



# **Biology and Health Sciences**

FOR RWANDAN SCHOOLS

**Senior 1**

**Teacher's Guide**

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# INTRODUCTION

## 1. How to use this Teacher's Guide

This Teacher's Guide accompanies the textbook for *New Secondary Biology and Health Sciences for Rwanda S1*. It is designed to support teachers in implementing Rwanda's new curriculum, set to be launched in January 2016. The main purpose of the curriculum is to equip Rwandans with the necessary competences (knowledge, skills, values and attitudes) to realise the aims of Vision 2020 and recent government policies. These involve turning Rwanda into a competence-based society, which necessitates a curriculum that incorporates the best of education practices in the developing world.

Teachers are encouraged to read the Introduction to this Guide in order to understand how *New Secondary Biology and Health Sciences for Rwanda S1* meets the needs of the new competence-based curriculum. The Introduction provides a clear explanation of what a competence-based curriculum is, as well as how to develop competences in learners. It lists the cross-curricular basic competences and describes the generic competences in user-friendly terms. In addition, it lists and explains the cross-cutting issues that are integral to the curriculum, highlighting the importance of addressing these issues with young learners. Since the new competence-based curriculum requires a shift in terms of teaching, learning and assessment approaches, the Introduction to this Guide also provides a clear explanation of student-centred learning, formative and summative

assessment, teaching multi-ability learners (including those with special educational needs), classroom organisation, and different infrastructure and facilities. It includes a detailed Content map that outlines the key components of each learning unit in this course, as well as sample lesson plans. Finally, the Introduction contains a clear explanation of *New Secondary Biology and Health Sciences for Rwanda S1* and its importance to learners in Rwanda and in society in general. The broad *New Secondary Biology and Health Sciences for Rwanda S1* syllabus competences are also outlined, as well as the typical resources and skills required for teaching this subject in the classroom.

Following the Introduction, the bulk of this Teacher's Guide consists of clear, concise and user-friendly notes for the teacher that are designed to support the implementation of *New Secondary Biology and Health Sciences for Rwanda S1*. Notes are presented unit by unit and correlate closely with the syllabus for *New Secondary Biology and Health Sciences for Rwanda S1*. These notes have been written as comprehensively as possible in order to provide all teachers with the support they need. Thus, less confident teachers or those working in more challenging conditions are guided step-by-step through the teaching and learning process for this subject, and more confident teachers or those working in more favourable conditions are also encouraged to extend and enrich their learners beyond the syllabus requirements.

## 2. How *Biology and Health Sciences for Rwanda S1* meets the needs of the new competence-based curriculum

*New Secondary Biology and Health Sciences for Rwanda S1* aims to meet the needs of the new competence-based curriculum through the provision of a textbook and Teacher's Guide that are based on the key components of such a curriculum. Following a brief description of a competence-based curriculum, these key components are explained in further detail below.

### a) What is a competence-based curriculum?

The new curriculum is competence-based and designed to be relevant to the labour market needs of the Country. This means in practice that the specified subject content and knowledge should be delivered to students by the use of a wide range of exercises and activities that simultaneously develop the specified competences in the students as well as imparting content knowledge. The competence-based approach takes time but is not an 'add-on' to the knowledge curriculum. An integrated approach to teaching and learning is required.

### b) How to develop competences in learners

A competency is the ability to do a certain task successfully, as the result of having obtained a particular combination of knowledge, skills, attitudes and values. The national policy documents, which are based on the aspirations of Rwanda as a nation, focus on cross-cutting 'basic competences' and cross-cutting 'generic competences'. Basic competences are addressed in the broad subject competences and in the objectives listed for each year and for each unit of learning.

Basic competences relate to:

- Literacy
- Numeracy
- ICT and digital competences
- Citizenship and national identity
- Entrepreneurship and business development
- Science and technology

Generic competences, on the other hand, are not subject-specific and may be applied to any subject or situation. These core competences, which must be emphasised in the learning process alongside the basic competences, are the ability to:

- **Critical thinking and problem-solving skills:** Think creatively and widely in order to find solutions to problems in a variety of situations.
- **Creativity and innovation:** Take the initiative and to use one's imagination to generate new ideas and construct new concepts.
- **Research:** Gather and use information to formulate and answer questions, and to explain ideas, concepts and phenomena.
- **Communication in official languages:** Use the language of instruction to communicate effectively and correctly through speaking and writing.
- **Cooperation, interpersonal management and life skills:** Cooperate effectively with others in a team and to demonstrate positive moral values and respect towards the rights, feelings and beliefs of others; practically and actively conserve and protect the environment; promote personal, family and community health, hygiene and nutrition, and to respond creatively to life's challenges.
- **Lifelong learning:** Advance one's knowledge and skills independently and to be equipped to deal with new knowledge and learning challenges as one progresses through life.

### c) Cross-cutting issues

There are eight cross-cutting issues, which reflect key national concerns and are integrated into the curriculum for all subject areas. These are:

- **Genocide studies:** This is aimed at helping learners to understand the circumstances leading to genocide and the inspiring story of healing and rebuilding national unity. It is also aimed at encouraging learners to develop an awareness of the role and responsibility of each individual to ensure that nothing of this nature ever happens again.
- **Environment and sustainability:** This is aimed at fostering learners' understanding of the impact of humans on the environment and their part in sustaining the environment around them. Learners need to develop knowledge of sustainability, as well as the skills, attitudes and values to practise and promote sustainability in their world.
- **Gender:** This is designed to get learners to recognise basic human rights and the importance of promoting female equality. They learn to understand that preventing the female population from participating fully in society has a negative impact on the development of the nation as a whole. A good understanding of gender equality enables future generations ensure that the potential of the whole population is realised.
- **Comprehensive sexuality education:** This issue deals with topics such as HIV/AIDS, STI, family planning, gender equality and reproductive health. Addressed in an age-appropriate, gender-sensitive and life skills-based way, it provides learners with the appropriate knowledge, skills, values and attitudes to make positive choices about their sexuality and life style. Many young people are under-informed or misinformed about sexuality and gender, and this can make them vulnerable to abuse, ill health and unplanned pregnancies. Comprehensive sexuality education deals with these issues in a respectful, empathetic and open way, which emphasises basic human rights.
- **Peace and values education:** Peace education is obviously vital in the curriculum, since peace is a prerequisite for a society to flourish and for individuals to focus on personal achievement and their contribution to the nation. Values education helps to ensure that young people contribute positively to society through promoting peace and being committed to avoiding conflict.
- **Financial education:** This equips learners with sound financial practices and behaviours that ensure their economic well-being and that of the nation as a whole. It provides them with the tools for participating in a healthy economy, which has the potential for transforming other areas of their lives as well.
- **Standardisation culture:** This helps learners to understand the importance of standards as a key component of economic development and sustainability. The adoption of a standardisation culture has a positive impact on infrastructure, industrialisation, economic growth, trade and the welfare of the nation as a whole.
- **Inclusive education:** This involves ensuring that all learners are engaged in education, regardless of their gender or ability, including those with learning difficulties or other disabilities. It ensures that all learners participate actively and positively in education, and it embraces different learning styles and other difficulties.

#### **d) What is student-centred learning (SCL)?**

The new curriculum requires a move towards student-centred learning (SCL) and *New Secondary Biology and Health Sciences for Rwanda S1* is designed to support this move. SCL (also sometimes called Active Learning) entails learners being actively involved in their learning, rather than passive recipients of information passed on by the teacher or from a textbook. Thus, they learn by engaging in activities that require them to question, discuss, do practical tasks, solve problems, work in a group, think critically, use their imaginations and so on.

Typically, they construct knowledge for themselves by moving from the concrete through the pictorial to the abstract. In this way, they develop skills, attitudes and values in addition to content knowledge. The creation of a learner-friendly environment is therefore based on the capabilities, needs, interests and experiences of the learners themselves. SCL also helps learners to become more responsible for their own learning and to develop an awareness of their preferred learning styles. In addition, it teaches them to 'think about their thinking' and to have greater insights into the learning process and how they reach a particular solution, product or decision.

The shift to student-centred or active learning necessitates a change in teaching styles too. Teachers (and textbooks) are no longer considered to be the 'font of all knowledge', as their roles shift to being facilitators, organisers, advisors, counsellors and role-models. For many teachers, who are accustomed to more traditional ways of teaching, this may be

unsettling. However, this Teacher's Guide is designed to support and encourage teachers in implementing SCL in the following ways:

- Suggestions are given for classroom organisation, which include whole class, group, pair and individual work, ensuring learners engage in participatory and interactive activities;
- Lists of suitable resources and materials are provided that enable learners to explore, discover and construct knowledge in a variety of different ways;
- Advice on how to elicit and assess prior knowledge on new topics is given, so that learners are able to build new understandings based on what they already know;
- A range of learning activities are included that enable learners to develop and consolidate new knowledge, skills, values and attitudes in different ways that take into account the fact that individuals progress in different ways and at different rates;
- Assessment procedures are clearly outlined in order to determine the effectiveness of teaching and learning processes;
- Helpful questions and answers are provided that enable teachers to evaluate learning and to offer appropriate remediation, consolidation and enrichment to learners.

Thus, not only does this Teacher's Guide support teachers in creating a suitable learner-friendly environment to foster learning both in and out of the classroom, but it also supports the development of teachers themselves in their new professional roles.

### **e) Assessment requirements**

Assessment plays a crucial role in a learner-centred, competence-based curriculum and it presents new challenges that are not applicable to a more traditional, knowledge-based curriculum. Since the focus is now on how the learner is able to apply knowledge, skills, values and attitudes in different contexts, the nature of assessment has changed both in terms of what to assess and how to assess. The curriculum emphasises two types of assessment, namely **Formative or continuous assessment** (assessment for learning) and **Summative assessment** (assessment of learning). These two types of assessment are explained in more detail below:

#### **Formative assessment (assessment for learning)**

Formative or continuous assessment may be formal or informal and it is used to check if learning is actually occurring. Before each learning unit, the teacher has to identify assessment criteria and procedures for evaluating learners against these criteria. Then, at the end of each learning unit, the teacher has to ensure that every learner has mastered the key unit competence before progressing on to the next unit. The teacher has to assess how well each learner masters both the subject and generic competences described in the syllabus and, from this, will develop a picture of the learner's all-round progress.

This Teacher's Guide provides clear advice and guidelines to teachers for implementing formative assessment in every learning unit. Key unit competence, assessment criteria and learning objectives are signposted at the start of every unit, and advice is given on what and how to assess learners at the end of every unit. In

addition, suggestions are provided for assessing learners' prior knowledge or experience at the start of a learning unit, as well as for assessing the learning process during the unit. A variety of formative assessment methods are advocated, including observation, oral questioning, peer and self-assessments, pen and paper, and so on. This Teacher's Guide also focusses on involving the learners in the formative assessment process, so that they become more aware of and responsible for their own learning.

#### **Summative assessment (assessment of learning)**

Summative assessment is used to assess the learner's competence at the end of a process of learning. Typically, it is used to assess whether learning objectives have been achieved and the results may be used to rank or grade learners, to decide on progression, to select for the next level of education, or for certification. Summative assessment needs to be integrative in order to show that the learner has mastered all the competences. Thus, assessment tasks require learners to apply their knowledge, skills, values and attitudes in different contexts. Summative assessment usually occurs at the end of a learning unit, at the end of a school term and at the end of a school year.

As with formative assessment, this Teacher's Guide provides clear guidelines to teachers for implementing summative assessments at the end of every learning unit. Practical advice is given on what to assess, how to assess and how to award marks or score via simple rubrics, answer memos, checklists and so on. These are designed to assist teachers with assessing learners' competences in an integrative way, and with making decisions about progression onto the next unit or level.



### **f) Teaching multi-ability learners**

All learners have the right to engage with their learning, regardless of their different needs or abilities, whether these are physical, emotional, social or intellectual. This Teacher's Guide therefore has a section in every learning unit, which is aimed at assisting the teacher with catering for learners with different needs and abilities. These include those who require remediation, those who require consolidation, and those who require extension work. Each subsection is clearly signposted and typically includes questions (with possible answers) that can be posed to each group in order to facilitate their learning. In addition, careful thought has been given to the resources and materials listed for every learning unit, so that the needs of different learners may be met.

### **g) Catering for SEN learners**

An integral part of teaching multi-ability learners includes catering for those with special educational needs (SEN). Inclusive education involves the provision of learning materials and activities that enable those with physical, emotional, social or intellectual difficulties to actively engage in and fully benefit from the learning process. SEN learners must feel acknowledged and as much a part of the teaching and learning environment as those without these particular needs. Thus, *New Secondary Biology and Health Sciences for Rwanda S1* reflects positive images of the active inclusion of disabled people in its texts, illustrations and activities. Suggestions are also given to teachers in the unit notes of this Teacher's Guide to emphasise this message whenever possible, both in and out of the classroom.

### **h) Gender representation**

Learners with SEN difficulties are portrayed in a positive way, and every attempt is made to involve them as active participants in this course. Any kind of gender stereotyping is avoided in this course material and every effort has been made to demonstrate gender equality in the home, at school, in the work place, and in all other aspects of society. Where necessary, notes have been included in this Teacher's Guide to remind and encourage teachers to emphasise the important message of gender equality, and to treat this issue with the importance and respect it deserves.

### **i) Different infrastructure and facilities**

As with many other education systems in Africa, there is a great deal of variation in Rwanda amongst schools in terms of infrastructure, facilities, resources and conditions. This may be particularly so in urban versus rural schools. In more challenging circumstances, teachers may be tempted to ignore the requirements of a competence-based curriculum and focus solely on teaching syllabus content. Thus, *New Secondary Biology and Health Sciences for Rwanda S1* is designed to enable all schools and learners in Rwanda to develop the required competences. It takes into account basic levels of resource provision and clearly states the minimum level of work needed for all schools and learners to meet the curriculum requirements. However, it also takes into account higher levels of resource provision and therefore incorporates a 'layered approach' to learning activities that provides for schools with or without a computer lab, science lab, library, Internet connectivity and so on. Teaching notes may therefore consist of alternative suggestions, depending on the resources available at a particular school.

For example, they may state:  
*If your learners have access to the Internet, then...*  
*If your learners do not have access to the Internet, then...*

### **k) Classroom organisation**

In keeping with the shift towards active, student-centred learning that a competence-based curriculum demands, *New Secondary Biology and Health Sciences for Rwanda S1* emphasises the organisation of the classroom as an activity-based, learner-centred environment. Different ways of organising the classroom are suggested and encouraged including whole class, large and small group, paired and individual activities. As group work and pair work may be unfamiliar and therefore threatening to many teachers (and learners), it is worth spending time at the start of the course to establish some class agreements or rules about this type of interactive learning. It is also advisable for teachers to introduce paired and group work activities slowly, and gradually to increase them as they (and learners) become more familiar with them.

Suggestions for implementing paired and group work activities include:

- Establishing a signal that your class understands means the start or end of pair or group work (for example, raising your hand, ringing a little bell, writing a particular symbol on the board).
- Having each learner turn to the person next to/behind/in front of them for pair work, in order to avoid too much movement around the classroom.
- Having each pair join up with the pair next to/behind/in front of them for small group work.
- Numbering learners from one to eight and then asking all the ones to form a large group, all the twos to form another large group, and so on.
- Having a few basic rules for listening

and speaking in a pair or group (such as taking turns, making sure everyone has a chance to say something, using appropriate body language, learning a few terms to express agreement or disagreement politely).

- Allocating different roles to different members of each group (such as someone who writes down everyone's ideas, someone else who reports back everyone's ideas to the rest of the class, someone who makes sure everyone contributes to the discussion, and someone who collects all the materials for the group).
- Pairing or grouping learners according to their abilities so that they are able to progress at their own pace and benefit from remediation activities (weaker learners) or extension activities (stronger learners).
- Mixing learners into multi-ability pairs or groups so that weaker learners can benefit from the input of stronger learners, and vice versa.

