as the do the activity. Are they able to present?

Conversation

Talk to learners as they are doing the activity. Inform them on what you expect.

Product

Are learners able to write the correct information?

Answers to check your progress 2.1

Refer to learner's book page 27

1. Is the mode of nutrition in which organisms depend upon other organisms to survive?
2. By keeping the bread in a cool and dark place, it will last longer and stay fresh. Heat, humidity and light are all bad for bread but great for fungi or mold, so consider your fridge your best bet to keep your bread fresh and yummy.
3. Parasite, saprophyte, autotrophs, symbiosis

2.2 Structure of human teeth

Activity 2.2: Structure of human teeth

Refer to learner's book page 27

This lesson requires learners to be keen observing various human being teeth. Make sure all the materials required for this practical are available. All learners irrespective of gender to participate in carrying out the activity.

Introduce the lesson reviewing what the learners learnt about human teeth in upper grades in primary. Also remind them of they learnt in the previous lesson. Now give them ample time to carry out activity as you monitor and also conversing with them. Refer to learner's book for further details.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they able to follow the procedure correctly?

Conversation

Talk to learners as they are doing the activity. Inform them on what you expect.

Product

Are learners able to answer the study questions correctly?

Activity 2.3: Investigating the structure and function of human teeth

Refer to learner's book page 29

This lesson requires learners to be keen observing various human being teeth. Make sure all the materials required for this practical are available. All learners irrespective of gender to participate in carrying out the activity.

Introduce the lesson remind them of they learnt in the previous lesson. Now give them apple time to carry out activity as you monitor and also conversing with them. Let learners attempt study questions in their exercise books, mark their book and award marks accordingly. Correct them where they went wrong by referring to the facts on learners

Assessment opportunities

Observation

Observe learners as the do the activity. Are they able to follow the procedure correctly?

Conversation

Talk to learners as they are doing the activity. Inform them on what you expect.

Product

Are learners able to answer the study questions correctly?

Answers to check your progress 2.2

Refer to learner's book page 30

1. Refer to learner's book page 26
2. Once the decay has eaten through the dentin the only thing left is the pulp, which contains numerous blood capillaries and sensory nerves.
3. To protect the inner parts of the tooth from infection by bacteria and other microorganisms. It also protects the inside of the tooth from the mechanical damage by hard food materials such as bones.

Activity 2.4: Research activity

This activity requires learners to do research. Caution them on dangerous chemicals such as hydrochloric acid. Remind them to handle them with care. Also suggest various places where they can get various materials needed for the research. Provide materials such as hydrochloric acid which learners cannot easily get. After they are done with their research, let them share their findings in class as you give explanation to their findings.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they able to come up with the correct procedure?

Conversation

Talk to learners as they are doing the activity. Inform them about dangers associated with carrying out that practical if not handled keenly.

Product

Are learners able to share correct information with other members of the class.

Answers to check your progress 2.3

Refer to learner's book page 33

1. (a) Enamel (b) Vitamin D and calcium (c) If there is a hole or a crack on the enamel.
2. Teeth mechanically breaks down food into smaller particles which can be easily digested by other parts of the digestive system.

2.3 The digestive system

Activity 2.5: Dissection of a rabbit to observe the digestive system and compare it to the human digestive system

Refer to learner's book page 33

Let the learners work in groups in the classroom to carry out the activity. Guidance should be given to enable safety of the learners and assistance to help achieve the aim of the activity.

The students will name the sequence of digestion in reference to the mouth, esophagus, stomach, small intestine, and large intestine by labeling the body parts in the order the activity was demonstrated. The student will research and report on how the body's digestive system works to break down food physically and chemically, absorb nutrients from the food, and finally eliminate indigestible material.

You will carry out the activity following the steps given in learners book. Learners to do the activity too as you will be explain. All learners to participate in doing this activity. Ask learners challenging questions at each stage to make them understand more.

Assessment opportunities

Observation

Observe learners as the do the activity. Are they able to come up with the correct procedure?

Conversation

Talk to learners as they are doing the activity. Inform them about dangers associated with carrying out that practical if not handled keenly.

Product

Do their drawings portray the expectation of the practical activity?

Activity 2.6: To study digestive system of insects

Refer to learner's book page 33

This activity involves learners observing digestive system of an insect. As a teacher guide learners in comparing human digesting system, you can do this by engaging learners through various questions based on what they can see in the picture of learners book. Clarify further referring to learner's book.

Assessment opportunities

Observation

Observe learners as the do the activity. Are they able to come up with the correct procedure?

Conversation

Talk to learners as they are doing the activity.

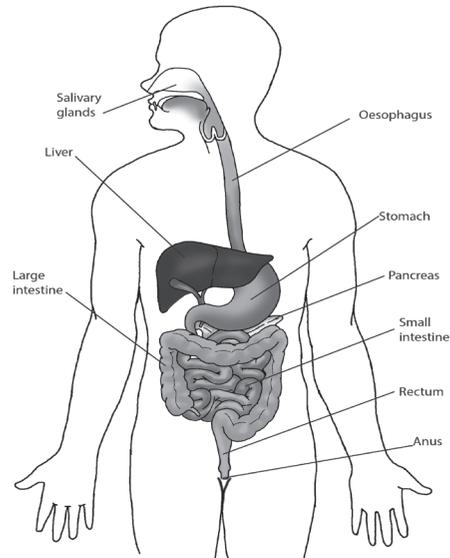
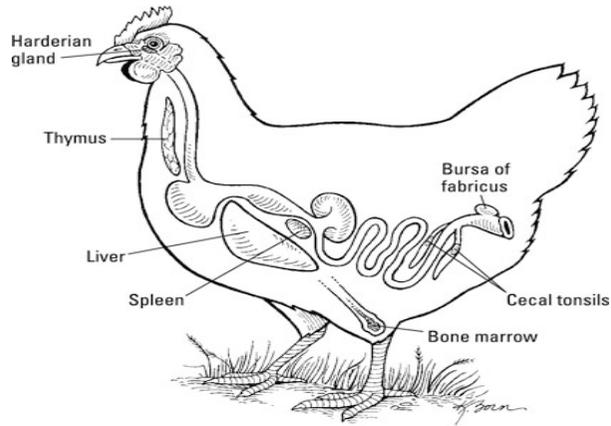
Product

Check if the collected information is correct.