### **3. How to use the sample lesson plans**

This Teacher's Guide contains comprehensive notes for the teacher on each learning unit in *New Secondary Biology and Health Sciences for Rwanda S1*. Within the notes for each learning unit, there are clear and concise lesson plans. Lesson planning is crucial in order to ensure that all learning objectives in each unit are covered. Thus, comprehensive support is provided so that the full range of knowledge, skills, attitudes and values are met over time through a variety of learning activities and experiences. In this Teacher's Guide, every effort has been made to ensure the lesson plans are simple, direct and user-friendly. Below are two sample lesson plans, which indicate the kind of useful information that these plans provide for teachers of this course.

## Sample lesson plan 1

School Name: \_\_\_\_\_ Teacher's name: \_\_\_\_\_

Term	Date	Subject	Class	Unit	Lesson no.	Duration	Class size
1	16/03/2016	Biology and Health Sciences	S1	1	1 of 4	40 min	45
<b>Type of Special Educational Needs to be catered for in this lesson and number of learners in each category</b>				Visual difficulties: 2 Speech, language and communication: 1			
<b>Unit title</b>			Introduction to Biology				
<b>Key unit competence</b>			Explain the meaning of Biology and its application; recall the characteristics common to all organisms and be able to apply safety and first aid in daily life.				
<b>Title of the lesson</b>			What is Biology?				
<p><b>Learning Objectives</b></p> <p>Knowledge and understanding: Define Biology and state its main branches; list the importance of studying Biology</p> <p>Skills: Compare characteristics of Life throughout different groups of organisms focusing on their nutrition, respiration, excretion, reproduction, growth, sensitivity and movement. Compare living things and deduce their differences. Practice rules and Regulations governing the laboratory and know how to avoid accidents in the laboratory. Use first aid kit</p> <p>Attitudes and values: Acknowledge the diversity and uniqueness of different organisms.</p>							
<b>Plan for this class</b>			Groups in classroom/laboratory or outdoors				
<b>Learning materials</b>			Student book				
<b>References</b>			References influencing the lesson planning: photos in the Student book; some specimens of living and non-living things				

<b>Timing for each step</b>	<b>Description of teaching and learning activity</b> By discussing the meaning of Biology and its applications, the learners will learn that Biology is the study of life.		
	<b>Teacher activities</b>	<b>Learner activities</b>	<b>Generic Competences and cross-cutting issues to be addressed</b>
<b>Introduction:</b> 5 min	Explain learning objectives and any associated assessment.	Discuss groups of animals and diseases.	Generic competence: Critical thinking; research and problem solving Basic competence: Literacy
	Arrange groups for oral activity.  Discuss photos in Student Book.	Talk about photos on page 2.	Cross-cutting issue: Environment and sustainability: Biology will help us understand how living organisms interact with their environments and how they keep a healthy balance to survive.
<b>Development of lesson:</b> 25 min	Discuss Figure 1.3 on page 3 – the branches of Biology. Explain new terminology. Discuss why studying Biology is important. Monitor progress against planned timing.	Complete Exercise 1.1. Discuss whether learning outcomes have been achieved.	
<b>Conclusion:</b> Summary and assessment 10 min	Discuss answers to Exercise 1.1. Reinforce learning outcomes.	Contribute to feedback.	
<b>Teacher self-evaluation</b>	Evaluate what went well and how learning could have been improved. Identify what needs to be carried forward to the next lesson.		

## Sample lesson plan 2

School Name: \_\_\_\_\_ Teacher's name: \_\_\_\_\_

Term	Date	Subject	Class	Unit	Lesson no.	Duration	Class size
1	25/06/2016	Biology and Health Sciences	S1	5	1 of 4	40 min	45
<b>Type of Special Educational Needs to be catered for in this lesson and number of learners in each category</b>				Visual difficulties: 2 Speech, language and communication: 1			
<b>Unit title</b>			Plant and animal cells				
<b>Key unit competence</b>			Differentiate between animal and plant cells using a light microscope.				
<b>Title of the lesson</b>			The cell				
<b>Learning Objectives</b> Knowledge and understanding: State the role of a cell in a living organism; describe the structure of plant and animal cells. Skills: Organise a science practical, set-up according to instructions. Attitudes and values: Appreciate the importance of cells; show perseverance when observing slides; pay attention while handling slides and sharp instruments.							
<b>Plan for this class</b>			Groups in classroom/laboratory				
<b>Learning materials</b>			Microscope; prepared slides of onion epidermis and human cheek cells; drawing paper				
<b>References</b>			References influencing the lesson planning: micrographs in the Student's book				

Timing for each step	Description of teaching and learning activity By discussing and observing the different structures of plant and animal cells under a microscope, the learners will learn how to distinguish between a unicellular and a multicellular organism.		
	Teacher activities	Learner activities	Generic Competences and cross-cutting issues to be addressed
<b>Introduction:</b> 10 min	Introduce the unit by referring to specimens of onion cells viewed in the previous unit. Arrange groups for oral activity.	Discuss the slides. Complete oral activity in groups.	Generic competence: Research and problem solving Basic competence: Literacy; Science and technology  Standardisation culture: When chemical products are purchased, they should be of a high standard or quality. It's important that they will be disposed of or recycled to avoid harming our environment and human life in general.
<b>Development of lesson:</b> 20 min	Describe the cell and distinguish between unicellular and multicellular organisms. Refer to the diagrams of a plant and an animal cell in Figure 5.2 on page 51, and describe structures common to both. Arrange groups for Experiment 5.1. Distribute prepared slides. Facilitate learners' progress and check that they can calculate magnification.	Look at Figure 5.2, and find organelles that are common to both plant and animal cells. Complete Experiment 5.1, and examine whether learning outcomes have been achieved.	
<b>Conclusion:</b> Summary and assessment 10 min	Make sure learners pack up carefully. Set Exercise 5.1 for homework. Reinforce learning outcomes.	Pay attention to storing microscopes correctly.	
<b>Teacher self-evaluation</b>	Evaluate what went well and how learning could have been improved. Identify what needs to be carried forward to the next lesson.		

#### 4. How to use the Content map

In addition to comprehensive notes for each learning unit, *New Secondary Biology and Health Sciences for Rwanda S1* also contains a Content map in both the Teacher's Guide and the textbook. The Content map is intended to provide a clear and easy reference to both the teacher and the learner on the following for each learning unit:

- Number of lessons (and homework)
- Introductory activity (for example, a class discussion on a particular topic)
- Classroom organisation (whole class, groups, pairs and individual work)
- Equipment required (list of resources and materials required)

- Learning activities (list of learning activities as per the syllabus)
- Competences practised (broad subject competences and generic competences)
- Subject practice (content of particular subject)
- Vocabulary acquisition (list of key new words)
- Numeracy (if applicable to the subject)
- Study skills
- Revision
- Assessments (informal and formal formative and summative assessments)
- Learning outcomes (list of learning objectives as per the syllabus)

Below is the Content map for *New Secondary Biology and Health Sciences for Rwanda S1*:

#### Content map

	Unit 1: Introduction to Biology	Unit 2: Introduction to classification	Unit 3: The external structure and importance of flowering plants	Unit 4: Magnifying instruments and biological drawings
<b>Number of lessons</b>	4 lessons	6 lessons	10 lessons	6 lessons
<b>Introduction</b>	Discuss classes of animals learnt in earlier grades	Group discussion on biodiversity in Rwanda	Group discussion: brainstorm functions of flowers, development of plants and reproduction of plants, as discussed in earlier grades	Group discussion on magnification and magnifying instruments
<b>Classroom organisation</b>	Individual; groups; class	Individual; pairs; groups	Individual; pairs; groups	Individual; pairs; groups

<b>Equipment required</b>	Reading materials; worksheets and visual materials; specimens, such as leaves and insects; hand lens; preserved specimens	Reading and visual materials; worksheets; specimens, such as leaves and insects; hand lens; preserved specimens	Charts and diagrams; collected specimens of flowering plants; roots, stems, and typical and modified leaves	Hand lens; prepared slides; light microscope; collected specimens (leaves, seeds, flower, etc.)
<b>Activities</b>	Brainstorm; interpret concept map; case study; practise observation skills	Tabulate; recall; match columns; use identification keys	Observe and identify parts; relate structure to function; biological drawings; tabulate; research; write a report	Identify parts of a microscope; learn how to use and care for a microscope; observe specimens using a microscope; biological drawings; calculate magnification
<b>Competences practised</b>	Literacy; critical thinking; research and problem solving	Literacy; critical thinking; data analysis	Literacy; research data analysis, communication	Literacy; science and technology; data analysis
<b>Science practice</b>	Simple experiment: Light a Bunsen burner	Identify an animal using a key	Observe parts of the plant and modified structures; biological drawings; research skills	Handle equipment; follow instructions; calculate; biological drawing of specimens viewed with microscope
<b>Vocabulary acquisition</b>	New words about branches of Biology	New words about classification groups	New words about the parts of the leaf, stem, root and flower	New words about microscopes and magnification
<b>Study skills</b>	Translation of information from concept map and diagrams; reading a case study and answering questions	Tabulation; use of mnemonic	Structure and function relationship; biological drawing; functions of plant parts; definitions of terminology; write a report	Calculation of magnification
<b>Revision</b>	Classification of organisms	Differences between living and non-living things	Structure of a plant	Biological drawing from Unit 2
<b>Assessments</b>	Activities; exercises; homework	Activities; exercises; homework	Activities; exercises; homework; formal assessment	Activities; exercises; homework
<b>Learning outcomes</b>	Explain the meaning of Biology and its application; recall the characteristics common to all organisms; apply safety and first aid in daily life	Explain the need for and apply classification; use identification keys to name unknown specimens	Describe the external structure of a typical flowering plant	Identify the components of a hand lens and light microscope; identify proper use and care of a hand lens and light microscope



	<b>Unit 5: Plant and animal cells</b>	<b>Unit 6: Levels of organisation in multicellular organisms</b>	<b>Unit 7: Food nutrients and diet</b>	<b>Unit 8: Structure and functions of human gas exchange system</b>
<b>Number of lessons</b>	4 lessons	4 lessons	8 lessons	6 lessons
<b>Introduction</b>	Class discussion	Discussion in pairs	Group discussion	Revise prior knowledge of respiration
<b>Classroom organisation</b>	Individual; pairs; groups; class	Individual; pairs; groups	Individual; pairs; groups	Individual; pairs; groups
<b>Equipment required</b>	Microscope; prepared slides	Microscope; prepared slides or micrographs	Bread, maize porridge or other complex carbohydrate; test tubes; a white tile; droppers; iodine solution; cooked chicken, meat or egg; butter; water; nuts (crushed); sodium hydroxide solution; copper sulphate solution; ethanol; test tube racks; permanent markers; test strips for testing proteins, fats and glucose	A dissecting set; plastic sheeting; a hand lens; lung of a goat, sheep or cow (with the trachea and bronchi intact); water; a container; a towel; soap; disinfectant; rubber tubing; transparent plastic bottles; forked glass tubing or straws; rubber bands or string; microscope; prepared slides
<b>Activities</b>	View specimens using a microscope; biological drawing; calculate magnification	View prepared slides using a microscope; biological drawing; terminology	Food tests; data analysis; case study	Dissection; draw; build a model; view prepared slides using a microscope
<b>Competences practised</b>	Literacy; science and technology; research	Literacy; critical thinking; science and technology; research and problem solving	Literacy; science and technology; communication skills; cooperation	Literacy; science and technology; research
<b>Science practice</b>	Use a microscope to view specimens; calculate magnification	Use a microscope to view specimens; observe; biological drawings	Follow instructions; present results; data analysis	Follow instructions; relate structure to function; make a model; calculate magnification

<b>Vocabulary acquisition</b>	New words about plant and animal cells	New words about tissues, organs and organ systems	New words about food nutrients and diet	New words about gaseous exchange
<b>Study skills</b>	Tabulate; compare; research information	Relate structure to function; learn definitions of new words	Tabulate; interpret data	Tabulate; relate structure to function
<b>Revision</b>	Magnification	Cell structure	Food nutrients from earlier grades	Respiration from earlier grades; definition, function and gases
<b>Assessments</b>	Activities; homework; formal assessment	Activities; exercises; homework	Activities; exercises; homework	Activities; exercises; homework
<b>Learning outcomes</b>	Apply knowledge of cell structure to differentiate between animal and plant cells using a light microscope	Explain specialisation of cells, and the link between levels of organisation in multicellular organisms	Identify the different food nutrients and list their significance to the human body	Describe the structure and functions of the human gas exchange system

	<b>Unit 9: Tropic responses</b>	<b>Unit 10: Skeletal systems of organisms</b>	<b>Unit 11: Classification of diseases</b>	<b>Unit 12: Human reproductive system</b>
<b>Number of lessons</b>	5 lessons	6 lessons	5 lessons	10 lessons
<b>Introduction</b>	Revise root structure	Discuss prior knowledge of skeletons and their functions	Discuss health and disease – prevalence and prevention in local community	Discuss gender in groups
<b>Classroom organisation</b>	Individual; pairs; groups	Individual; pairs; groups	Individual; pairs; groups	Individual; pairs; groups
<b>Equipment required</b>	Two bean plants; cotton thread; ink; a ruler; a cardboard box; a pair of scissors; a clinostat; bean seeds that have been soaked in water overnight; paper towels; elastic bands; marker pens; four glass jars; a pot plant	Different bones; a sharp pencil; a ruler; an eraser; drawing paper	Sugar (table sugar); table salt; two teaspoons; a clean one-litre bottle with a lid; boiled water; a clean measuring cylinder or any suitable container; soap	Two sets of cards of different colours

<b>Activities</b>	Conduct experiments on tropisms; research	Discuss; structure and function of different bones; draw; case study	Classify diseases; research the spread of different diseases; interpret information on a poster; prepare oral hydration fluid; research ageing	Relate structure to function; understand sex determination using role-play; discuss gender and gender equality issues
<b>Competences practiced</b>	Literacy; science and technology; data analysis, research	Literacy; research; team work	Literacy; cooperation	Literacy; cooperation
<b>Science practice</b>	Follow instructions; present and interpret results; tabulate; research skills	Interpret information; biological drawing; observe	Follow instructions; research information	Identify structures; relate structure to function; learn new terminology; compare sperm and ovum
<b>Vocabulary acquisition</b>	New words about tropisms	New words about types of skeletons and human bones	New words about diseases, their spread and prevention	New words about sexual reproductive organs, hormones and gender issues
<b>Study skills</b>	Research information; learn terminology	Learn terminology; comprehension skills	Interpret data in a pie chart	Learn terminology; label diagrams
<b>Revision</b>	Root structure and functions	Biological drawing	Deficiency diseases and the importance of a balanced diet	How structure is related to function
<b>Assessments</b>	Activities; exercises; homework	Activities; exercises; homework; formal assessment	Activities; exercises; homework	Activities; exercises; homework
<b>Learning outcomes</b>	Describe the response of plants to light and gravity, and explain the importance of tropic responses in plants	State the different types of skeleton, and identify the main parts of the skeleton	Classify diseases and explain ways of preventing the spread of infectious diseases	Explain the structure, function and processes of the human sexual and reproductive system, and relate to understanding sex and gender

	<b>Unit 13: Puberty and sexual maturation</b>	<b>Unit 14: Reproduction, pregnancy and childbirth</b>
<b>Number of lessons</b>	8 lessons	8 lessons
<b>Introduction</b>	Group discussion on teenage issues	Discuss prior knowledge about pregnancy
<b>Classroom organisation</b>	Individual; pairs; groups	Individual; pairs; groups
<b>Equipment required</b>	None	None
<b>Activities</b>	Learn new terminology; understand the events of the menstrual cycle; interpret information in a chart; perform role-play about unintended pregnancy	Discuss; learn new terminology
<b>Competences practised</b>	Literacy; cooperation	Literacy; critical thinking; cooperation
<b>Vocabulary acquisition</b>	New words about puberty and the menstrual cycle	New words about pregnancy and childbirth
<b>Vocabulary acquisition</b>	New words about puberty and the menstrual cycle	New words about pregnancy and childbirth
<b>Study skills</b>	Interpret information in a graph	Learn structures and functions
<b>Revision</b>	Reproductive structures and hormones	Reproductive structures and hormones
<b>Assessments</b>	Activities; exercises; homework	Activities; exercises; homework; formal assessment
<b>Learning outcomes</b>	Explain the physical, emotional and social changes related to puberty	Explain the processes of reproduction, pregnancy and childbirth

## 5. Biology and Society

### The role of Biology in society

Biology is the study of life, and it plays a central role in our daily lives. Biology helps us to understand living systems and how to maintain the health of people, animals and plants. It also helps us to understand what is beneficial and what is harmful to humans and the environment. The study of Biology has contributed to developments in medicine, conservation, agriculture, fisheries and food processing industries, in particular.

### Biology and the learner

Studying Biology as a subject prepares learners for future careers in medicine, agriculture, conservation, food science

and other related fields. It helps learners to understand the natural world and their role in it. It also encourages them to develop the necessary knowledge, skills, attitudes and values to tackle problems relating to people and the environment.

### Broad Biology syllabus competences

The syllabus lists the following broad Biology competences for learners at the end of the Ordinary Level:

1. Experience an enjoyable and worthwhile educational experience, whether or not they go on to study science beyond this level.
2. Acquire sufficient knowledge and understanding to:
  - Use ICT skills effectively to enhance learning and education to become

- confident citizens in a technological world and develop an informed interest in scientific matters
- Be suitably prepared for studies beyond the Ordinary Level of secondary education.
3. Recognise that science is evidence-based, and understand the usefulness and limitations of the scientific method.
  4. Analyse and explain scientific phenomena relating to real-life experience.
  5. Use and experiment using a range of scientific and technological tools and equipment, and draw appropriate conclusions.
  6. Develop skills that:
    - Are relevant to the study and practice of Biology
    - Are useful in everyday life
    - Encourage a systematic approach to problem solving
    - Encourage safe and efficient practice
    - Encourage effective communication through the language of science
    - Protect learners against common illnesses and fatal diseases, including HIV/AIDS and malaria
    - Develop motor skills to perform a variety of physical skills for leisure.
  7. Develop attitudes and basic values relevant to Biology, such as:
    - Concern for accuracy and precision, objectivity, integrity, enquiry, initiative, inventiveness, curiosity, research skills and creativity
    - Peace and tolerance, justice, respect for others and for human rights, solidarity and democracy, patriotism, hard work, commitment, resilience and dignity.
  8. Enable learners to appreciate that:
    - Science is subject to social, economic, technological, ethical and cultural influences and limitations
    - The applications of Science may be both beneficial and detrimental to

the individual, the community and the environment

- We need to respect life and the natural equilibrium
- We need to demonstrate awareness and concern for the environment, conservation and sustainability, and act accordingly
- We need to advocate personal, family and community health, hygiene and nutrition.

As explained earlier in the Introduction to this Teacher's Guide, these broad Biology and Health Science syllabus competences are to be developed with the generic competences, so that learners are able to communicate, use their imaginations, and apply critical thinking and problem-solving skills in a wide range of situations both inside and outside the classroom.

### **Ordinary Level Biology syllabus**

The syllabus lists the following key competences for Biology at the end of Secondary one:

- Explain the meaning of Biology and its application, recall the characteristics common to all organisms and be able to apply safety and first aid in daily life
- Explain classification and its significance
- Describe the external structure of a typical flowering plant
- Identify components, proper use and care of a hand lens and light microscope
- Differentiate between animal and plant cells using a light microscope
- Explain specialisation of cells, and the link between levels of organisation in multicellular organisms
- Identify the different food nutrients and their significance to the human body
- Describe the structure and functions of the human gas exchange system
- Describe response to light and gravity by plants, and explain the importance of trophic responses in plants

- Analyse the different types of skeletons and identify the main parts of human skeleton
- Classify diseases and explain ways of preventing the spread of infectious diseases
- Explain the structure, functions and processes of the human sexual and reproductive system, and relate to understanding sex and gender
- Explain the physical, social and emotional changes related to puberty
- Explain the process of reproduction, pregnancy and childbirth.

Since all learning occurs best in context, *New Secondary Biology and Health Sciences for Rwanda S1* is designed to provide learners in Secondary One with a range of meaningful and stimulating contexts that appeal to learners at the Lower Secondary Level. Knowledge, skills, attitudes and values are developed through different activities, in which learners are required to question, observe, make hypotheses, experiment, take notes, handle equipment, work as a team and so on. A variety of resources are also used for activities in the classroom and for fieldwork, including science equipment, microscopes, hand lenses, natural materials, posters, charts, sorting trays, nets and measuring devices. Each key unit competence is addressed effectively, and practical and helpful advice is given on what and how to assess whether learners have met this competence. In addition, particular attention is given to assisting teachers with organising learners in the science laboratory or during fieldwork, and with demonstrating how to use equipment effectively. Subject-specific vocabulary is highlighted too, so that learners develop the necessary skills to understand and use language in scientific contexts. Thus, *New Secondary Biology and Health Sciences for*

*Rwanda S1* is designed to support and encourage teachers to embrace the challenge of implementing the new Biology competence-based syllabus in Secondary One.

### **Health and safety practices for Biology**

Below are 10 basic rules for ensuring Biology is taught and learnt in a healthy and safe environment:

1. Use the appropriate laboratory equipment and materials to carry out experiments.
2. Demonstrate and explain clearly to learners how to use the equipment correctly and safely.
3. Identify potentially dangerous situations in the laboratory, classroom or during fieldwork, and ways to prevent these from happening.
4. Keep a first aid box in the laboratory, classroom or out in the field, and have clear procedures in place in the event of an emergency.
5. Store all materials safely and label them. Lock away hazardous materials.
6. Wear protective clothing (for example, gloves, eye gear) when handling hazardous materials.
7. Dispose of hazardous materials safely and legally.
8. Keep all materials, storage facilities, work surfaces and your own hands clean at all times. Wear disposable gloves when necessary.
9. Use ICT tools (for example, computers, the Internet) to demonstrate concepts and experiments that are too dangerous to demonstrate in a school environment.
10. Establish clear and firm rules for working in the laboratory, classroom or out in the field, and ensure all learners adhere to them at all times.

## Sub-topic: Biodiversity

### UNIT 1 Introduction to Biology

**Key unit competence:** To be able to explain the meaning of biology and its application, recall the characteristics common to all organisms and be able to apply safety and first aid in daily life.

#### At the end of this unit, learners should be able to:

- Define Biology and state its main branches
- Explain the importance of studying Biology
- Identify different forms of life from a wide range of organisms
- List the characteristics of living things
- Explain the principles of the first aid and how and when first aid kit is used
- Compare characteristics of life throughout different groups of organisms focusing on their nutrition, respiration, excretion, reproduction, growth, sensitivity and movement
- Compare living things and explain their differences
- Practice rules and regulations governing the laboratory and know how to avoid accidents
- Use first aid kit
- Know what to do if someone is injured in the laboratory
- Acknowledge the diversity and uniqueness of different organisms
- Appreciate the importance of Biology in society.

#### 1. Content summary

- Introduction to biology and different branches of Biology.
- Importance of studying biology.  
Characteristics of living things:
  - Nutrition
  - Respiration
  - Excretion
  - Reproduction
  - Growth
  - Sensitivity
  - Movement
- Safety rules and regulations in the laboratory
- First aid and first aid Kit

#### 2. Key vocabulary

Characteristics, photosynthesis, toxic

#### 3. Competences practised

Basic competence

- Literacy: Listening carefully for understanding and seeking clarification when necessary

Generic competence

- Research and problem solving: Research the internet or library for more information on the branches of Biology.
- Critical thinking: Learn to be safe in a laboratory or near scientific instruments.
- Communication: Communication is crucial when dealing with an accident in a laboratory.

#### 4. Cross-cutting issues

Environment and sustainability: Biology will help us understand how living organisms interact with their environments and how they keep a healthy balance to survive.

#### 5. Classroom organisation

Individuals and groups in classroom/ laboratory

#### 6. Teaching materials

Student's Book; some specimens of living and non-living things; Bunsen burner; matches; beaker; water; poster of laboratory safety rules; first aid kit

#### 7. Before you start

Teacher: Explain the learning objectives and any associated assessment. Arrange groups for oral activity. Discuss the photos in the Student's Book.

Learners: Ensure they understand clearly the objectives, activities and assessment. Discuss groups of animals and diseases. Talk about the photos on page 2.

#### 8. Teaching steps [4 periods]

##### Guidance on the introductory activity

This introductory activity helps you to engage learners in the introduction of **Introduction to Biology** and invites the learners to follow the next lessons.

##### Teacher's activity:

- Ask students to read carefully the activity and discuss the given questions.
- Engage students in working collectively the activity.
- Help students with different problems.
- Ask any four students to present their findings while others are following.

#### The expected answers

The answer will depend on the observation of students.

Characteristics that help to group living things are:

- Modes of feeding
- Ability of locomotion
- Modes of reproduction

What show that things are living are all characteristics of living things such as **Nutrition or feeding, Respiration, reproduction, movement and locomotion, growth and development, excretion, irritability or sensitivity, Other characteristics:** Adaptation, being composed by cells

#### Lesson 1 Introduction to biology and different branches of biology

- Teacher: Discuss activity 1.1 – the branches of Biology. Explain new terminology. Discuss why studying biology is important. Supervise Exercise 1.1. Monitor progress against planned timing.
- Learners: Complete self assessment 1.1. Discuss whether learning outcomes have been achieved.
- Teacher: Discuss answers to self assessment 1.1. Discuss case study and reinforce learning outcomes.
- Learners: Contribute to feedback and ensure all learning outcomes have been met.

#### Lesson 2 Importance of studying biology

- Learners do the activity 1.2 in student book.
- Teacher helps them in their discussion and explain the concepts.
- Learners do the question in self assessment 1.2.



### **Lesson 3 Characteristics of living things**

- Teacher: Explain learning objectives and any associated assessment. Review prior learning of characteristics of living things. Show learners some specimens and decide whether they are living or dead. Collect learners' ideas for achieving the objective(s).
- Learners: Hold a group discussion on the characteristics of living things. Observe specimens and decide whether they are living or non-living, and give reasons.
- Teacher: Discuss the seven characteristics of living things, and explain all new terminology. Discuss the diversity of organisms. Outline the learning activities with clear guidelines relating to effectiveness and timing. Check tabulation skills, and revise if necessary. Supervise learning activity. Monitor progress against planned timing.
- Learners: Review Table 1.1 in the Student's Book, and learn the seven characteristics of living things. Learners to complete self assessment 1.3 individually and examine whether the learning outcomes have been achieved. Understand the diversity of living things.
- Teacher: Check answers and reinforce learning outcomes.
- Learners: Contribute to feedback, and ensure all learning outcomes have been met.

### **Lesson 4 Safety rules and regulations**

- Teacher: Review prior learning about safety rules. Discuss the need for safety rules. Collect learners' ideas for achieving the objective(s). Ensure that there is a clear understanding of objectives, activities and assessment
- Learners: Explore and give feedback relevant to prior learning

- Teacher: Arrange groups to complete Activity 1.4. Demonstrate safe lighting of a Bunsen burner to boil water. Supervise activity, with concern for safety. Monitor progress against planned timing.
- Learners: Do Activity 1.4 with care. Focus on learning objectives, and concentrate on learning gains from each activity. Complete tasks, and examine whether learning outcomes have been achieved.
- Teacher: Capture feedback about safety precautions from Activity 1.4. Reinforce learning outcomes by reading through safety rules.
- Learners: Discuss whether safety rules were followed. They also do the questions of self assessment 1.4.

### **Lesson 5 First aid and the first aid kit**

- Teacher: Explain learning objectives and any associated assessment. Discuss the need for a first aid kit. Arrange groups. Collect learners' ideas for achieving the objective(s).
- Learners: Complete Activity 1.5 in groups. Ensure that there is a clear understanding of objectives, activities and assessment.
- Teacher: Discuss Activity 1.5. Review some of the first aid outlined in the Student's Book. Set up first aid kits for learners to use. Supervise learning activities. Monitor progress against planned timing.
- Learners: Provide feedback for Activity 1.5. Complete self assessment 1.5 and discuss. Complete tasks, and examine whether learning outcomes have been achieved.
- Teacher: Discuss and check the self-assessment 1.5.

## 9. Support for learners with learning difficulties

### Remedial

1. List the seven characteristics of living things.
2. Write down three branches of Biology.
3. Give definitions for each of the following terms:
  - a) respiration
  - b) sensitivity.

### Answers

1. Movement, sensitivity, respiration, nutrition, excretion, growth, reproduction
2. Any three branches described in Figure 1.3.
3. a) A series of chemical reactions that take place in all living cells to make energy  
b) Responsiveness to changes in the environment

### Consolidation

1. Write down any four branches of Biology and explain what each one is.
2. Give three resources that we get from living things.
3. List three essential items in a first aid kit.

### Answers

1. Any four branches described in Figure 1.3.
2. Any resources such as food crops, fabrics, building materials, etc.
3. Burn shield, plasters, eyewash

### Extension

1. Write down any other career in Biology that is NOT mentioned in this unit.
2. Find out the names of two plants that are used to make medicines.
3. Find out more about respiration.

### Answers

1. Any career such as dietician, pathologist, etc.
2. Answers will vary. Examples: quinine comes from the quinine tree; aspirin comes from the willow tree.
3. Learners can find out more about the requirements and products of respiration.

## 10. Suggested answers for activities

### Introductory activity

1. Any animal group. Examples: insects – locusts, beetles; fish – trout, perch; mammals – donkey, lion
2. Mammals, fish, birds, arthropods, reptiles, amphibians
3. Biology

### Activity 1.1

1. The study of life
2. Any three branches of Biology – use Figure 1.3 in the Student's Book. Examples: taxonomy – the study of the classification of living things, how they are identified, and what makes them similar and/or different; biotechnology – the study of the use of biological processes in industry and in the production of medicines, such as antibiotics

### Activity 1.2

Refer to student's book for answers to questions of this activity.

### Activity 1.3

1. Nutrition, sensitivity, movement, reproduction, growth
2. Learners consider the characteristics of life .

### Activity 1.4

1. Liquid on floor, sucking liquid out of beaker, inserting finger into electrical plug socket, beaker on edge of bench, dripping tap, leakage from apparatus, candle burning near liquid, broken glass on floor, spilt chemical powder, pouring liquid close to Bunsen burner, learner not wearing shoes, pouring liquid too fast and spilling, heating test tube without safety glasses and pointing it at other learners
2. Learners make lists and compare them.
3. Make sure benches are clear of chemicals, carefully light Bunsen burner, wear safety goggles and laboratory coats, be careful of hot water.

### Activity 1.5

1. Answers will vary. Examples: burns from spilt chemicals, cuts from broken glass, slipping on spilt liquids
2. Learners should list items such as burn shields, plasters, tweezers, gauze pads and bandages.

## 11. Answers for end unit assessment 1

1. A – respiration      B – growth  
C – nutrition        D – sensitivity
2. 2.1 – B                2.2 – E  
2.3 – A                2.4 – G  
2.5 – D                2.6 – C  
2.7 – F
3. Tell the teacher.
4. Treatment for a cut:
  - Stop the bleeding by applying direct pressure on the area.
  - Clean the area using warm water.
  - Apply an antiseptic ointment.
  - Cover the cut with a sterile bandage or non-stick plaster.
  - If the cut is deep, go to a clinic or doctor.
- 5,6,7 refer to student book.

## Sub-topic: Classification of living things

### UNIT 2 Introduction to classification

**Key unit competence:** To be able to explain the need for, and apply classification and use identification keys to name unknown specimens.

**At the end of this unit, learners should be able to:**

- Explain why we need to classify living organisms
- Name the five kingdom system of classification
- Name the characteristics of the organisms making up the five kingdoms
- Apply the binomial system of naming species
- Compare living and non-living things and explain their differences
- Explain hierarchical classification
- Explain how organisms are grouped together into different taxonomic categories
- Use simple identification keys to identify given organisms
- Appreciate the need for classification of organisms.

#### 1. Content summary

- Importance of classification
- The concept of hierarchical classification
- The binomial system for genus and species
- The five kingdom system of classification and the main features of each kingdom.
- Use of simple identification keys.