Answers to check your progress 2.4

Refer to learner's book page 37

1.



3. Refer to learner's book page 35
4. An incomplete digestive system has only one opening to the digestive tract. Ingested food and excreted waste products pass through the same opening. Incomplete digestive systems are found in Cnidarians and Flatworms.
5. A complete digestive tract allows animals to continuously feed without waiting for waste to be eliminated before beginning to digest new foods. In species can develop. Digestive tracts with two openings also make digestion more efficient, since they provide different sites with different physical and chemical conditions (mouth, stomach, bowels) for the action of different complementary digestive enzyme systems. this way, the absorption of larger amounts of nutrients is possible and therefore bigger and more complex

UNIT
3

Transport, respiration and gaseous exchange

Refer to learner's book page 38 to 60

Learn about		Key inquiry questions
<p>Learners should investigate, using first and second hand sources, the range of transport systems in unicellular and multi-cellular organisms. They should develop an understanding about surface area to volume ratio and the need for effective transport systems for metabolism to be effective and how the systems are inter-related. This will require a study of the structure and functions of the heart, arteries, veins and capillaries, single and double circulatory systems, and how structure relates to how gases and organic substances are transported and exchanged. They should investigate the mammalian blood composition and functions, other tissue fluids and the lymphatic system; immune responses their types, and vaccination.</p>		<ul style="list-style-type: none"> • How do animals transport the necessary materials into various parts of their bodies? • How is gaseous exchange vital for sustaining animal life? • How can we explain animals' ability to defend themselves against the infectious agents? • How does gaseous exchange occur in protozoa? • How different is aerobic respiration from anaerobic respiration?
Learning outcomes		
Knowledge and understanding	Skills	Attitudes
<ul style="list-style-type: none"> • Understand the processes of transport, respiration, gaseous exchange, excretion and homeostasis in animals 	<ul style="list-style-type: none"> • Investigate open and closed circulatory system in animals, explain diffusion and mass flow of liquids • Relate the microscopic structures of kidney, lungs, skin, to their functions 	<ul style="list-style-type: none"> • Show curiosity to know about functions of the different organ systems in animal body.

Contribution to the competencies:

Creative and critical thinking: as learners begin to know about the structures and functions of the different organ systems they will be inspired to critical self-editing and hence develop a 'can do' attitude

Communication: this is enabled through sharing of individual and collective views on what they are learning

Co-operation: as they do practical work they will be willing to get on with one another

Links to other subjects:

Biology: Anatomy and Physiology

Chemistry: use of chemical symbols e.g. O₂, CO₂, etc.

Mathematics: counting the pulse rate of the heart

Assessment opportunities

Opportunities for all three forms of assessment are indicated for each of the activities.

- Observation
- Conversation
- Product

Learning outline

Learners have already learnt about living things and some of the processes involved in a living thing in biology Secondary 1. In this unit, they will be studying transport, respiration and gaseous exchange in animals. The transport in animals is among the most difficult and challenging concepts to explain to learners. An easy approach is needed to demonstrate this complex concept. I describe visual and pedagogical examples that can be performed quickly and easily during class to assist students in their understanding of transport in plants.

Learners are also being introduced to different types of respiratory surfaces and organs and mechanisms of gaseous exchange in various organisms. The main ideas that need to be emphasized are the characteristics of respiratory surfaces that allow gaseous exchange across them, different respiratory surfaces and mechanisms of gaseous exchange.

It is important to establish a link between gaseous exchange and respiration. Learners should be able to explain why oxygen is required by the cells, and where the carbon (IV) oxide being eliminated by the cells comes from i.e. which process taking place in the cells utilizes oxygen to produce carbon (IV) oxide among other products and by products.

This is important because it helps the student to distinguish clearly between the two different yet related processes of respiration and gaseous exchange.

Using the student textbook

There are both words and pictures in the textbooks, and as your learners are developing their reading skills, it is important to read the text with them. That way you will be modeling reading and will help their development. Learners should be encouraged to read along with you or copy you where phrases are more complex. Phrases in the text book are relatively short, but where there is more to read, these passages should be broken down into shorter phrases. Encourage learners to ask questions to clarify their understanding and enable more able learners to respond to these questions where appropriate.

It is helpful to have some keywords on posters or boards around the learning space if possible so that they get used to seeing them and become familiar with spellings. Learners could develop this collection as they progress through the unit.

The student competence

1. Critical thinking

This unit gives the learners variety of activities that they should work out and deduce the outcomes. The learners should think critically to answer some questions.

2. Co-operation

As learners are doing the activities, they should be able to work collaboratively and harmoniously so as to help each other in the learning process. Encourage them to take turns when doing activities.

3. Communication

In their discussions and presentation in groups and as a whole class, there are many opportunities for communication.

Cross cutting issues

Environment and sustainability

Learners should be given the opportunity to consider how sustainable development is the kind of development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Learners should consider this within the context of the local environment, reflecting upon the benefits of protecting the environment near to where they are. Simple ways of conserving water like closing taps should be encouraged.

Links to other subjects

This unit provides an opportunity to develop data handling skills in mathematics. Learners are also developing their English skills so focus on accurate use of vocabulary.

3.1 Understanding transport in animals

Refer to learner's book page 39

Activity 3.1

You could begin the topic by reviewing what the students learned in primary science about the human circulatory system. You can do this by asking the following suggested question. "What is a circulatory system?" Emphasise that blood stays in the blood vessels in a closed circulatory system and in an open circulatory system it does not stay in the blood vessels. Give examples of organisms with open circulatory system and organisms with closed circulatory systems. Point out the advantages of each type of circulatory system. Ask learners to come up with improvise charts which simplify open and closed circulatory system.

Assessment opportunities

Observation

Observe learners as they do the activity.

Conversation

Talk to learners as they are doing the activity.

Product

Check if the collected information is correct.