#### 2. Key vocabulary

Taxonomy, hierarchical classification, binomial system, prokaryotic, dichotomous key

#### 3. Competences practised

Basic competence

- Literacy: Listening carefully for understanding and seeking clarification when necessary

Generic competence

- Data analysis: The use of identification keys to gather data
- Critical thinking: Weigh up evidence and make appropriate decisions based on experience and relevant learning

#### 4. Cross-cutting issues

Peace and values education: When you are working in pairs or as a group during an activity, work in unity and respect each other's point of view.

#### 5. Classroom organisation

Pairs and groups in classroom

#### 6. Teaching materials

Collected specimens and photos; collected specimens of a variety of organisms

## 7. Before you start

- Teacher: Explain the learning objectives and any associated assessment. Review prior learning. Collect learners' ideas for achieving the objective(s). Facilitate oral activity.
- Learners: In groups, complete oral activity about living and non-living things. Guess the number of different animals and plants in Rwanda. Discuss how to put into groups.

## 8. Teaching steps [5 periods]

### Guidance on the introductory activity

This introductory activity helps you to engage learners in the introduction of Introduction to classification and invites the learners to follow the next lessons.

### Teacher's activity:

- Ask students to read carefully the activity and discuss the given questions.
- Engage students in working collectively the activity.
- Help students with different problems.
- Ask any four students to present their findings while others are following.

### The expected answers

The answer will vary and depend on the observation of students.

### Lesson 1 The importance of classification

- Teacher: Discuss the need for classification of the diverse plants and animals in Rwanda. Outline Activity 2.1 and give clear guidelines relating to effectiveness and timing. Supervise the activity and revise tabulation if necessary. Monitor progress against planned timing.
- Learners: Complete Activity 2.1 in pairs. Ensure tabulation is correct. Complete tasks and examine whether learning outcomes have been achieved.

- Teacher: Capture feedback from Activity 2.1. Reinforce learning outcomes.
- Learners: Contribute to feedback and ensure all learning outcomes have been met.

### Lesson 2 The concept of hierarchical classification

- Teacher: Consolidate the need for classification of the diverse plants and animals in Rwanda. Explain the term 'hierarchical classification'.
- Learners: Refer to the photos and diagrams in the Student's Book.
- Teacher: Discuss the five kingdoms used for classification, and explain the characteristics of each one. Use figures and specimens for each kingdom.
- Learners: Classify examples of organisms into each of the five kingdoms.
- Teacher: Practise the mnemonic for the classification groups. Reinforce learning outcomes.
- Learners: Contribute to feedback and ensure all learning outcomes have been met.

### Lesson 3 The binomial system

- Teacher: Remind learners about the need to name organisms. Explain language difficulties.
- Learners: Discuss how the naming of organisms needs to be universal.
- Teacher: Develop the concept of the binomial system using examples. Set up specimens and photos for learners to place in groups. Monitor progress against planned timing.
- Learners: Practise naming different organisms. Place specimens into groups based on characteristics.

#### Lesson 4 The five system kingdom

- Ask learners to recall characteristics of living things
- Explain the five kingdoms of organisms as they are new to learners.

#### Lesson 5 Use simple identification keys

- Teacher: Ask learners how they would classify the things in their desks or pencil boxes. Explain what an identification key is.
- Learners: Look in desks or pencil cases, and arrange items in groups.
- Teacher: Go slowly and carefully through the steps for using a key in Activity 2.5.
- Learners: Work out how to use identification keys.
- Teacher: Consolidate how to use a key. Reinforce learning outcomes.
- Learners: Contribute to feedback, and ensure all learning outcomes have been met.
- Teacher: Consolidate identification keys. Set up specimens and pictures of different organisms.
- Learners: Check understanding of steps in using an identification key.
- Teacher: Refer to question 5 in Activity 2.5. Outline the learning activities with clear guidelines relating to effectiveness and timing. Learners to complete question 5 using specimens. Monitor progress against planned timing.
- Learners: Draw up an identification key using specimens and/or photos. Complete tasks and examine whether learning outcomes have been achieved.
- Teacher: Consolidate how to use a key. Reinforce learning outcomes.
- Learners: Contribute to feedback, and ensure all learning outcomes have been met.

### 9. Support for learners with learning difficulties

#### Remedial

1. Name the five kingdoms of organisms.
2. Identify the kingdoms to which each of these organisms belongs:
  - a) It has a cell wall and chloroplasts.
  - b) It is a single cell.
  - c) It reproduces by means of spores.
3. In the name *Panthera leo*, which is the species and which is the genus name?

#### Answers

1. Animals, plants, fungi, protocista, monera
2. a) Plants  
b) Protocista  
c) Fungi
3. *Panthera* is the genus; *leo* is the species.

#### Consolidation

1. Give an example of one organism in each kingdom.
2. Explain how the binomial system works.
3. List the features of plants.

#### Answers

1. Animal – human; plants – maize; fungi – mushroom; protocista – amoeba; monera – bacteria
2. Each organism is given two names: a genus and a species name. These are Latin names, so they are recognised worldwide.
3. They contain chlorophyll and have cell walls.

#### Extension

1. What does the word 'prokaryotic' mean?
2. Find out the scientific names of any three organisms not mentioned in this unit.
3. Design an identification key. Collect four different leaves from outside. Call them A, B, C and D. Draw up a key to identify them. Let other learners test your key.

## Answers

1. It means that there is no membrane around the genetic material of an organism.

## 10. Suggested answers for activities

### Activity 2.1

1. Living: frog, sprouting seed;  
non-living: aeroplane, tree log
2. The frog and the seed show the seven characteristics of living things; the aeroplane and the log do not.
3. a) Aeroplane  
b) Tree log
4. Animal: frog; plant: sprouting seed
5. The frog feeds on other organisms and moves around. The sprout is green, so it contains chlorophyll and makes its own food in the presence of sunlight.

### Self assessment 2.1

1. i. For easy identifying organisms.  
ii. Allows scientists to identify, group and properly name a newly discovered organism  
iii. To avoid chaos and confusion among scientists.
2. Common names are only used in a certain region by people who understand the local language. For the scientists worldwide to understand each other scientific names had to be introduced.

### Self assessment 2.2

1. species, genus, family, order, class, phylum, kingdom

### Self assessment 2.3

1. a) Linnaeus  
b) Taxonomy
2.  
2.1 – F   2.2 – D   2.3 – E   2.4 – B  
2.5 – G   2.6 – C   2.7 – A

## Self assessment 2.4

1. Animals, plants, fungi, protoctista, monera
2. a) Plants  
b) Protoctista  
c) Fungi
- 3.

Kingdom	Animalia	Buffalo, hyena, hare, cheetah, jellyfish, lynx
Phylum	Chordata	Buffalo, hyena, hare, cheetah, lynx
Class	Mammalia	Buffalo, hyena, hare, cheetah, lynx
Order	Carnivora	Hyena, cheetah, lynx
Family	Felidae (cats)	Cheetah, lynx

## 11. End unit assessment 2

- 1) (a) Species
- 2) (c) Annelida
- 3) The following are the answers:

Name of organism	Kingdom
Housefly	Animalia
Maize	Plantae
Frog	Animalia
Bat	Animalia
Eagle	Animalia

- a) Classification of organisms into respective Kingdoms
- b) Maize and frog because maize has chlorophyll and cell wall while in a frog they are absent.
- c) Mays represent a species.
- d) A species is the smallest group of classification where organisms resemble one another and they are capable of interbreeding together to produce viable offspring

Plants have cells with chloroplasts that contain chlorophyll thus are autotrophs while members of fungi do not have chloroplasts and they feed heterotrophically (are saprophytes).

4. Refer to student book

5.

<b>Kingdom</b>	Animalia	Cow, perch, locust, lion, donkey, leopard
<b>Phylum</b>	Chordata	Cow, perch, lion, donkey, leopard
<b>Class</b>	Mammalia	Cow, lion, donkey, leopard
<b>Order</b>	Carnivora	Lion, leopard
<b>Family</b>	Felidae (cats)	Lion, leopard

6. Learners to draw a dichotomous key using visible features to identify the following:

A – fish; B – pigeon; C– butterfly; D – ant.

**Key:**

1. Has a backbone

\_\_\_\_\_ See 2

Does not have a backbone

\_\_\_\_\_ See 3

2. Moves by means of wings

\_\_\_\_\_ *Pigeon*

Moves by means of fins

\_\_\_\_\_ *Fish*

3. Can fly \_\_\_\_\_ *Butterfly*

Cannot fly \_\_\_\_\_ *Ant*



## Sub-topic: Classification of living things

### **UNIT 3** The external structure and importance of flowering plants

**Key unit competence:** To be able to analyse the external structure of a typical flowering plant

#### **At the end of this unit, learners should be able to:**

- Explain why we need to use magnifying instruments
- Identify a given unknown specimen
- Recall that a hand lens is a simple magnifying glass for observing relatively small objects
- Identify the different components of a light microscope and explain their functions
- Recall that microscopes are delicate instruments that need great care
- Explain that the light microscope has various levels of magnification
- List the features of a good biological drawing
- Explain that magnification is the number of times larger an image is than the object (specimen) under the microscope
- Manipulate a hand lens to observe relatively small specimens
- Manipulate a light microscope to observe various specimens from prepared slides
- Illustrate the biological specimens observed under a light microscope
- Illustrate well labelled biological diagrams of specimens
- Compare the relationship between the actual size of the specimen and its image
- Measure and calculate the magnification of a given specimen
- Appreciate the need for using a light microscope and a hand lens in observation of specimens
- Show perseverance when making scientific observations
- Show care and proper use of the magnifying instruments.

#### **1. Content summary**

- External structure of a flowering plant limited to the shoot system: stems, leaves and flowers.
- External structure of root systems and functions.
- Functions of modified stems, leaves and roots.
- Importance of flowering plants.

#### **2. Key vocabulary**

Monocotyledons, dicotyledons, node, internode, pollination, dispersal, modified, asexual reproduction, lamina, petiole, surface area, midrib, inflorescence, ovules, tap root, fibrous root

#### **3. Key competences practised**

Basic competence

- Literacy: Listening carefully for understanding and seeking clarification when necessary

Generic competence

- Data analysis and presentation of findings: Learn how to collect data, analyse and present findings.
- Communication: Develop good communicating skills when working in groups.
- Research: Research hydroponics

#### 4. Cross-cutting issues

Environment and sustainability: We need to ensure that we use sustainable farming practices in Rwanda.

#### 5. Classroom organisation

Individuals, pairs and groups in classroom/laboratory

#### 6. Teaching materials

Specimens of flowering plants (with roots, stem, leaves and flowers) – one monocotyledon and one dicotyledon, e.g. a bean plant or black jack; a hand lens; specimens or photos of a rhizome of ginger, a canna lily, couch grass or potato; a creeping stem of oxalis; a corm of coco yam; a stolon of a strawberry; specimens of different types of leaves and of modified leaves, e.g. onion, cactus; specimens of different flowers; plants with fibrous and tap root systems; examples of modified roots such as carrots, cassava and sweet potato; specimens or photos of prop roots of maize or sugarcane; clasping roots of vanilla; aerial roots of *Ficus*; buttress roots of flamboyant tree; breathing roots of white mangrove; stilt roots of red mangrove; storage root of carrot or sweet potato; reference books

#### 7. Before you start

- Teacher: Arrange learners in groups. Facilitate discussion on prior knowledge from Upper Primary about the functions of flowers and asexual reproduction. Discuss the importance of food crops in reference to Figure 3.1.
- Learners: Do the Oral activity in groups. Ensure a clear understanding of objectives, activities and assessment.

#### 8. Teaching steps [10 periods]

#### Guidance on the introductory activity

This introductory activity helps you to engage learners in the introduction of The external structure and importance of flowering plants and invites the learners to follow the next lessons.

#### Teacher's activity:

- Ask students to read carefully the activity and discuss the given questions.
- Engage students in working collectively the activity.
- Help students with different problems.
- Ask any four students to present their findings while others are following.

#### The expected answers

Answer will vary and depend on the students' observations.

#### Lesson 1 The external structure of a flowering plant

- Teacher: Describe the structure of a flowering plant using the specimen. Draw a table to show the differences between monocotyledonous and dicotyledonous plants. Monitor progress against planned timing.
- Learners: Observe the specimens of monocotyledonous and dicotyledonous plants. Analyse the differences listed in Table 3.1 in the Student's Book. Complete tasks, and examine whether learning outcomes have been achieved.
- Teacher: Prepare learners for doing Experiments 3.1 and 3.2 by revising biological drawings. Reinforce learning outcomes.
- Arrange learners in pairs. Provide guidance for Experiment 3.1.
- Learners: Contribute to feedback, and ensure all learning outcomes have been met.

- Learners: Read instructions for Experiment 3.1 and 3.2.
- Teacher: Facilitate learners' completion of Experiment 3.1 and 3.2. Monitor progress against planned timing.
- Learners: Complete Experiment 3.1 and 3.2, and examine whether learning outcomes have been achieved.

### a) The stem

- Teacher: Set up specimens of different stems. Discuss stem modifications. Revise biological drawings.
- Learners: Consolidate position and features of stem.
- Teacher: Describe how the stem's structure is related to its functions. Outline the learning activities with clear guidelines relating to effectiveness and timing. Learners complete Experiment. Monitor progress against planned timing.
- Learners: Complete Experiment. Complete tasks and examine whether learning outcomes have been achieved.
- Teacher: Check drawings. Consolidate structure and function relationship. Reinforce learning outcomes.
- Learners: Contribute to feedback, and ensure all learning outcomes have been met.

### b) Leaves

- Teacher: Use specimens to show how leaves can differ. Recall differences in leaves in monocotyledons and dicotyledons.
- Learners: Observe leaves.
- Teacher: Review leaves with reference to Figure 3.5. Outline the learning activities with clear guidelines relating to effectiveness and timing. Discuss the functions of leaves.
- Learners: Ensure they know new terminology and functions of the parts of leaves as shown in Table 3.2 in the Student's Book.

- Teacher: Consolidate structure related to function. Reinforce learning outcomes.
- Learners: Contribute to feedback, and ensure all learning outcomes have been met.

### c) Flowers

- Teacher: Use specimens of flowers to show learners the different parts of a flower. Decide whether specimen is a monocotyledon or a dicotyledon.
- Learners: Observe flower parts.
- Learners: Identify the parts of a flower and explain the function of each part. Complete Exercise 3.1. Complete tasks and examine whether learning outcomes have been achieved.
- Teacher: Discuss answers to Exercise 3.1. Reinforce learning outcomes.
- Learners: Contribute to feedback and ensure all learning outcomes have been met.

## Lesson 2 The external structure of a root system

- Teacher: Consolidate prior knowledge of parts of plants. Revise differences between roots of monocotyledonous and dicotyledonous plants. Arrange learners in groups.
- Learners: Explore and give feedback relevant to prior learning.
- Teacher: Use specimens to show different root systems: tap and fibrous. Discuss the main functions of roots. Describe root modifications using examples. Monitor progress against planned timing.
- Learners: Observe types of roots, understand their functions and identify modifications of roots. Complete Experiment 3.5. Complete tasks, and examine whether learning outcomes have been achieved.

- Teacher: Collate feedback from learners. Check accuracy of drawings. Reinforce learning outcomes.
- Learners: Contribute to feedback, and ensure all learning outcomes have been met.

### Lesson 3 The importance of flowering plants

- Teacher: Outline the importance of plants to human beings.
- Learners: Understand the importance of plants.
- Teachers: Outline Activity 3.3, giving clear guidelines relating to report writing, effectiveness and time frame. Monitor progress against planned timing.
- Learners: Complete Activity 3.3. Examine whether learning outcomes have been achieved.
- Teacher: Collate feedback from learners experiment 3.5. Check accuracy of drawings. Reinforce learning outcomes.
- Learners: Contribute to feedback, and ensure all learning outcomes have been met.

### Assessment

- Teacher: Give guidance on peer assessment. Arrange learners in pairs.
- Learners: Read through the assessment activity.
- Teacher: Monitor progress of assessment activity against planned timing. Introduce formal assessment task.
- Learners: Complete assessment activity in pairs. Complete Formal assessment task, and examine whether learning outcomes have been achieved.
- Teacher: Reinforce learning outcomes.
- Learners: Contribute to feedback, and ensure all learning outcomes have been met.