Activity 3.2: To examine the structure of a sheep or goats heart

Refer to learner's book page 40

Introduce this topic by asking the students to name the parts of the human circulatory system using the knowledge they learned in primary science.

You could also ask them to touch the part of the chest where they can feel their heart. Ask them to describe what they think is the function of the heart. Ask the students whether they think the heart ever stops to take a rest, and then starts again after it has rested. At this point, you can describe the structure of the heart and relate it to its function. You could use analogy of an ordinary water pump or any other pump that the students may be familiar with to find out what they understand the function of such a pump to be. Let them state what happens when such a pump fails.

Show them how to identify the left and the right side of the heart, as this contradicts what is ordinarily the case when studying other illustrations. Emphasise that the right side of the heart pumps deoxygenated blood from the body to the lungs for oxygenation. The left side of the heart pumps oxygenated blood to the body.

Emphasise that the heart is muscular with a special muscle called cardiac muscle and its function is to pump the blood around the body. Point out the presence of valves, which ensure that blood goes in the right direction. At this point, you can carry out dissection as learners observe what you are doing. Go through the procedure with them.

Ask them to identify various parts of the heart based on the explanation you gave earlier. to identify the atria and the ventricles. Ask them to attempt study questions of learners book. Give further explanation by referring to learners book.

Assessment opportunities

Observation

Observe learners as they do the activity. Are the following correctly what you are doing?

Conversation

Talk to learners as they are doing the activity.

Product

Check and correct the study questions done by learners.

Activity 3.3: Relating observable features of the heart to their functions

Refer to learner's book page 41

This lesson requires learners to be keen observing the structure of the heart. Make sure all the materials required for this practical are available. All learners irrespective of gender to participate in carrying out the activity.

Introduce the lesson by reviewing what the learners learnt heart in the previous lesson. Now give them ample time to carry out activity as you monitor and also conversing with them. Refer to learner's book for further details.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they able to do it?

Conversation

Talk to learners as they are doing the activity.

Product

Check if the collected information through their compiled notes is correct.

Activity 3.4: Investigating circulation of blood in the body

Refer to learner's book page 42

This lesson requires learners to be keen observing the structure of the heart. Make sure all the materials required for this practical are available. All learners irrespective of gender to participate in carrying out the activity.

Introduce the lesson by reviewing what the learners learnt heart in the previous lesson. Now give them ample time to carry out activity as you monitor and also, conversing with them. Refer to learner's book for further details.

Assessment opportunities

Observation

Observe learners as they do the activity.

Conversation

Talk to learners as they are doing the activity to check that they are understanding.

Product

Check on their findings as they share with the rest of the class.

Activity 3.5: Investigating pulse rate at the wrist before and after vigorous

Refer to learner's book page 44

Introduce the unit by reminding learners of what they learnt in the previous lesson. Try and bring out the relation on what learnt about heart in the previous lesson to pulse rate. Ask the learners to form group of four and do activity of learners book. Watch out as they come up with the steps required in carrying out the activity. Remind them making mistake is part of learning and therefore they should not be afraid of making mistakes.

Encourage each member of group to participate in practical activity. This nature's team work. Let the learners write the summary of the practical as they do study questions of learners book. Learners to use the observation from experiment/ activities to answer the question in learner's book. Explain its details by referring to learner's book for guidance.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they able to come up with the correct procedure for this activity?

Conversation

Talk to learners as they are doing the activity to check that they are understanding.

Product

Check on the table filled by learners.

Answers to check your progress 3.1

Refer to learner's book page 45

1.

Part	Adaptation	Functions
	It has set its own contraction rhythm due to the presence of pacemaker cells that stimulate the other cardiac muscle cells.	
		Prevents the backward flow of blood.
Aorta		
	It is thick and tough	
Papillary muscles		

2. Refer to learner's book page 39.
3. All parts of the heart are important. Because each and every part has a function that any other part cannot do.
4. Refer to learner's book page 36.

3.2 Blood vessels

Activity 3.6: Observing prepared slides of blood vessels

Refer to learner's book page 45

The lesson involves practical activity. You will engage learners in hands on activity and analysis. You are therefore required to provide all materials in advance for

practical. The class is to be organised in groups to allow each group member to participate as each member will be assigned work to do. When learners will be doing the practical activity, give them a reminder of how to use the microscope. Let them attempt study questions, mark and award marks after which you will correct them based on the facts of learners book.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they following the right procedure?

Conversation

Talk to learners as they are doing the activity to check that they are understanding.

Product

Check on learner's drawings.

Answers to check your progress 3.2

Refer to learner's book page 48

1. Aorta
2. Pericardium
3. Refer to learner's book page 44

Activity 3.7: Investigating the components of blood

Introduce this topic by reviewing what the students know about blood from their everyday knowledge and what they learnt in primary science. Ask them if they know what blood is made up of. Ask them to list components of blood on the chalkboard. Guide the students in this exercise to come up with a complete list of the components of blood. Use the points outlined in the Student's Book to discuss the composition of blood. Emphasise that blood consists of a liquid called plasma in which are suspended white blood cells, red blood cells and platelets.

Clarify that blood is about 90% of water and has a number of other substances dissolved in it. Point out to them that plasma contains blood proteins, food substances, waste substances, mineral salts and hormones. Organize them in groups and give them time to carry out the activity. Remind them to follow the rules involved when using a microscope. Let them attempt study questions, mark and award marks after which you will correct them based on the facts of learner's book.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they able to follow the procedure correctly?

Conversation

Talk to learners as they are doing the activity to check that they are understanding.

Product

Check and correct the study questions done by the learners.

Answers to check your progress 3.3

Refer to learner's book page 53

1. C
2. True, true, false, true
3. Bone marrow, oxygen, carbon dioxide
4.
 - i) increases surface area to volume ratio for the diffusion of oxygen
 - ii) has high affinity for oxygen
 - iii) This creates a space for more cytoplasm and therefore more oxygen to be packed in them.
5. Fight diseases germs in the body.
6.
 - a) Red blood cells. Their shape is biconcave. They aid in transportation of oxygen.
 - b) Lymphocyte
 - c) Protects the body from diseases recognising foreign proteins that invade cells.
7. Thickness and stiffness of artery walls.
8. Platelets were formed which prevented further bleeding.
9. Arteries have thick layer of muscles and elastic fibres which contract and relax to adjust their diameter as blood flows through them. Veins on the other hand have valves which prevent backflow of blood.

10. Heart purifies blood while lungs supplies the heart with unpurified blood for purification.
11. Check on various graphs drawn by learners.

3.3 Lymphatic system

Activity 3.8: Investigating lymphatic system

Refer to learner's book page 54

This lesson involves practical work which focus on observation and identification. As a teacher it is your role to make sure all the materials required for the practical are available. Allow learners to do practical with the materials provided. Follow keenly as they do the activity. Let them do the study question as you explain details of the practical by referring to learner's book.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they able to follow the procedure correctly?

Conversation

Talk to learners as they are doing the activity to check that they are understanding.

Product

Check and correct the study questions done by the learners.

Answers to check your progress 3.4

Refer to learner's book page 56

1. Blood specifically platelets
2. B
3. Refer to learner's book page 51

Activity 3.9: Immune response

Refer to learner's book page 56

Introduce the topic by asking the learners if they have ever caught chicken pox. For those who say yes, ask them how many times they have had it. Then ask them if they

have ever had common cold. For those who say yes, ask them how many times. For those who have never had chicken pox, ask the class why they think this is the case.

Let them brainstorm about the idea for a few minutes. Use the points outlined in the learner's book pages on the description of what immunity is. Clarify that unlike in the ABO blood system, some antibodies are not always already existing in the blood. Explain that they are formed as a result of antigens foreign to the body entering it. Distinguish clearly between natural and artificial immunity. Emphasise that the antibodies are produced in the immune system these includes lymph nodes, tonsils, thymus gland and spleen.

Mention that:

- (a) The body reaction to foreign bodies or antigens that leads to the production of antibodies and the special cells is called the immune response.
- (b) Any substance that causes an immune response is called an antigen.
- (c) Lymphocytes recognise antigens and either produce antibodies or kill the foreign cells directly.
- (d) In active immunity, the body produces its own antibodies.
- (e) In passive immunity, a person receives antibodies from another person.
- (f) Active immunity develops as a result of having a disease and recovering from it (natural immunity), or induction by artificially introducing weakened antigens into the body (active or artificial immunity).

Assessment opportunities

Observation

Observe learners as they do the activity. Are they able to follow the procedure correctly?

Conversation

Talk to learners as they are doing the activity to check that they are understanding.

Product

Check and correct the study questions done by the learners.

Answers to check your progress 3.5

Refer to learner's book page 58

1. Passive, antibody, placenta, breast milk
2. Refer to learner's book page 57

3.4 Aerobic and anaerobic respiration

Activity 3.10: Demonstration of anaerobic respiration in animals

Refer to learner's book page 59

This activity is done outside classroom. Ensure that the learners are able to access the field when learners in other classes are not using the field. Give them time to do the activity after which they answer the study questions. Clarify further by referring to learner's book.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they able to follow the procedure correctly?

Conversation

Talk to learners as they are doing the activity to check that they are understanding.

Product

Check and correct the study questions done by the learners.

Answer to check your progress 3.6

Refer to learner's book page 60

1. Breathing heavily.
- 2.

Aerobic respiration	Anaerobic respiration
1) It takes place in the presence of oxygen.	1) It takes place in the absence of oxygen.
2) In aerobic respiration, complete oxidation of glucose takes place.	2) In anaerobic respiration, the glucose molecule is incompletely oxidised.
3) End products are CO ₂ and water.	3) End products are either ethyl alcohol or lactic acid and CO ₂ .
4) Lot of energy is liberated (38 ATP).	4) Relatively small energy is liberated (2 ATP).
5) It occurs in plant's and animal's cells.	5) Occurs in many anaerobic bacteria and human muscle cells.
6) $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + 686 \text{ K.cal}$	6) $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2 + 56 \text{ K.cal}$

Refer to learner's book page 61 to 76

Learn about		Key inquiry questions
<p>Learners should investigate the nature of respiratory and excretory surfaces and mechanisms involved in gaseous exchange in a range of unicellular and multicellular animals (protozoa, insects, fishes, amphibians, reptiles, birds and mammals). They should explore the inter-relationships, structure and functions of the organs responsible for excretion and homeostasis e.g. the liver, skin and kidneys; and know about excretory products and nitrogenous metabolism (ammonia, urea and uric acids) and relate this to osmosis and diffusion.</p> <p>This will lead them to understand the processes of transport in animals, explain respiration and the processes of gaseous exchange in different kinds of animals, and understand excretion and homeostasis.</p>		<ul style="list-style-type: none"> • Why do animals use different organs for performing excretion? • Why is excretion of nitrogenous wastes less of a problem for plants than animals? • How do animals regulate temperature fluctuation within their body in relation to their environments? • How does Amoeba regulate water content in its cell?
Learning outcomes		
Knowledge and understanding	Skills	Attitudes
<ul style="list-style-type: none"> • Understand the processes of transport, respiration, gaseous exchange, excretion and homeostasis in animals 	<ul style="list-style-type: none"> • Investigate open and closed circulatory system in animals, explain diffusion and mass flow of liquids • Relate the microscopic structures of kidney, lungs, skin, to their functions 	<ul style="list-style-type: none"> • Show curiosity to know about functions of the different organ systems in animal body.

Contribution to the competencies:

Creative and critical thinking: as learners begin to know about the structures and functions of the different organ systems they will be inspired to critical self-editing and hence develop a 'can do' attitude

Communication: this is enabled through sharing of individual and collective views on what they are learning

Co-operation: as they do practical work they will be willing to get on with one another

Links to other subjects:

Biology: Anatomy and Physiology

Chemistry: use of chemical symbols e.g. O₂, CO₂, etc.

Mathematics: counting the pulse rate of the heart

Assessment opportunities

Opportunities for all three forms of assessment are indicated for each of the activities.

- Observation
- Conversation
- Product

Learning outline

The content in this unit is about excretion in living thing. You may remind the learner of what they learnt about respiration and gaseous exchange in unit 3. You can do this by asking questions during introduction of the in order to move from known to unknown.