## 9. Support for learners with learning difficulties

### Remedial

If learners have difficulty grasping the structure of flowering plants, give them the following three questions:

1. Define each of these words:
  - a) node
  - b) stamens
  - c) lamina
  - d) modified
  - e) petiole
  - f) midrib.
2. Draw a diagram to show the difference between a tap root system and a fibrous root system.
3. Give two examples of plants that have modified:
  - a) roots
  - b) stems
  - c) leaves.

### Answers

1. a) The place where a shoot/leaf attaches to the stem  
 b) The male parts of the flower; they consist of the anthers and the filaments  
 c) The thin, flat surface of the leaf  
 d) Changed for a particular function  
 e) The short stalk that attaches a leaf to the stem  
 f) The main vein in a leaf
2. See Figure 3.8
3. a) Carrot, sweet potato  
 b) Ginger, potato, yam  
 c) Onion, garlic, cactus

### Consolidation

1. a) What is meant by the term 'surface area'?  
 b) Why does a leaf have a large surface area?  
 c) How does this help the leaf in its function of photosynthesis?

2. List three plants that have modified:
  - a) stems
  - b) roots
  - c) leaves.
3. Give two functions of:
  - a) roots
  - b) veins
  - c) stems.

### Answers

1. a) 'Surface area' refers to the area of the outside part of an object.  
 b) To trap the maximum amount of light energy  
 c) Light is needed for photosynthesis, so a large surface area enables more photosynthesis to occur.
2. a) Ginger, potato, yam, strawberry, banana, sisal  
 b) Carrot, sugarcane, sweet potato  
 c) Onion, garlic, succulent, cactus
3. a) Absorb water and mineral salts and provide anchorage in soil.  
 b) Transport water and food and provide support for the leaf.  
 c) Provide attachment for leaves and flowers; support fruits; can photosynthesise; transport water and food.

### Extension

1. Some plants are modified for asexual reproduction by having suckers and stolons. Find out about other ways in which plants can reproduce asexually.
2. A plant has flowers parts in multiples of four and a net-like pattern of veins. What type of plant is this?

### Answers

1. Use the following websites for research:  
[http://www.biology4kids.com/files/plants\\_reproduction.html](http://www.biology4kids.com/files/plants_reproduction.html)  
<http://study.com/academy/lesson/asexual-reproduction-in-plants-advantages-disadvantages-types.html>

2. It is a dicotyledonous plant.

### Checklist 1

Report ...	Yes	No
1. is accurate	1	0
2. contains sufficient information	1	0
3. uses some subheadings	1	0
4. shows evidence of research	1	0
5. is neat and well presented	1	0
<b>Total</b>	<b>5</b>	<b>5</b>

### Checklist 2

Drawing ...	Yes	No
1. is accurate	1	0
2. has correct labels for features or parts	1	0
3. is large and clear	1	0
4. has straight label lines	1	0
5. has a heading/title	1	0
<b>Total</b>	<b>5</b>	<b>5</b>

## 10. Suggested answers for activities

### Activity 3.1

Check that learners have correctly labelled shoot system, root system, bud, node, internode, leaves, stem, flowers, fruits and roots.

### Self assessment 3.1

1. Shoot system – enables the plants to make leaves  
 Root system – absorbs soil water;  
     anchors the plant into the soil  
 Bud – produces new leaves and flowers  
 Node – the place where shoots form on the main stem  
 Internode – the distance between two shoots  
 Leaves – photosynthesis

Stem – supports flowers and leaves;  
pathway for transport of water and food

Flowers – reproductive structures

Fruits – contain seeds

Roots – absorb soil water; anchor the plant into the soil.

2, 3,4. Refer to student book

5. a) Carries food made by photosynthesis from the leaf to the stem; transports mineral salts and water from the stem to the leaf; supports the leaf.
- b) The transfer of pollen grains from the stamens to the stigma.
- c) A plant that has one seed leaf, or cotyledon.
6. a) Leaves are the main organs of photosynthesis.
- b) Leaves are suited to their function in the following ways:
  - They have a large surface area, to trap sunlight.
  - They contain chlorophyll, which is needed for photosynthesis.
  - They contain stomata, which enable the exchange of gases.
  - Their veins transport water to the cells for photosynthesis and move the products of photosynthesis to other parts of the plant.
7. A monocotyledonous plant

### Activity 3.2

- Prop roots – large roots above ground that support the plant.
- Clasping roots – roots with outgrowths that can twist around other plants for support.
- Aerial roots – thick roots above ground that support the plant.

- Buttress roots – thick roots above ground that support the plant.
- Breathing roots – roots with large spaces between their cells to enable gases to move through them.
- Stilt roots – large roots above ground that provide support.
- Storage roots – roots that contain tissues that can be used to store carbohydrates.

Learners to make labelled drawings of some roots that they have collected.

### Activity 3.3

Learners should research plants that are used in Rwanda. For example, they could discuss food crops grown in their local area, plants that are used as medicines in their community, and plants used to make different items, e.g. cotton, sisal, wood for construction and furniture.

## 11. Answers for End Unit assessment 3

1. a) Lamina  
b) Tap root  
c) Monocotyledons
2. Learners to draw a diagram of a flower using Figure 3.7 in the Student's Book to help them. Then, they must ask their partners to label the different parts: petals, sepals, stigma, style, anther, ovary, nectary, carpel and stamen.
3. The leaf is adapted in the following ways to enable it to photosynthesise:
  - It has a large surface area, to trap sunlight.
  - It contains chlorophyll, which is needed for photosynthesis.

- It contains stomata, which enable the exchange of gases.
- Its veins transport water to the cells for photosynthesis and move the products of photosynthesis to other parts of the plant.

4, 5, 6. Refer to Q4 b, c in formal assessment below.

- can be used to make medicines
- can be used to make fabrics
- help to make our surroundings beautiful. (Any 3) (3)

5. Use rubric 1 to mark the poster: (14)

## 12.

### Formal assessment answers

- A – mongoose
  - B – black-backed jackal
  - C – bat-eared fox
  - D – duiker
  - E – buffalo
  - F – large-scaled girdled lizard
  - G – scorpion
  - H – blue crane (8)
- Modified leaves
  - Modified stem
  - Modified root (3)
- 3.1 Animals
  - 3.2 Plants
  - 3.3 Accept any plant, e.g. hibiscus
  - 3.4 Reproduce by means of spores/  
do not photosynthesise
  - 3.5 Mushroom/yeast
  - 3.6 Protoctista
  - 3.7 Do not have a nucleus (7)
- Learners draw a labelled diagram similar to Figure 3.7 in the Student's Book. (8)
  - Tap root and fibrous root system (2)
  - Flowering plants are important because they:
    - are a food source for animals and people
    - maintain a balance of gases in the atmosphere
    - are important food crops
    - provide shelter
    - are a source of timber

## Rubric 1

CRITERIA	5	4	3	2	1
	Excellent	Very good	Good	Fair	Needs help
Headings, main points, facts/ concepts	Excellent. Bold heading. Relevant facts. Interesting, with evidence of research and insight	Clear heading. Facts clear and well ordered. Well researched.	Clear heading. Facts mostly clear and well ordered	Heading clear but not appropriate. Facts clear but not well ordered	Not clear/ muddled. Important facts left out/ lost in detail
Interesting information		Excellent information. Evidence of extensive research	Good information. Evidence of some research	Adequate information. Little evidence of research	Poorly researched. Insufficient information
Organisation, layout, aesthetic appeal, use of colour	Excellent layout and organised use of relevant visuals/colour. Strikingly appealing		Eye-catching. Good use of colour/ additional relevant pictures. Appealing layout		Adequate use of colour and order in layout. A good effort

**Total marks: 45**



## TOPIC 2 | Organisation and maintenance of life

### Sub-topic: Cell structure

#### UNIT 4 Magnifying instruments and biological drawings

**Key unit competence:** To be able to explain the components and demonstrate proper use and care of a hand lens and light microscope.

##### At the end of this unit, learners should be able to:

- Explain why we need to use magnifying instruments
- Identify a given unknown specimen
- Recall that a hand lens is a simple magnifying glass for observing relatively small objects
- Identify the different components of a light microscope and explain their functions
- Recall that microscopes are delicate instruments that need great care
- Explain that the light microscope has various levels of magnification
- List the features of a good biological drawing
- Explain that magnification is the number of times larger an image is than the object (specimen) under the microscope
- Manipulate a hand lens to observe relatively small specimens
- Manipulate a light microscope to observe various specimens from prepared slides
- Illustrate the biological specimens observed under a light microscope
- Illustrate well labelled biological diagrams of specimens
- Compare the relationship between the actual size of the specimen and its image
- Measure and calculate the magnification of a given specimen
- Appreciate the need for using a light microscope and a hand lens in observation of specimens
- Show perseverance when making scientific observations
- Show care and proper use of the magnifying instruments.

#### 1. Content summary

- Need for magnifying instruments in Biology
- Features of a hand lens
- Parts of a light microscope.
- Functioning of the light microscope
- Biological drawings
- Calculation of magnification.

#### 2. Key vocabulary

Magnified, epidermis, proportion, magnification

#### 3. Competences practised

Basic competence

- Literacy: Listening carefully for understanding and seeking clarification when necessary
- Science and technology: Learn how to use magnifying instruments and how to take care of them.

Generic competence

- Data analysis and presentation of findings: Collect biological specimens for Homework activity

#### 4. Cross-cutting issue

Environment and sustainability: Think about how you dispose of microscopes and other old pieces of technology. How can you do this in a way that doesn't damage the environment?

#### 5. Classroom organisation

Pairs and groups in classroom/laboratory

#### 6. Teaching materials

Hand lenses; microscopes; microscope slides; glycerine; razor blade; pollen grains; cover slips; needle; forceps or small tweezers; dropper; onion bulb; iodine solution; dead fly or mosquito; biological specimens

#### 7. Before you start

- There are practical activities in this unit for which you will need to prepare in advance of the lessons. If your school does not have sufficient microscopes for the learners to use, you can do the practical activities as a demonstration.
- Teacher: Discuss the new topic and sub-topics. Look at Figure 4.1, and start learners thinking about why we need microscopes. Establish prior knowledge. Arrange learners in groups.
- Learners: Understand the content of the new topic and learning outcomes.

#### 8. Teaching steps [6 periods]

##### Guidance on Introductory activity

Guide students to work on the introductory activity that is in the student textbook.

Suggested answers on:

- 1) • To come up with a clear description of an observed thing.
  - To facilitate the study of that thing.

- 2) Magnification is the increase of an object observed under a magnifying instrument to be well studied.
- 3) Students may say that in previous levels they observed small structures under the magnifying instruments in order to have detail information on them.

#### Lesson 1 Why do we need magnifying instruments?

- Teacher: Outline the learning activities with clear guidelines relating to effectiveness and timing. Facilitate the oral activity. Monitor progress against planned timing.
- Learners: Complete the introductory activity in groups. Complete tasks, and examine whether learning outcomes have been achieved. Then after, complete the activity 4.1
- Teacher: Consolidate what magnification is and which instruments are used for magnifying specimens. Reinforce learning outcomes.
- Learners: Contribute to feedback, and ensure all learning outcomes have been met.

#### Lesson 2 Parts and functioning of a microscope

- Teacher: Show learners a hand lens. Pass it around the class, and let the learners look through it.
- Learners: Understand how hand lenses and microscopes enlarge images.
- Teacher: Demonstrate the compound microscope and the functions of its parts using an actual microscope, or use Figure 4.5 in the Student's Book. Outline the learning activities with clear guidelines relating to effectiveness and timing. Learners complete activity 4.2 in groups. Monitor progress against planned timing.

- Learners: Observe the parts and functions of a light microscope. Complete activity 4.3, and examine whether the learning outcomes have been achieved.
- Teacher: Ensure learners are confident with the parts and functions of the microscope in preparation for the next lesson. Reinforce learning outcomes.
- Learners: Contribute to feedback, and ensure all learning outcomes have been met.

### Lesson 3 How to use and store a microscope

- Teacher: Read through the instructions for Activities 4.2 and 4.3, and demonstrate how to use and store the microscope. Emphasise the need to look after microscopes and handle them properly.
- Learners: Listen carefully to how to use a microscope.
- Teacher: Outline the learning activities with clear guidelines relating to effectiveness and timing. Learners complete Activities 4.2 and 4.3. Facilitate learners as they work through the two activities. Monitor progress against planned timing.
- Learners: Complete Activities 4.2 and 4.3, and examine whether learning outcomes have been achieved.
- Teacher: Check that microscopes have been safely packed away. Reinforce learning outcomes.
- Learners: Contribute to feedback, and ensure all learning outcomes have been met.

### Lesson 4 Biological drawings

- Teacher: Discuss learners' drawings from the previous lesson. How could they be improved?

- Learners: Look at drawings, and comment on how they could be improved.
- Teacher: Make a list of features of a good biological drawing. Discuss magnification, and work through the worked example in the Student's Book. Then relate magnification to biological drawings. Do the worked example.
- Learners: Think of ways to improve drawings, and examine whether learning outcomes have been achieved.
- Learners: Contribute to feedback and ensure all learning outcomes have been met.

### Lesson 5 Assessment

- Teacher: Allow learners time to go outside to collect specimens for viewing.
- Learners: Collect specimens.
- Teacher: Outline the learning activities with clear guidelines relating to effectiveness and timing. Learners complete Experiment 4.1. Monitor progress against planned timing.
- Learners: Complete Experiment 4.1. Use a hand lens to view the specimen and do a neat biological drawing. Calculate the magnification of the drawing. Examine whether learning outcomes have been achieved.
- Teacher: Discuss difficulties that learners may have had during the activity. Reinforce learning outcomes. Set the assessment task for homework.
- Learners: Contribute to feedback, and ensure all learning outcomes have been met.

## 9. Support for learners with learning difficulties

### Remedial

1. Copy Figure 4.7 to practise biological drawing.
2. A learner looks through a microscope using a 10× eyepiece lens and a 40×

- nosepiece lens. What is the total magnification that he or she is using?
- A learner draws a leaf 20 cm long. The leaf is actually 4 cm long. What is the magnification of the drawing?

### Answers

- Assess the drawing use this checklist:
  - is accurate
  - has correct labels for features or parts
  - is drawn with single, unbroken lines
  - is large and clear
  - has straight label lines
  - has a heading/title
  - is not shaded or coloured in.
- $10 \times 40 = 400\times$
- $20 \div 4 = 5\times$

### Consolidation

- A learner looks through a microscope using a  $10\times$  eyepiece lens and a  $100\times$  nosepiece lens. What is the total magnification that he or she is using?
- A learner draws a leaf 10 cm long. The leaf is actually 2 cm long. What is the magnification of the drawing?
- A learner draws a leaf 15 cm long. The leaf is actually 3 cm long. What is the magnification of the drawing?

### Answers

- $10 \times 100 = 1,000\times$
- $10 \div 2 = 5\times$
- $15 \div 3 = 5\times$

### Extension

- List two advantages and one disadvantage of hand lenses.
- Find a leaf that has an epidermis that is easy to peel off. View the epidermis using a microscope.
- A learner draws a specimen using a scale bar. His scale bar shows that 1 cm represents  $50 \mu\text{m}$ . His drawing is 10 cm in length. What is the actual length of the specimen?

### Answers

- Advantages – easy to carry in the field; easy to operate; not as fragile as a microscope  
Disadvantages – can only view at lower magnifications
- $10 \times 50 = 500 \mu\text{m}$

### Checklist 3

Drawing ...	Yes	No
1. is accurate	1	0
2. has correct labels for features or parts	1	0
3. is large and clear	1	0
4. has straight label lines	1	0
5. has a heading/title	1	0
<b>Total</b>	<b>5</b>	<b>5</b>

## 10. Suggested answers fo activities

### Activity 4.2

- Use Figure 4.5 in the Student's Book.