Excretion is a characteristic of all living organisms and is integral in ensuring that internal body conditions are maintained at optimal required levels for proper functioning of the body. Emphasise the need for studying and taking this topic seriously in the course of your lessons. All living organisms living organisms remove toxic metabolic wastes but may use different structures. You should also motivate the learner to want to know how to take care of their bodies to maintain proper functions of excretory organs.

During the lesson, strive to bring to awareness of learners the fact that this topic is related to anatomy and physiology. Let them understand that at this level, they may only need the basic information otherwise more details on mechanisms of excretion in higher organisms will be learnt later.

Using the student textbook

There are both words and pictures in the textbooks, and as your learners are developing their reading skills, it is important to read the text with them. That way you will be modeling reading and will help their development. Learners should be encouraged to read along with you or copy you where phrases are more complex. Phrases in the text book are relatively short, but where there is more to read, these passages should be broken down into shorter phrases. Encourage learners to ask questions to clarify their understanding and enable more able learners to respond to these questions where appropriate.

It is helpful to have some keywords on posters or boards around the learning space if possible so that they get used to seeing them and become familiar with spellings. Learners could develop this collection as they progress through the unit.

The student competence

1. Critical and creative thinking

Guide the learners to discover for themselves as they work in groups. This can also be achieved when learners answer probing questions and do more research on the excretion and homeostasis by themselves. This competence also comes about as learners think about their findings in the activities and as they give out their suggestions. Encourage learners to come up with innovative ways.

2. Communication

The competence comes as learners participate in pairs and group work and present their work to the rest of the class. Encourage all learners irrespective of their abilities to participate in group discussion and during presentation by asking questions. The teacher should convey ideas effectively through spoken and written English by applying appropriate grammar and relevant vocabulary.

3. Co-operation

This competence comes as learners participate in pairs and groups work and present their work to the rest of the class. Encourage all learners irrespective of their abilities to participate in group discussions and during presentations by asking questions. This can also be achieved during presentation, you can allow rational presentation within group members.

Cross-cutting issues

1. Environment awareness and sustainability.

Emphasise to the learners that environment is made up of both living and non living things. Therefore, they should not destroy plants and kill animals during their practical studies instead they should try to conserve them. Remind them to keep their environment clean.

2. Peace education

Bring to the attention of the learners the need to accommodate other people's view. Discipline should be observed at all times in these groups since some cases can make learners diverge from the main objectives

Links to other subjects

During the lesson, strive to bring to awareness of learners the fact that this topic is related to anatomy and physiology. Let them understand that at this level, they may only need the basic information otherwise more details on mechanisms of excretion in higher organisms will be learnt later.

4.1 Main excretory products in animals

Refer to learner's book page 62

Activity 4.1: Investigating main excretory products in animals

This is a practical and a discussion lesson that will involve an activity by the learners. You will engage learners in a discussion regarding the activity on investigating release of carbon dioxide as a waste metabolic gas and assessing learning achievements. You are therefore required to get the various reference materials and required apparatus and reagents in advance and organise the class in a way that will encourage the teaching methods suggested.

Introduce the unit by asking learners to state examples of products that are released through gaseous exchange in order to build on content they learnt previously. Ask learners if they know the process that releases carbon dioxide in animals.

Learners to organize themselves into groups of four to carry out activity 4.1. Provide the required reagents and apparatus to each group. Encourage them to work as a team as they share duties, listen to others opinion and also air their views. This will improve their communication, team work and interpersonal skills.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they able to set up the apparatus as required?

Conversation

Talk to learners as they are doing the activity to check that they are understanding.

Product

Check and correct the study questions done by the learners.

Answers to check your progress 4.1

Refer to learner's book page 63

1. C

2. B

3. C

4. Metabolic, deamination, ammonia/ uric acid, ammonia

5. It is insoluble and requires very little water to excrete

4.2 Excretion in unicellular organisms

Refer to learner's book page 64

Activity 4.2

This is a discussion and practical lesson that will involve activities by the learners. You will engage the learners in a discussion regarding the activities and assessing learning achievements. You are therefore required to get the various materials in

advance and organise for the practical activity by availing the light microscopes and permanent slides of unicellular protists.

Let the learners discuss in groups meaning of the terms provided. The learners should work in groups to enhance cooperation and interpersonal skills. They should then present their work to the rest of the class. Provide the learners with microscopes and permanent slides of Amoeba or Paramecium and let them identify cell membrane and contractile vacuoles. Let the learners discuss the findings of their observations in groups. Confirm this activity by going to each group. Provide more time to learners with visual impairment more time to make their observations with your assistance. Explain to the learners the concept of surface area to volume ratio and why diffusion alone can suffice in for excretion unicellular organisms. End lessons by instructing them to attempt Self-evaluation test 4.2 in their Textbooks.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they able to define the words correctly?

Conversation

Talk to learners as they are performing the activity to check their level of understanding.

Product

Did they do the activity as expected?

Answers to check your progress 4.2

Refer to learner's book page 64

1. They have a very high surface area to volume ratio; this means that most of their body is in contact with the external environment. Hence they can rely only on simple diffusion in removal of metabolic waste product.
2. Water continuously enters the cell from the external environment by osmosis. Water then enters the contractile vacuoles which when full; move and fuse with the cell membrane then open to release excess water out of the cell.
3. They would develop more contractile vacuoles to remove excess water from their cells.

4. i) Deamination
- ii) Liver
- iii) Carbon and ammonia respectively

4.3 Structure and function of excretory organs in higher organisms

Activity 4.3: Excretion in higher organisms

Refer to learner's book page 65

It is a practical lesson that will involve activities by learners. You are therefore required to get the various materials in advance.

You will engage the learners in a discussion regarding the activities and assessing learning achievements. Organise the class in away that will encourage the teaching methods suggested. This lesson requires a field study around the school to collect grasshoppers or locusts for the practical activity of identifying the tracheal system in insects. Learners should work in groups to enhance co-operation and interpersonal skills. This will also be achieved when analysing the collected insects and also observed animals. Lead in discussion of the results.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they able to do it?

Conversation

Talk to learners as they are doing the activity to check that they are understanding.

Product

Check and correct the table filled by learners.

Answers to check your progress 4.3

Refer to learner's book page 71

Bowman's capsule, glomerular filtrate, Glucose and amino acids, active transport, Mitochondria, loop of Henle, urea, Mineral salts.

Activity 4.4: To examine and draw the mammalian kidney

Refer to learner's book page 68

This lesson will involve a practical activity and discussion. Prepare for all requirements for the lesson in time. Introduce the lesson by showing the learners parts of the human excretory system. Give learners some minutes to look at the diagram of the excretory system in their learner's book. Explain to the learners the position of the kidneys in the human body. Thereafter introduce the practical activity of identifying structure of the kidneys using the mammalian kidneys provided. This is a self-discovery activity for the learners. Your guidance is required to meet the objective of the lesson. Organise them into groups to assess teamwork and interpersonal skills. With your guidance, let the learners identify the cortex, medulla, pelvis and ureters of the kidneys. Let learners write notes and draw human their observations.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they able to follow the procedure correctly?

Conversation

Talk to learners as they are doing the activity to check that they are understanding.

Product

Check on learners drawings. Are they drawing the correct diagrams?

Activity 4.5: To examine and draw the mammalian kidney

This is an explanation and discussion lesson that will involve activities by the learners in researching on factors in the internal environment of animals. You will engage the learners in a discussion regarding the research activity and assessing learning achievements. Begin the lesson by asking learners to state some of the metabolic processes that take place in their bodies and products of these processes. Let them relate what you are discussing with picture A and picture B of learners book. Explain to them what is homeostasis is and the mechanism of negative feedback.

Organise the learners in groups of four and let them research on conditions of internal environment that need to be maintained within narrow limits. Guide learners to carry out in groups of six activity 4.6 of learner's book. Guide the learners calculate the means of the students' initial and final temperature and explain the reason for the drop or rise of temperature.

Let the learners present their work to the rest of the class. This will improve their communication skills. After which you will give further clarification by referring to learner's book.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they able to follow the procedure correctly?

Conversation

Talk to learners as they are doing the activity to check that they are understanding.

Product

Check and correct the study questions done by the learners.

Answers to check your progress 4.3

Refer to learner's book page 71

1. C
2. D
3. B
4. C
5. C
6. B

4.4 Homeostasis

Activity 4.7: To observe prepared slides of mammalian skin

Refer to learner's book page 72

This is a discussion lesson that will involve a practical work on mammalian skin. You are therefore required to get the various reference materials in advance and organise the class in a way that will encourage the teaching methods that you

will prefer. Give learners time to carry out the activity as you check on what they are doing. Refer to learners book to clarify further. Learners to attempt check your progress 4.4 after the lesson.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they able to follow the procedure correctly?

Conversation

Talk to learners as they are doing the activity to check that they are understanding.

Product

Check and correct the study questions done by the learners.

Answers to check your progress 4.4

Refer to learner's book page 75

1. C

2. C

3. B

4. A

5. They are poikilothermic, hence they do not utilize their food to regulate body temperature.

6. They have thick fur and fat layer for insulation against heat loss.

**UNIT
5****Organisms interaction with their environment
and the effect of climate change**

Refer to learner's book page 77 to 102

Learn about	Key inquiry questions
<p>Learners should describe how organisms interact with their physical and biological environment; classify organisms as autotrophs and heterotrophs based on their adaptive features, and investigate predation, parasitism, commensalism, competition (intra specific and inter-specific), synergism, etc. and the effect of climate change.</p> <p>Learners should investigate organisms: plants, insects, reptiles, birds, fishes etc. and their adaptations to the environment in terms of colour, body shape, nutrition and movement. They should understand biotic and abiotic factors that affect the distribution of organisms trophic level, nutrient cycle and energy flow: (food chain, food web, nutrient cycle, energy flow, ecological pyramids, pyramid of numbers, pyramid of energy, primary and secondary productivity) and investigate the concepts of ecology, ecosystem, habitat, species, population, community, biome, carrying capacity and the different niches and relate these to the South Sudan ecological zones, succession). They understand the importance of mathematical modeling in ecology and as a result students will understand how animals and plants are adapted to live in different environments, and how climate change, biotic and abiotic factors, influence the distribution of organisms and relate this to South Sudan.</p>	<ul style="list-style-type: none">• How do organisms interact with their environment?• Why are organisms classified into autotrophic and heterotrophic groups?• Why do organisms live in communities?• What is an ecosystem?• How are minerals retained and recycled in an ecosystem?• Why is flow of energy important in an ecosystem?• What are the major South Sudan ecological zones?• How is the use of mathematical modeling important in ecology?

Learning outcomes		
Knowledge and understanding	Skills	Attitudes
<ul style="list-style-type: none"> Understand how organisms interact with each other and with their environment 	<ul style="list-style-type: none"> Develop investigation skills by accessing a wide range of sources Ability to use mathematical models e.g. for predictions Develop ability to classify the organisms according to their food requirements Develop the skills of field visit in various ecological zones 	<ul style="list-style-type: none"> Appreciate interdependency of organisms on one another and on their environment Appreciate South Sudan eco systems Value the diversity of life found in South Sudan
<p>Contribution to the competencies:</p> <p>Critical thinking: develop critical thinking and creativity through exploration of the environment while doing practical exercises of field ecology</p> <p>Communication: is enhanced as they go about talking to one another describing what they see and collect for further discussion</p> <p>Co-operation: is strengthened in the course of group work</p>		
<p>Links to other subjects:</p> <p>Geography: studying ecosystems biotic and abiotic factors and their role in distribution of organisms</p> <p>Mathematics: study of population, modeling</p> <p>Chemistry: studying nutrients cycles, use of chemical symbols</p> <p>Environment and sustainability: climate change</p>		

Assessment opportunities

Opportunities for all three forms of assessment are indicated for each of the activities.