### Self assessment 4.1

- $12 \div 4 = 3\times$
- $10 \times 25 = 250\times$
- $10 \times 40 = 400\times$

## 11. End Unit assessment 4

- Hand lens and light microscope
- You can use a hand lens outside the laboratory. You can change the magnification of a microscope, which you cannot do with a hand lens.
- Advantage of hand lens – easy to use outside.  
Advantage of microscope – can view specimens at a higher magnification.
- The high power objective is very close to the glass slide. If you use the coarse focus adjustment knob, the objective lens will go through the slide.

5.

Eyepiece magnification	Objective lens magnification	Total magnification
5×	25×	125×
10×	10×	100×

6.  $3 \div 1,5 = 2\times$

7. A – coarse focus adjustment knob

B – nosepiece objective lens

C – stage

D – diaphragm

E – mirror

## Sub-topic: Cell structure

### UNIT 5 Plant and animal cells

**Key unit competence:** To be able to differentiate between animal and plant cells using a light microscope.

#### At the end of this unit, learners should be able to:

- Explain the role of a cell in a living organism
- Describe the structure of a plant and animal cells
- Identify the different parts of the cell
- Explain the uses of the various structures seen under the light microscope in the plant and animal cell
- Explain that cells with high rates of metabolism contain large numbers of mitochondria for sufficient energy
- Organize a science practical setup according to given instructions
- Prepare slides of human cheek cells and epidermal cells of an onion
- Explain the differences in the structure of plant and animal cells seen under a light microscope
- Demonstrate that plant and animal cells differ in shape
- Appreciate the importance of cells in organisms
- Show perseverance when observing slides of plant and animal cells
- Pay attention while handling delicate slides and sharp instruments to avoid injury.

#### 1. Content summary

- The cell as a basic unit of life.
- The structure of a plant to (cellulose) cell wall, nucleus, cytoplasm, chloroplasts, vacuoles and location of the cell membrane.
- The structure of animal cell limited to cell membrane, nucleus, cytoplasm and vacuoles.
- Uses of the structures seen under the light microscope in the plant and animal cell.
- Role of mitochondrion.

#### 2. Key vocabulary

Unicellular, multicellular, organelles, selectively permeable, enzymes, permeable, chlorophyll

#### 3. Competences practised

Basic competence

- Literacy: Listening carefully for understanding and seeking clarification when necessary
- Science and technology: Use microscopes and micrographs to identify structures not seen with the naked eye.

Generic competence

- Research: Use the library or internet to research other cell organelles not learnt in the unit.

#### 4. Cross-cutting issue

Standardisation culture: You need to buy good quality materials, that are not harmful to humans.

## 5. Classroom organisation

Individuals and groups in classroom/  
laboratory

## 6. Teaching materials

Microscope; prepared slides of onion epidermis and human cheek cells; drawing paper; slides of micrographs of organelles; paper

## 7. Before you start

- This unit is an introduction to plant and animal cells. Try to find some micrographs of different organelles in books or on the Internet. Emphasise the differences between plant and animal cells.
- Teacher: Introduce the unit by referring to specimens of onion cells viewed in the last unit. Establish prior knowledge of cells. Arrange learners in groups for oral activity.
- Learners: Discuss cells as seen in onion epidermis slides. Complete oral activity in groups

## 8. Teaching steps [4 periods]

### Guidance on Introductory activity

Guide students to work on the introductory activity that is in the student textbook.

Answers will vary depending on learners' observations and findings.

### Lesson 1 The cell

- Learners: Do the activity 5.1
- Teacher: Describe the cell, and distinguish between unicellular and multicellular organisms. Refer to the diagrams of a plant and an animal cell in Figure 5.2 in the Student's Book. Describe structures common to both. Arrange groups for Experiment 5.1.

Distribute prepared slides. Remind learners about setting up and using microscopes. Facilitate learners' progress, and check that they can calculate magnification.

- Learners: Complete the oral activity in groups. Look at Figure 5.2, and find organelles that are common to both plant and animal cells. Complete self assessment 5.1, and examine whether learning outcomes have been achieved.
- Teacher: Make sure learners pack up carefully self assessment 5.1
- Learners: Pay attention to storing microscopes correctly.

### Structures found in plant and animal cells

- Teacher: List structures in both plant and animal cells.
- Learners: Understand that there are some organelles that are common to plant and animal cells.
- Teacher: Use slides to explain the structure and function of the cell membrane, nucleus, mitochondria and vacuoles.
- Learners: Do the experiment 5.1, and examine whether learning outcomes have been achieved.
- Teacher: Discuss the results of experiment 5.1. Reinforce learning outcomes.
- Learners: Contribute to feedback, and ensure all learning outcomes have been met.

### Lesson 2 Differences in the structure of plant and animal cells

- Teacher: List structures in plant cells.
- Learners: Understand that there are some organelles that are found only in plant cells.
- Teacher: Use slides to explain the structure and functions of the cell wall

and chloroplasts. Use Table 5.1 in the Student's Book to show the differences between plant and animal cells. Give guidance on completing self assessment 5.2. Monitor progress against planned timing.

- Learners: Complete self assessment 5.2, and examine whether learning outcomes have been achieved.
- Teacher: Discuss the answers to self assessment 5.2. Reinforce learning outcomes.
- Learners: Contribute to feedback, and ensure all learning outcomes have been met.

### Assessment

- Teacher: Explain to learners that they will do the assessment in the lesson, working on their own. Monitor progress against planned timing.
- Learners: Complete the assessment task.
- Teacher: Collect the assessment for marking.

## 9. Support for learners with learning difficulties

### Remedial

1. What is the difference between a unicellular organism and a multicellular organism?
2. Give the functions of the following organelles:
  - a) nucleus
  - b) mitochondrion
  - c) chloroplast.
3. What is the difference between a plant cell and animal cell in their:
  - a) shape
  - b) size of vacuoles
  - c) outer covering?

### Answers

1. Unicellular organisms consist of only one cell; multicellular organisms consist of many cells.

2.
  - a) Controls the functioning of the cell; contains hereditary information.
  - b) Produces energy.
  - c) Is the place where photosynthesis occurs.
3.
  - a) Plant cells have a regular shape; animal cells have an irregular shape.
  - b) Vacuoles in plant cells are large; vacuoles in animal cells are small, or there are none.
  - c) Plant cells have a cell wall and a cell membrane; animal cells have only a cell membrane.

### Consolidation

1. Fill in the missing words in the following sentences:
  - a) The nucleus is found near the \_\_\_\_\_ of an animal cell and on the \_\_\_\_\_ of a plant cell.
  - b) The \_\_\_\_\_ is a darker region in the nucleus.
  - c) Mitochondria have a \_\_\_\_\_ membrane.
  - d) Vacuoles are filled with a \_\_\_\_\_ that contains \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_.
2. Copy and label Figure 5.2 on page 51 in the Student's Book.
3. Explain the difference between a permeable membrane and a selectively permeable membrane.

### Answers

1.
  - a) The nucleus is found near the **centre** of an animal cell and on the **side** of a plant cell.
  - b) The **nucleolus** is a darker region in the nucleus.
  - c) Mitochondria have a **double** membrane.
  - d) Vacuoles are filled with a fluid that contains **water, mineral salts** and **food molecules**.
3. A permeable membrane allows all molecules to pass through it; a



selectively permeable membrane allows only some molecules to pass through it, and not others.

### Extension

1. Find out about the structure and functions of the following cell organelles:
  - a) endoplasmic reticulum
  - b) ribosomes
  - c) Golgi bodies.
2. A scientist viewed a nucleus using an electron microscope. What is an electron microscope?
3. The nucleus was seen to be 5 cm wide when using an electron microscope. The magnification used was 10,000 $\times$ . What is the actual width of the nucleus?

### Answers

1. a) Endoplasmic reticulum:
  - The endoplasmic reticulum is a network of membranes inside the cell.
  - Some parts of the membranes have ribosomes attached to them. This forms rough endoplasmic reticulum (rough ER). Some parts do not have ribosomes, and this is called smooth endoplasmic reticulum (smooth ER).
  - Proteins are made by the ribosomes on rough ER.
  - The smooth ER forms a transport system through which proteins can move.
  - Proteins made by ER are sometimes secreted by the cell.
- b) Ribosomes:
  - These are small structures inside the cytoplasm that play an important role in making protein molecules. Proteins are used inside the cell.
  - Protein production is controlled by the nucleus.

c) Golgi bodies:

- Golgi bodies form a network of membranes inside the cell.
  - Golgi bodies are important for changing proteins made by the endoplasmic reticulum.
  - The modified proteins are secreted from the cell in a similar way to the proteins made by the ER.
2. An electron microscope uses electrons instead of light to form an image of a specimen. It can view specimens at very high magnifications.
  3.  $5\text{ cm} = 5 \times 10,000\ \mu\text{m} = 50,000\ \mu\text{m}$   
Width of nucleus =  $50,000 \div 10,000 = 5\ \mu\text{m}$

## 10. Suggested answers for activities

### Activity 5.1

1. cell  
tissue  
organ  
organism
2. Light microscopes and electron microscopes
3. The biologist would have to decide on the amount of detail that he or she needed to see. Light microscopes magnify only up to 2,000 $\times$ , whereas electron microscopes magnify several hundred thousand times.

### Experiment 5.1

1. Answers will vary. Examples: worked carefully with glass slides; worked carefully with microscopes.
2. Plant cells have a regular shape; animal cells have an irregular shape.
3. The onion cells have a cell wall and a vacuole; the cheek cells have neither of these structures.
4. Answers will vary.

### Self assessment 5.1

- An organism that consists of one cell.
  - An organism that consists of many cells.
  - A structure within a cell that has a particular function.
- Unicellular – amoeba; multicellular organism – jellyfish, dog, etc.
- Controls entry and exit of substances into and out of the cell.
  - Controls the functioning of the cell.
- Mitochondria
- Mineral salts and food molecules
  - Vacuoles in animal cells are small, and are found on the side of the cell; those found in plant cells are large and are found in the centre of the cell.

### Self assessment 5.2

- It gives the cell its shape; it enables substances to move freely into and out of the cell.
  - Cellulose
- They are where photosynthesis takes place.
  - Chlorophyll

## 11. Answers for end unit assessment 5

- 1.1 – B; 1.2 – C;  
1.3 – F; 1.4 – D;  
1.5 – E; 1.6 – A
- A structure that allows free movement of substances through it
  - Passed on to offspring
  - Chemicals that speed up reactions
  - Chemical reactions in plants that use light energy and chlorophyll to convert carbon dioxide and water to oxygen and glucose.

3.

	Plant cell	Animal cell
Shape	Regular	Irregular
Outer covering	Cell wall	Cell membrane
Organelles	Nucleus, mitochondria, chloroplasts, cytoplasm, vacuoles	Nucleus, mitochondria, cytoplasm, vacuoles
Vacuoles	Large	Small or none

## Sub-topic: Cell structure

### UNIT 6 Levels of organisation in multicellular organisms

**Key unit competence:** To be able to explain specialisation of cells, and the link between levels of organisation in multicellular organisms

#### At the end of this unit, learners should be able to:

- Recall that a cell is a basic structure of an organism
- Describe the different types of cells in this unit and state their functions
- Describe the different cell structures found in animals and plants and how they relate to their functions
- Identify different levels of organisation in multicellular organisms
- Observe and illustrate different types of cells and tissues under light microscope or micrographs
- Categorize plant and animal tissues using observation of micrographs or slides
- Illustrate well labelled structures of xylem and phloem tissue from slides or micrographs of sections of vascular plants
- Sequence the levels of organization of multicellular organisms from the simplest to the most complex
- Differentiate the relationship between the structure and function of specialised cells
- Appreciate the complexity of life from the tiny cell through to the tissue, organ, system and organism levels of organisation
- Be aware that an organism is a complex organisation of cells, an important unit of life.

#### 1. Content summary

- Structure and function of ciliated cells, root hair cells, xylem vessels, palisade and mesophyll cells, nerve cells, red blood cells, sperm and egg cells
- Advantages of specialization of cells
- Levels of organization in multicellular organisms.

#### 2. Key vocabulary

Specialised, adapted, cilia, mucus, nerve impulses, surface area, haemoglobin, flagellum, motile, enzymes, acrosome, ova, nutrients, zygote, palisade mesophyll cells, spongy mesophyll cells

### 3. Competences practised

Basic competence

- Literacy: Listening carefully for understanding and seeking clarification when necessary
- Science and technology: Use microscopes and micrographs to identify structures not seen with the naked eye. These microscopic structures help explain cell specialisation in multicellular organisms.

Generic competence

- Critical thinking: Explore and evaluate alternative explanations to those presented by others
- Research: Create mind maps to establish what they have learnt in the previous units.

### 4. Cross-cutting issue

Comprehensive sexuality education:

Understanding what healthy cells are and how they function in the body, enables us to live a happy, healthy life.

### 5. Classroom organisation

Pairs in classroom

### 6. Teaching materials

Micrographs or slides of specialised cells

### 7. Before you start

- This unit builds on the work covered in the previous unit. Once again, you will need to have microscopes or micrographs of plant and animal tissues set up before the lessons. Focus on structure related to function in each type of tissue.
- Teacher: Consolidate the basic structure of the cell, and emphasise that it is the basic unit of life. Arrange learners in pairs for the oral activity.
- Learners: Complete oral activity.

### 8. Teaching steps [4 periods]

### Guidance on Introductory activity

Guide students to work on the introductory activity that is in the student textbook.

Answers will vary depending on learners' observations and findings.

### Lesson 1 Cell specialisation

- Learners: Do activity 6.1 Q1 (a & b) and present their answers.
- Teacher: Define specialisation, and describe some examples of specialised cells. Use slides and micrographs to help your explanation of ciliated cells, nerve cells and red blood cells. Emphasise how the cells are specialised for their functions. If time allows, ask learners to complete self assessment 6.1.
- Learners: Observe how cells are structurally different, depending on their function.
- Teacher: Consolidate new words and orient learners to answers to self assessment 6.1.
- Learners: Give feedback on answers.

### Specialised animal and plant cells

- Teacher: Give guidelines for activity 6.1 question 2. Arrange learners in groups, and distribute materials.
- Learners: Set up microscopes according to rules.
- Teacher: Learners to complete activity 6.1 question 2. Facilitate learners' progress, and offer assistance with drawings where necessary. Monitor progress against planned timing.
- Learners: Observe micrographs and slides and describe how cells are suited to their functions. Make drawings of observed slides.
- Teacher: Discuss answers to questions for activity 6.1.
- Learners: Provide feedback and ensure

learning outcomes have been achieved.

- Learners do self assessment 6.1

## Lesson 2 Organisation in multicellular organisms

- Learners do activity 6.2
- Teacher: Ask learners if they know what is meant by 'levels of organisation'. Discuss unicellular and multicellular organisms, with examples.
- Learners: Understand the difference between unicellular and multicellular organisms.
- Teacher: Describe the increase in complexity of cells, tissues, organs, organ systems and organisms. Use an animal and a plant as examples. Emphasise the advantages of cell specialisation. Learners complete self assessment 6.2 if time allows. Otherwise, set it as a homework task. Monitor progress against planned timing. Learners to complete peer assessment.
- Learners: Complete assessment 6.2 and the assessment task.
- Teacher: Discuss the answers in class.
- Learners: Provide feedback on the answers to the exercise and assessment task.

### 9. Support for learners with learning difficulties

#### Remedial

1. Arrange the following structures in the correct order, starting with the smallest:  
organ      cell      tissue  
organ system      organ
2. Give a definition for each of the following terms:
  - a) specialisation
  - b) permeable
  - c) zygote
  - d) motile.
3. Give three advantages of specialisation of cells.

#### Answers

1. cell, tissue, organ, organ system, organ
2. a) When structures have become adapted to perform particular functions  
b) Allowing molecules to pass through  
c) The single cell formed after fertilisation  
d) Able to move
3. Specialisation enables cells to grow bigger and to carry out complex processes. Different cells carry out different functions. Specialised cells can work together to form tissues, organs and organ systems.

#### Consolidation

1. Use the information in Unit 6 in the Student's Book to draw a mind map to show information about the following animal cells: ciliated cells, red blood cells, nerve cells, sperm cells and egg cells.
2. Use the information in Unit 6 in the Student's Book to draw a mind map to show information about the following plant cells: root hair cells, xylem cells and mesophyll cells.
3. Give one example of a specialised cell, and state its function.