- Observation
- Conversation
- Product

Learning outline

An understanding of the relationships between an organism and its environment can be attained only when the environmental factors that can be experienced by the organism are considered. This interaction constitutes overall adaptation of the organisms to their environment, which also includes the continuity of species. However, the availability of organisms in an area is dependent on the type of environment. Thus, the availability of specific species is indirectly dependent on the various factors like annual rainfall, average temperature conditions, position of the earth with respect to the sun. These factors give rise to the existence of biomes like grasslands, rainforests and deserts. The climate in the specific biome further decides the species richness in that area. In this unit, learners will explore ecological interactions at the population, community, and ecosystem levels.

Using the student textbook

There are both words and pictures in the textbooks, and as your learners are developing their reading skills, it is important to read the text with them. That way you will be modeling reading and will help their development. Learners should be encouraged to read along with you or copy you where phrases are more complex. Phrases in the text book are relatively short, but where there is more to read, these passages should be broken down into shorter phrases. Encourage learners to ask questions to clarify their understanding and enable more able learners to respond to these questions where appropriate.

It is helpful to have some keywords on posters or boards around the learning space if possible so that they get used to seeing them and become familiar with spellings. Learners could develop this collection as they progress through the unit.

The student competencies

1. Critical and creative thinking

This comes majorly through interpretation of pictures, giving reasons for interpretation and explanation. This competence also comes about as learners think about their findings in the activities and as they give out their suggestions. Encourage learners to come up with innovative ways.

2. Cooperation

Learners are asked to work in pairs, groups and as a class, so there are continuous opportunities for co-operation and teamwork. This provides good opportunity to create roles in groups so that for example, there is a writer, questioner, presenter and group leader.

3. Communication

In their discussions and presentations in groups or as a whole class, there are many opportunities for communication. The teacher should convey ideas effectively through spoken and written English by applying appropriate grammar and relevant vocabulary.

Cross cutting issues

1. Peace education

Throughout the unit, learners should be encouraged and made aware of the need to accommodate everyone's ideas and options. Through the discussions, they will at times agree or disagree on issues at hand. They should be made to embrace the views of others and treat them as learning process. This way, peace and values of education will be promoted.

2. Environment awareness and sustainability.

Emphasise to the learners that environment is made up of both living and non living things. Therefore, they should not destroy plants and kill animals during their practical studies instead they should try to conserve them. Remind them to keep their environment clean.

Links to other subjects

During the lesson, strive to bring to awareness of learners the fact that this topic is related to ecology. Let them understand that at this level, they may only need the basic information otherwise more details will be learnt later.

5.1 Definition of terms in ecology

Refer to learner's book page 78

Activity 5.1: Definition of terms in ecology

This lesson will require that you take learners for a tour around their school. This you can do at their free time maybe on a weekend as it requires time. Educational tours helps in understanding the concept of ecology. This will increase their curiosity and bring them to appreciate this branch of science. You are therefore required to get the various reference materials in advance and also get resource person which can be a local person from the area where you are carrying out the studies. Also seek permission from the right personnel at the right time. You will engage learners in a discussion regarding the activity on investigating their environment on ecological zones. Let the resource person explain more to the learners as they ask questions to seek clarification. Use the observable features to define the ecological terms given in the learners' textbook. Show to the learners the ecological zones of South Sudan with their associated biomes and how they are unique. Back at school organize the learners in the classroom into groups of five to carry out activity 5.1. Provide the required published journals to each group. Encourage them to work as a team as they share duties, listen to others opinion and also air their views. This will improve their communication, team work and interpersonal skills. Emphasize the importance of an ecosystem's carrying capacity. Provide the learners with various Biology reference textbooks. Let them find out more about the biomes of South Sudan and how they are unique and important. Explain in details the aim of the activity by referring to learner's book.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they able to follow the procedure correctly?

Conversation

Talk to learners as they are doing the activity to check that they are understanding.

Product

Check the table they have completed to describe different organisms that exist in different areas.

Answer to check your progress 5.1

Refer to learner's book page 80

1. C
2. B
3. C
4. D
5. B
6. Ecosystem, adaptations, niche, community, biome.
7. A population comprises of total number of organisms of a particular species in a given area at a specific time while a community is made up of several populations found at a specific geographical location.

5.2 Factors in an ecosystem

Refer to learner's book page 80

Activity 5.2

This is a discussion and practical lesson that will involve activities by the learners. You will engage learners in a discussion regarding the activities and assessing learning achievements. You are therefore required to get the various materials in advance. Give learners time to carry out the activity and present to the class. Let them come up with the conclusion from the discussion.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they able to follow the procedure correctly?

Conversation

Talk to learners as they are doing the activity to check that they are understanding.

Product

Check on their presentation. Are they able to present well.

Activity 5.3 Predators and prey

Refer to learner's book page 81

This lesson will require that you provide learners with graphical representations of oscillating numbers of species of organisms in an interaction as in the prey-predator relationship. Introduce the lesson by defining mathematical model. Explain this concept using the Lotka-Volterra ecological model on prey-predator relationships. Use a sample data to draw graphs to show the oscillating numbers of prey and predator in an association. Provide a sample data on numbers of prey and predators over a specific period of time; let them account for the fluctuations in numbers of the given organisms. Also provide the required published journals to each group. Encourage them to work as a team as they share duties, listen to others opinion and also air their views. This will improve their communication, team work and interpersonal skills.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they able to follow the procedure correctly?

Conversation

Talk to learners as they are doing the activity to check that they are understanding. Can they remember prey and predator?

Product

Look at the graphs and notes compiled by learners. Do they reflect what was found?

Activity 5.4

Refer to learner's book page 82

Learners here are expected to research more about parasitism and predation. As they share their findings with the class, ensure that the rest of the class grab or take notes of the correct points only. Assist them in understanding points that they can't understand well. Learners are also expected to design posters that differentiate symbiosis and mutualism. Apart from the structure of the design, check on the message that is in each poster.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they able to follow the procedure correctly?

Conversation

Talk to learners as they are doing the activity to check that they are understanding. Can they remember prey and predator? What about mutualism and symbiosis.

Product

Look at the notes and posters design by learners. Are they providing the relevant information?

Activity 5.5 Commensalism

Refer to learner's book page 85

Learners here are expected to research more about commensalism. As they share their findings with the class, ensure that the rest of the class grab or take notes of the correct points only. Assist them in understanding points that they can't understand well.

Assessment opportunities

Conversation

Talk to learners as they discuss the activity to check if they are understanding.

Product

Look at the notes, pictures, graphs and illustrations provided by the learners. Are they providing the relevant information?

Activity 5.6

Refer to learner's book page 87

The purpose of this lesson is to introduce learners to the concept of abiotic factors, one of the elements that define an ecosystem, and how these become limiting factors in an ecosystem. The teacher will have a variety of teaching strategies to review the students' prior knowledge of their understanding of the organizational patterns and relationships that are found in any ecosystem. In addition, the teacher will combine different teaching methods (technology/multimedia/internet,

art, laboratory experiment, note writing strategy, self formative assessment) to introduce and deliver the main topic of this lesson. Teachers to give learners time to carry out activity 5.6 of learners book. Learners to research more about abiotic factors and share their findings with the rest of the class. Ensure that each learner participates during discussion. Allow learners to ask you more questions on areas that they do not understand.

Assessment opportunities

Conversation

Talk to learners as they discuss their findings. Allow room for questions from learners.

Product

Check diagrams posters and notes compiled by the learner. Do they reflect the aim of the practical activity?

Answers to check your progress 5.2

Refer to learner's book page 91

1. A
2. A
3. B
4. C
5. D
6. A
7. Transpiration, photosynthesis, germination and growth.
8. Commensalism
9. Symbiosis
10.
 - a) Mimicry
 - b) camouflage

11.

a) Zebras are grazer and therefore feed on grass while giraffes are browsers therefore feed on twigs and leaves at the top of a tree.

b) Increased rainfall results to an increase in plants/vegetation thereby bringing about an increase in number of predators due to abundance of food.

12. a) Flooded grassland and savanna

b) Tropical, subtropical grassland, savanna and shrub land.

13. In plants- wind affects pollination, dispersal of seeds and fruits. In animals- wind affects predation and migration.

14. Process by which an existing community is eventually replaced by an existing community.

15. It is a composite of fungal mycelia and algae; such that fungi absorbs water and minerals from the unfavorable substratum while the algae photosynthesizes.

5.3 Classification of organisms

Refer to learner's book page 92

Activity 5.7

The lesson should help learner to appreciate the importance of classification of organisms. This activity is about debate and advertisement through creation of posters by learners. As a teacher role-play the judge, choose the opposers, proposers and speaker. Let each side to choose their debaters. Allow them to draft their main points that they will use in debating. Learners can do this by designing different posters for their points. As the judge, let your judgment be based on the strong points. Correct learners after debating by giving facts about classification of organisms. Learners also to carry out activity 5.7 of learner's book and share their findings with the rest of the class.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they able to follow the procedure correctly?

Conversation

Talk to learners as they are doing the activity to check if they are understanding.

Product

Check on the main points during debate, do they reflect the motion. Also check the table filled by learners. Did learners fill the table correctly?

Activity 5.8

Refer to learner's book page 97

This is a discussion lesson. You will engage learners drawing ecological pyramids and discussing their shapes. You are therefore required to get the various reference materials in advance and organize the class in a way that will encourage the teaching methods suggested. This lesson will require that you use available living organisms to generate food chains that you will use to draw the ecological pyramids. Guide learners to draw their own pyramids of numbers and energy using the food chains they had drawn earlier. Let the learners discuss the shapes for the normal and inverted pyramids. Let the learners write notes in their books.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they able to follow the procedure correctly?

Conversation

Talk to learners as they are doing the activity to check that they are understanding.

Product

Check diagrams drawn by the learner. Do they reflect the aim of the practical activity?

5.4 Nutrient cycle

Refer to learner's book page 97

Activity 5.9: The carbon cycle

This is a practical activity which requires the learner to arrange on how to get the materials from the laboratory technician. Learners to organize themselves to carry out the activity. Let them discuss their findings and answer the study questions that follow.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they able to follow the procedure correctly?

Conversation

Talk to learners as they are doing the activity to check that they are understanding.

Product

Check the study questions answered by learners. Did they answer them correctly?

Activity 5.9: Nitrogen cycle

Refer to learner's book page 97

This activity is all about drawing nitrogen cycle. Learners to ensure that all the materials are available. Give them time to draw and award marks based on correct information conveyed.

Assessment opportunities

Observation

Observe learners as they do the activity. Are they coming up with the correct drawings?

Conversation

Talk to learners as they are doing the activity.

Product

Check their drawings as they stick them on the wall. Are they giving the real picture of nitrogen cycle?

Answers to check your progress 5.3

Refer to learner's book page 101

1. B
2. B
3. B
4. B
5. A
6. Animals that feed on flesh for example Lion, wild dogs and cheetah. Accept an appropriate example.
7. Autotrophs, primary producer, food chain, least
8. Non-cyclic
9. i) Green plants
ii) They will increase
10.
 - i) Green plants
 - ii) Tertiary consumer (iii) All organisms
 - iv) Locusts
11. B
12. Photosynthesis
13. The amount of energy available decreases at each trophic level
14. Nitrogen fixation involves the conversion of free nitrogen into forms that can be utilized by plants while nitrification involves the conversion of ammonium compounds into either nitrites or nitrates.
15. Water enters the earth's surface through precipitation in the form of rain, snow, dew or fog. Water evaporates from water bodies and return back to the atmosphere in the form of water vapour. Excess water vapour condenses to form clouds which falls back to the earth through precipitation. Water also leaves the bodies of plants through transpiration and from animals bodies by

evaporation. The sun is the ultimate source of energy in an ecosystem; this energy is incorporated into the photosynthetic organisms like plants and algae through photosynthesis. Some bacteria can obtain energy from breaking down chemical substance and synthesize organic food substances. For example the Sulphur –based bacteria breakdown hydrogen sulphide and use the hydrogen atoms in fixation of carbon dioxide. Greenhouse effect that causes global warming comes about when the atmosphere of the planet traps radiations emitted by the sun as a result of accumulation of green house gases.



South Sudan

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