#### Answers

1. Learners should draw a mind map to show the information in Unit 6 in the Student's Book.
2. Learners should draw a mind map to show the information in Unit 6 in the Student's Book.
3. Learners should give an example of a specialised cell, and state its function. Examples: ciliated cells, nerve cells, red blood cells, sperm cells, egg cells, root hair cells, xylem cells and mesophyll cells.

### Extension

1. a) Make a list of the specialised tissues in the stomach. Use Figure 6.10 on page 64 in the Student's Book to help you.  
b) What other tissue do you think would be found in the stomach?
2. a) Make a list of the specialised tissues in a leaf. Use Figure 6.11 on page 65 in the Student's Book to help you.  
b) Which organelle is found in abundance in the leaf?

### Answers

1. a) Epithelial tissue, muscle tissue  
b) Nerve cells
2. a) Epidermal tissue, mesophyll tissue, xylem and phloem tissue  
b) Chloroplast

## 10. Suggested answers for activities

### Introductory activity

1. The cell is the simplest living unit. Some organisms consist of just one cell.
2. No, not all cells are the same. There are animal and plant cells. Some cells are specialised to do certain functions.
3. Chloroplasts
4. No, some are single-celled and some are multicellular. Single-celled organisms are called unicellular. Organisms that consist of many cells are called multicellular. Examples of organisms that have many cells in their bodies include: cat, goat, locust, maize plant, etc.

### Self assessment 6.1

1. a) Adapted to perform a particular

function

- b) Tiny hair-like structures found on epithelial cells
  - c) Nerve cells that can conduct nerve impulses
  - d) A red pigment found in red blood cells that binds to oxygen molecules
2. a) Ciliated cells line surfaces, such as the lungs, where they trap dust. They are also found in the oviducts, where they help to move the ovum towards the uterus.  
b) They have cilia along one side, and there are mucus secreting goblet cells in-between them that help the ciliated cells in their functions.
  3. a) Red blood cells transport oxygen.  
b) Red blood cells have a large surface area to which oxygen molecules can attach. They also are made of haemoglobin molecules, which attract oxygen. They do not have a nucleus, so there is more space to carry oxygen.  
c) Learners should draw something similar to Figure 6.4 on page 60 in the Student's Book.

### Activity 6.1

Check learners' drawings. You can use them as an assessment task.

### Self assessment 6.2

1. a) The simplest unit of life  
b) A group of similar cells that work together to perform a particular function  
c) A group of similar tissues that work together to perform a particular function  
d) A group of organs that work together to perform a particular function

2. Cell – neuron; tissue – muscle tissue; organ – heart; organ system – digestive system
3. Learners should draw something similar to Figure 6.10 and 6.11 in the Student's Book.
4. Animal tissues – nerve tissue, muscle tissue; plant tissues – epidermal tissue, xylem tissue, mesophyll tissue

## 11. End unit assessment 6

1. a) A tail-like structure that enables a cell to move  
b) Able to move  
c) A region in the head of a sperm cell that contains enzymes. The enzymes are involved in penetrating the egg during fertilisation.  
d) The single cell formed when the egg and a sperm fuse during fertilisation.
2. a) Sperm cells carry the hereditary information from the father.  
b) They are motile so they can swim to meet the egg. They have many mitochondria, which produce energy to help them swim. The nucleus contains genetic information.  
c) Learners should draw a diagram similar to Figure 6.5 in the Student's Book.
3. a) Egg cells carry the hereditary information from the mother.  
b) When a sperm cell meets an egg cell, enzymes from the sperm break down the membrane around the egg cell. The nucleus of the sperm cell fuses with the nucleus of the egg cell.

- c) There are nutrients in the cytoplasm that provide the zygote with energy for cell division. The ovum's cell membrane allows only one sperm to pass through it. The large nucleus contains the hereditary information.
4. cell, tissue, organ, organ system, organ
5. a) When structures have become adapted to perform particular functions  
b) Allowing molecules to pass through
6. Refer to student book
7. Mitochondria. Large amounts of energy are needed for muscle contraction.
8. a) Red blood cells transport oxygen.  
b) Xylem cells transport water and mineral salts.
9. a) A – neurons  
B – xylem vessels  
C – root hair cells  
D – red blood cells  
b) Animal cells – neurons, red blood cells  
Plant cells – xylem vessels, root hair cells  
c) Neurons transmit nerve impulses. Xylem vessels transport water and mineral salts. Root hair cells increase the surface area of roots for water absorption. Red blood cells transport oxygen.  
d) Red blood cells have a biconcave shape, which gives them a large surface area. They are packed with haemoglobin, which attracts oxygen molecules. They do not have a nucleus, so there is more space for haemoglobin and oxygen molecules. They are elastic, so they can squeeze through narrow blood vessels.

## Sub-topic: Nutrition

### UNIT 7 Food nutrients and diet

**Key unit competence:** To be able to analyse the different food nutrients and their significance to the human body.

#### At the end of this unit, learners should be able to:

- Explain the importance of the classes of foods
- List the main sources of food nutrients
- List the chemical elements that make up carbohydrates, fats and proteins
- Explain that large molecules consist of smaller molecules joined together
- State that a balanced diet is eating a variety of foods containing all the nutrients and in the correct proportions
- Explain that people have different dietary needs, dependant on age, gender and activity levels including pregnant and breastfeeding mothers
- Explain the effects of malnutrition
- Explain that obesity is the build-up of excess fat in the body due to excess intake of calories
- Apply knowledge of deficiency symptoms to identify the different deficiency diseases among individuals
- Test for carbohydrates, proteins and lipids in different food samples
- Demonstrate the different functions of water, mineral salts and vitamins in the body
- Acknowledge the importance of having a balanced diet and its relation to age and gender
- Appreciate the need for a specific diet for individuals who carry out strenuous activities like sports and manual labour.
- Take care when using reagents to test for food types
- Appreciate the myths and values communities attach to certain foods
- Adopt and develop healthy eating habits by eating a balanced diet.

#### 1. Content summary

- Food nutrients and principal sources in food stuffs of food nutrients
- Importance of nutrients in human body and of having a balanced diet
- Composition of biological molecules limited to carbohydrates, lipids and proteins
- Formation of large biological molecules (starch, glycogen, cellulose, proteins and lipids) from small molecules such as glucose, amino acids and fatty acids/ glycerol.

- Deficiency symptoms limited to vitamin C and D and calcium, and iron only)
- Functions of vitamins, water and mineral salts
- Malnutrition limited to starvation, obesity, constipation and scurvy.

#### 2. Key vocabulary

Nutrients, elements, carbohydrates, monosaccharides, polysaccharides, lipids, proteins, amino acids, reagents, balanced diet, malnutrition, deficiency diseases



### 3. Competences practised

#### Basic competence

- Literacy: Listening carefully for understanding and seeking clarification when necessary
- Science and technology: Use experiments to test for various food nutrients.

#### Generic competence

- Communication: Develop good communicating skills when working in groups.
- Cooperation: Understand what healthy eating is so that knowledge can benefit their families. Understand that unhealthy eating can lead to nutritional disorders.

### 4. Cross-cutting issue

Peace and values education: When you are working in pairs or as a group during an activity, work in unity and respect each other's point of view.

### 5. Classroom organisation

Pairs and groups in classroom

### 6. Teaching materials

Bread, maize porridge or other complex carbohydrate; test tubes; a white tile; droppers; iodine solution; cooked chicken; meat or egg; butter; water; nuts (crushed); sodium hydroxide solution; copper sulphate solution; ethanol; test tube racks; permanent markers; test strips for testing proteins, fats and glucose

### 7. Before you start

- This unit involves food tests. Make sure that you have all the reagents needed well before the lesson. Facilitate the food tests as learners complete them. If you do not have sufficient equipment or reagents for the learners, you can demonstrate the food tests to the class.

- Teacher: Arrange learners in groups for the oral activity.
- Learners: Complete the oral activity.

### 8. Teaching steps [8 periods]

#### Guidance on Introductory activity

Guide students to work on the introductory activity that is in the student textbook.

1. Answers will vary depending on learners' preferences.
2. Carbohydrates, proteins, fats, vitamins, mineral salts?
3.
  - Carbohydrates are sources of energy
  - Proteins help in body tissue repair, growth, transport,....
  - Lipids are source of energy, insulating nutrient...
  - Salts and vitamins are responsible for fighting against diseases.

#### Lesson 1 Food nutrients

- Learners: Do activity 7.1 and present answers.
- Teacher: Discuss what learners eat, and review the oral activity. Discuss the importance of nutrients, and list the six types. Refer to Table 7.1 in the Student's Book for sources of food nutrients. Read through the instructions for Activity 7.1. Monitor progress against planned timing.
- Learners: Think about their favourite foods. Learners complete the oral activity in groups. They complete Activity 7.1 in pairs.
- Teacher: Discuss the answers to Activity 7.1 in class.
- Learners: Provide feedback on answers to Activity 7.1.

## Lesson 2 Importance of food nutrients

- Teacher: Consolidate food nutrients and give examples of each food group. Describe the structure and functions of carbohydrates, proteins, fats, vitamins, mineral salts and water. Refer to Table 7.2 in the Student's Book. Monitor progress against planned timing.
- Learners: Understand Table 7.2.
- Teacher: Prepare learners for food tests by asking them to bring in some local foods to test.
- Learners: Write down a reminder to bring food samples.

## Lessons 3 Food tests

- Teacher: The food tests will take two lessons. Arrange groups and set up materials.
- Learners: Assist with set up of practical activity.
- Teacher: Read through instructions with learners, and ensure that they have all the equipment and food samples needed. Facilitate the learners whilst they are doing the activity, and assist when necessary. Monitor progress against planned timing.
- Learners: Complete Experiment 7.1. Answer the questions for homework.
- Teacher: Make sure that learners have written down their results in the table.
- Learners: Check that all results are written in the table.

## Lesson 4 A balanced diet

- Teacher: Discuss with learners whether they think they have a balanced diet. Define a balanced diet.
- Learners: Think about diets.
- Teacher: Look at the percentages of different food groups in a balanced diet given in Table 7.3 in the Student's Book.

Read through Exercise 1, and let learners complete in pairs. Monitor progress against planned timing.

- Learners: Complete Exercise 1
- Teacher: Discuss the answers to Exercise 1. You may need to consolidate bar charts.
- Learners: Provide feedback on answers to Exercise 1.

## Lesson 5 Balanced diets for different people

- Teacher: Ask learners whether they all need to eat the same foods and in the same amounts.
- Learners: Think about what different people eat.
- Teacher: Discuss how young people, sportspeople, and pregnant and breastfeeding women need different foods and in different amounts.
- Learners: Understand why different people need different diets.
- Teacher: Prepare for the next lesson by asking learners about what happens if we do not have a balanced diet.
- Learners: Think about the consequences of not having a balanced diet.

## Lesson 6 Nutritional disorders

- Learners observe figure 7.11 and 7.12. They present their observations
- Teacher: Distinguish between nutritional disorders and deficiency diseases.
- Learners: Provide feedback.
- Teacher: Describe some deficiency diseases, for example, scurvy, rickets and anaemia. Talk about starvation, obesity and the impact of deficiency diseases.

## 9. Support for learners with learning difficulties

### Remedial

1. Name six groups of food nutrients.
2. Name the building blocks of:
  - a) proteins
  - b) carbohydrates.
3. List any three functions of:
  - a) vitamins
  - b) lipids.

### Answers

1. Carbohydrates, lipids, proteins, vitamins, mineral salts, water
2. a) Amino acids  
b) Monosaccharides
3. a) Vitamin C is needed to fight infections and heal wounds, and for healthy bones, teeth, skin and gums. Vitamin D helps the body to absorb calcium from food, which is needed for healthy bones and teeth.  
b) Lipids:
  - Provide energy.
  - Help with absorption of fat-soluble vitamins A, D, E and K.
  - Form a layer beneath the skin that insulates the body and reduces heat loss.
  - Form a layer around organs to provide protection from injury.

### Consolidation

1. What would be the colour change if a food sample, tested for starch with iodine, was positive for starch?
2. a) Explain the term 'balanced diet'.  
b) Which people should have a different diet from an average adult?  
  
c) In each case, explain why the person needs a different diet.
3. What is the difference between marasmus and kwashiorkor?

### Answers

1. Iodine would change from orange-brown to blue-black.
2. a) A balanced diet is a diet that contains all the required food nutrients in the correct amounts for an individual.  
b) Very active people, sportspeople, pregnant and breastfeeding women, and young people need different diets.  
c) Active people need more energy foods. Sportspeople need more energy foods and proteins for muscle building. Pregnant and breastfeeding women need extra energy and nutrients to sustain the growing baby and to make breast milk. Young people need extra energy and nutrients for growth. 3. Marasmus occurs when there are not enough nutrients in a child's diet. Kwashiorkor occurs when there are not enough proteins, mineral salts and vitamins in a child's diet.

### Extension

1. A child has the symptoms listed below. For each symptom, state which deficiency disease the child is suffering from.
  - a) bleeding gums
  - b) bent legs
  - c) little energy.
2. List the food groups found in:
  - a) fruits
  - b) eggs.
3. Distinguish between an element and a molecule.

### Answers

1. a) Scurvy  
b) Rickets  
c) Anaemia
2. a) Carbohydrates, vitamins, mineral salts  
b) Proteins, vitamins

3. An element is a single unit that cannot be broken down into anything simpler; for example, carbon and potassium. A molecule is made up of many elements joined together; for example, water and sodium hydroxide.

## 10. Suggested answers for activities

### Activity 7.1

1. Carbohydrates, proteins, vitamins

### Experiment 7.1

1.

Food sample	Colour change		
	Iodine	Biuret test	Ethanol
1. Bread	Orange to blue-black	Stays blue	No change
2. Maize porridge	Orange to blue-black	Stays blue	No change
3. Chicken	Stays orange	Becomes purple	Becomes cloudy
4. Meat	Stays orange	Becomes purple	Becomes cloudy
5. Egg	Stays orange	Becomes purple	No change
6. Butter	Stays orange	Stays blue	Becomes cloudy

### Questions

- Learners' lists will vary, depending on which food they tested. Note that food samples may contain more than one nutrient.
- Care with reagents; care with Bunsen burner
- Learners' answers will vary.

### Exercise 7.1

- Male athlete
  - Woman aged 70
- The male athlete needs the most energy for his sporting activity. The old woman does not need as much energy, as she is inactive.

## 11. End unit assessment 7

- Carbohydrates, lipids, proteins, vitamins, mineral salts, water
- bread
  - meat
  - vegetables
- carbon, hydrogen and oxygen
  - carbon, hydrogen, oxygen and nitrogen
  - carbon, hydrogen and oxygen
- glucose
  - amino acids
  - one glycerol molecule and three fatty acids
- It is a diet that contains all the required food nutrients in the correct amounts for an individual.
- Scurvy, rickets and anaemia.
- Learners' answers will vary, depending on their community.
    - Stunted growth, increased likelihood of getting infections, blindness (in the case of untreated vitamin A deficiency), being unable to take part in everyday activities, deformity and death
    - The sick person takes up the time of family members who care for him or her, so there is less time for food production.
    - There is less time for agriculture practice.
    - The health services and economy are negatively impacted.

Any two nutritional disorders; for example:

Nutritional disorder	Cause	Treatment	Prevention
Scurvy	Lack of vitamin C	Vitamin C supplements	A diet that includes foods containing vitamin C, e.g. oranges
Rickets	Lack of vitamin D and calcium	Vitamin D and calcium supplements	A diet that includes foods containing vitamin D and calcium, e.g. milk

8. a) Five  
 b) January  
 c) Foods rich in iron, such as spinach and red meat  
 d) Vitamin D and calcium

9. 1.1 – D    1.2 – C  
 1.3 – B    1.4 – A

10. a) Sodium hydroxide and copper sulphate  
 b) Iodine
11. a) The boy  
 b) The boy is growing, so he needs extra nutrients in his diet.
12. Miss Umutoni was suffering from a deficiency of vitamin C and iron. The foods that the doctor told her to eat are rich in vitamin C and iron, so after they had been included in her diet for some time, her symptoms disappeared.

## Sub-topic: Gas exchange and smoking

### UNIT 8 Structure and functions of human gas exchange system

**Key unit competence:** To be able to describe the structure and functions of the human gas exchange system.

**At the end of this unit, learners should be able to:**

- Identify the structures of the human gas exchange system namely the larynx, trachea, bronchi, bronchioles, alveoli and associated capillaries
- List the functions of the parts of the human gas exchange system
- Observe the structure of gas exchange system and relate it to its functions
- Demonstrate the structure of human gas exchange system using models
- Appreciate the similarity between the human gas exchange system and that of other mammals.

#### 1. Content summary

- Structure of the human gas exchange system
- Functions of the parts of the human gas exchange system.

#### 2. Key vocabulary

Respiration, gas exchange, diffusion, breathing, nostrils, trachea, bronchi, bronchioles, alveoli, mucus

#### 3. Competences practised

Basic competence

- Literacy: Listening carefully for understanding and seeking clarification when necessary
- Science and technology: use experiments to explain natural phenomena i.e. breathing.

Generic competence

- Research: Broaden their knowledge by researching gaseous exchange in other animals

#### 4. Cross-cutting issue

Environment and sustainability: Breathing safe air ensures good health. Rwandans strive to maintain a clean environment and by planting trees and conserving them. The areas of Umutara and Bugesera have been transformed by planting trees.

#### 5. Classroom organisation

Groups and pairs in classroom

#### 6. Teaching materials

A dissecting set; plastic sheeting; a hand lens; a lung of a goat, sheep or cow (with the trachea and bronchi intact); water; a container; a towel; soap; disinfectant; rubber tubing; transparent plastic bottles; forked glass tubing or straws; rubber bands or string

## 7. Before you start

- In this unit the human respiratory system is described in terms of its structure and functions. Ensure that you explain the difference between breathing, respiration and gas exchange, as these important concepts need to be understood later on in Biology.
- Teacher: Arrange learners in groups for the oral activity.
- Learners: Complete the oral activity.

## 8. Teaching steps [2 periods]

### Lesson 1 Structure of the human gas exchange system

- Teacher: Discuss the oral activity, and let learners complete it in groups.
- Learners: Complete oral activity and provide feedback.
- Teacher: Distinguish between respiration, breathing and gas exchange. Use the diagram in Figure 8.2 in the Student's Book to help your explanation of diffusion.
- Learners: Review Figure 8.2, and understand diffusion.
- Teacher: Describe the structure of the human lungs. Write key words on the board, and use charts and diagrams to assist you. Set up the dissection as a demonstration, or learners can work in groups. Facilitate their progress.
- Learners: Complete Experiment 8.1 in groups.
- Teacher: Set self assessment 8.1 for homework.

### Lesson 2 Functions of the parts of the human gas exchange system

- Teacher: Consolidate structure of the lungs and difference between breathing, gas exchange and respiration.
- Learners: Understand new concepts and provide feedback.

- Teacher: Describe gas exchange in the alveoli, between the air and the blood. Then move on to talk about gas exchange at the cell surface.
- Learners: Refer to Figure 8.4 in the Student's Book.
- Teacher: Review the instructions for Experiment 8.2. Allow learners to build the model, or you can do a demonstration. Set up a microscope to view slides in Activity 8.3.
- Learners: Complete Experiment 8.2 and self assessment 8.2.

## 9. Support for learners with learning difficulties

### Remedial

1. Define each of the following terms:
  - a) gas exchange
  - b) respiration
  - c) breathing.
2. Name two places where gas exchange takes place in humans.
3. Write down the structures that air travels through until it reaches the alveoli in the lungs.

### Answers

1.
  - a) The exchange of oxygen and carbon dioxide across a membrane
  - b) A series of chemical reactions that use oxygen and glucose to produce energy, carbon dioxide and water
  - c) The process of taking air into the lungs (breathing in) and releasing it (breathing out)
2. In the alveoli and in the tissues
3. Nostrils, nasal cavity, mouth cavity, larynx, trachea, bronchus, bronchioles

### Consolidation

1. Distinguish between gas exchange, breathing and respiration.
2. Look at Figure 8.5 in the Student's Book, and then write down what each

of the following structures in the model represents:

- a) rubber sheet
  - b) bell jar
  - c) balloon
3. a) Name one type of tissue that is found in the human respiratory system.
- b) How is this tissue adapted to its function?

### Answers

1. Gas exchange is the exchange of oxygen and carbon dioxide across a membrane. Breathing is the process of taking air into the lungs (breathing in) and releasing it (breathing out). Respiration is a series of chemical reactions that use oxygen and glucose to produce energy, carbon dioxide and water.
2. a) Diaphragm  
b) Thorax  
c) Lungs
3. a) Ciliated epithelium  
b) It has cilia which trap dust particles and prevent them from entering the lungs.

### Extension

1. The ciliated epithelial cells in the lung are 10 µm tall. A learner draws them 2 cm high; what magnification has the learner used?
2. Research a disease that affects the lungs.

### Answers

1.  $20,000 \div 10 = 2,000\times$
2. Learners should find out about emphysema, lung cancer or TB.

## 10. Suggested answers for activities

### Introductory activity

1. Respiration is a series of chemical reactions that use oxygen and glucose to produce energy, carbon dioxide and water.
2. To provide energy
3. Oxygen
4. Carbon dioxide

### Activity 8.1

1. Lungs
2. No; e.g., fish have gills
3. Nostrils, nasal cavity, mouth cavity, larynx, trachea, bronchus, bronchioles

### Self assessment 8.1

1. Learners should draw a diagram similar to Figure 8.3 in the Student's Book.
2. a) Keep the trachea open.  
b) Warms and moistens the air before it reaches the lungs.
3. Air sacs in the lungs
4. Elastic
- 5.

Part	Functions
Trachea	Passage for air to the lungs
Rings of cartilage in the bronchi	Keep bronchi open
Cilia in the nasal passage	Trap dust particles in the air

### Experiment 8.2

3. The balloons inflate.
4. The balloons deflate.



## 11. Answers to end unit assessment 8

1. – B
2. – A
3. – B
4. – C
5. – C
6. a) Gas exchange is the exchange of oxygen and carbon dioxide across a membrane. Breathing is the process of taking air into the lungs (breathing in) and releasing it (breathing out).  
b) Diffusion is the movement of molecules across a membrane from a place of higher concentration to a place of lower concentration. Breathing is the movement of air in and out of the lungs.
7. nostrils, nasal cavity, trachea, bronchi, bronchioles, alveoli
8. It takes place in the alveoli and in the cells of the body.
9. a) ciliated epithelial cells  
b) The tiny, hair-like structures help the mucus move down the trachea to the pharynx.

## Sub-topic: Co-ordination in plants and animals

### UNIT 9 Tropic responses

**Key unit competence:** To be able to explain a plant's response to light and gravity and explain the importance of tropic responses in plants.

**At the end of this unit, learners should be able to:**

- Recall that plants have a root system
- Identify the parts of the shoot that respond to light
- Define phototropism as a response in which parts of a plant grow towards or away from the light source
- Explain that gravitropism is a response in which parts of a plant grow towards or away from gravity
- Describe the change in shape of the shoot and root tips when exposed to light and ground level
- Explain the importance of phototropism and gravitropism in plants
- Carry out investigations showing the response of a plant shoot towards light and gravity
- Observe and illustrate plant shoots growing toward stimuli of light and gravity
- Show that plants respond quite differently compared to animals
- Appreciate the importance of tropisms in plants
- Show patience and perseverance when carrying out experiments that take a long time to get results.

#### 1. Content summary

The need for tropisms in plants (phototropism and gravitropism)

#### 2. Key vocabulary

Sensitivity, stimulus, tropism, phototropism, gravitropism,

#### 3. Competences practised

Basic competence

- Literacy: Listening carefully for understanding and seeking clarification when necessary
- Science and technology: use experiments to explain natural phenomena i.e. tropism.

Generic competence

- Data analysis and presentation of findings: Learn how to gather data and present their findings

#### 4. Cross-cutting issue

Environment and sustainability: Tropism helps us understand how plants react to their surroundings. This helps farmers to choose the correct land for their crops.

#### 5. Classroom organisation

Pairs and groups in classroom

#### 6. Teaching materials

Two bean plants; cotton thread; ink; a ruler; a cardboard box; a pair of scissors; bean seeds that have been soaked in water overnight; paper towels; elastic bands; marker pens; four glass jars; a pot plant

## 7. Before you start

- This unit describes tropisms in plants – the response of plants to different stimuli. The focus is on phototropism (response to light) and gravitropism (response to gravity). There are some practical activities for which you will need to collect the materials before the lesson. If your school does not have sufficient materials and equipment, you can set up the activities as demonstrations.
- Teacher: Arrange learners in groups for the oral activity.
- Learners: Complete oral activity

## 8. Teaching steps [5 periods]

### Guidance on Introductory activity

Guide students to work on the introductory activity that is in the student textbook.

Answers will vary depending on learners' observations and findings.

### Expected answer

The plant in picture A bent due to the light stimulus because on the side facing light auxin hormone is in low concentration elongation of cell does not occur while on the dark side of the plant A, the auxin hormone concentration is high. This causes the cells on that side to elongate, hence the bending of the plant towards the source of light.

The growth movement of the shoot and radical depends on the Auxin hormone concentration on their lower side.

The high concentration of auxin on lower side of the shoot provoke the cells elongation and the shoot bends upwards.

The high concentration of auxin hormone on lower side of the radical prevents the cell elongation, but the upper side with low concentration undergoes the cells

elongation, hence the growth of radical downwards.

The kind of response for plant A is PHOTOTROPISM

On the other side, the response is GEOTROPISM or GRAVITROPISM

This unit is about TROPIC RESPONSES

### Lesson 1 Meaning and types of tropism

- Learners do introductory activity
- Teacher: Introduce the unit and review the introductory activity.
- Learners: Learners complete the activity 9.1.
- Teacher: Discuss tropisms as well as the words 'sensitivity', 'response' and 'stimulus'. Describe phototropism.
- Learners: Read through Experiment 9.1 in preparation for the next lesson.

### Experiment demonstrating phototropism

- Teacher: Arrange learners in groups and set up Experiment 9.1. If you use a clinostat, describe its functioning.
- Learners: Read instructions for Experiment 9.1. Help set up the practical.
- Teacher: Observe set up, and offer assistance when necessary. This activity takes place over some time, so learners will need to have an opportunity to look at their plants after 4 to 6 days. The plants will need to be watered daily. Supervise learning activities. Monitor progress against planned timing.
- Learners: Water plants daily. Check plants after 4 to 6 days. Answer questions about results after 4 to 6 days.
- Teacher: Discuss gravitropism (also called geotropism).
- Learners: Refer to Figure 9.4 in the Student's Book.

### Experiment demonstrating gravitropism

- Teacher: Soak bean seeds the night before the lesson. On the day of the lesson, set up Experiment 9.2 and demonstrate how to fold the seeds in the paper towel.
- Learners: Read instructions for Experiment 9.2.
- Teacher: Observe learners as they set up the experiment. Supervise learning activities. Monitor progress against planned timing. Make sure that learners mark their jars clearly. This experiment runs over ten days, so the learners will need an opportunity to check their bean seeds every second day and record their results.
- Learners: Complete the questions on completion of the experiment.

### Lesson 2 Why do plants respond to light and gravity?

- Learners do activity 9.2
- Teacher: Discuss why plants respond to light and gravity. Mention thigmotropism, and demonstrate examples of plants that show this. Arrange pairs for Activity 9.2.
- Learners: Provide feedback.
- Teacher: Read through the instructions for Activity 9.2.
- Learners: Find information about thigmotropisms and write up a report of findings.

### Assessment

- Teacher: Set the assessment task as a class activity.
- Learners: Complete the assessment task.
- Teacher: Monitor progress against planned timing. Take in assessment task for marking.

## 9. Support for learners with learning difficulties

### Remedial

1. Give the meaning of each of the following terms:
  - a) tropism
  - b) stimulus
2.
  - a) Name two types of tropisms.
  - b) For each type, write down the stimulus and response in the stems and roots.
3. Explain why roots grow downwards.

### Answers

1.
  - a) The response of a plant to a stimulus
  - b) A factor that brings about a change in an organism or a response
2.
  - a) Phototropism and gravitropism
  - b) Phototropism – the stimulus is light; stems grow towards light; roots grow away from light.  
Gravitropism – the stimulus is gravity; stems grow against gravity; roots grow with gravity.
3. Roots grow downwards into the soil to find water and minerals.

### Consolidation

1. Give the meaning of each the following words:
  - a) tropism
  - b) stimulus
  - c) response
  - d) phototropism.
2. Give one reason why plant shoots respond to:
  - a) light
  - b) gravity.
3. Make a labelled drawing to show how the shoot and root grow in a seedling.

### Answers

1.
  - a) The response of a plant to a stimulus
  - b) A factor that brings about a change in an organism or a response

- c) A change that occurs as a result of a stimulus
- d) The response of plants to light
- 2. a) Plant shoots respond to light because they need it for photosynthesis.
- b) Roots grow downwards into the soil in response to the downward force of gravity, to find water and minerals.
- 3. Learners should draw a diagram similar to Figure 9.2 and Figure 9.4 in the Student's Book.

**Extension**

- 1. Write a paragraph to compare how animals and plants respond to stimuli.
- 2. Find out about taxic responses in animals.

**Answers**

- 1. Animals respond quickly; plants respond slowly. Animals respond to a greater number of stimuli than plants do. A response in an animal often involves its whole body; in plants it involves only part of the plant.
- 2. A taxic response is an animal's response to a unidirectional stimulus, for example, light, temperature, gravity or chemicals.

**10. Suggested answers for activities**

**Activity 9.1**

- 1. Tap and fibrous root systems
- 2. Roots absorb water and mineral salts from the soil; they anchor the plant into the soil; some are modified for food storage.
- 3. Roots have a large surface area for the absorption of water; they contain transport tissue and have root hairs.

**Experiment 9.1**

- 1. a) The roots grew downwards, and the stems grew upwards.
- b) The roots grew downwards, but the stems grew towards the light.
- 2. A stem grows towards light, so it is positively phototropic.

**Experiment 9.2**

- 1. The roots grew downwards, and the stems grew upwards.
- 2. Root – positively gravitropic; stem – negatively gravitropic
- 3. a) The stem started to grow upwards.
- b) The plant grew like this as it is negatively gravitropic.
- c) The pot plant was put into a dark cupboard so that it would not receive light, which meant that only the effect of gravity was tested.

**Activity 9.2**

- 1. a) The plant leaves curl up in response to touch.
- b) Learners should show the curling response in their drawings.
- 2. Learners should write up a short paragraph that includes the following information:

Stimulus	Name of tropism	Positive response of plant part	Negative response of plant part
Touch	Thigmotropism ('thigmo' means touch)	Curles	No response
Water	Hydrotropism ('hydro' means water)	Moves towards water	Moves away from water
Chemicals	Chemotropism ('chemo' means chemical)	Moves towards a chemical	Moves away from a chemical

## 11. Answers for end unit assessment 9

1. No. An animal responds quickly; a plant responds slowly. Animals respond to a greater number of stimuli than plants do. A response in an animal often involves its whole body; a response in a plant involves only part of the plant.
2. a) The growth of a stem **towards** or away from a light **stimulus** is called **phototropism**.  
b) Plant stems are **negatively** gravitropic.  
c) Plant **roots** are positively gravitropic.
3. To absorb maximum light for photosynthesis.
4. Learners should show the plant shoot bending upwards.
5. Learners should write an experimental report as follows:  
**Materials:** germinating bean seeds; clinostat; pins  
**Method:**
  1. Place four seedlings onto the clinostat (on its side) and start it rotating.
  2. Place another four seedlings on to a stationary clinostat (on its side).
  3. Leave the seedlings for two days.

### **Results:**

On the rotating clinostat, the seedlings' roots grew straight. On the stationary clinostat, they grew downwards.

### **Conclusion:**

Seedlings' roots respond positively to the downward force of gravity; they are positively gravitropic.

## TOPIC 2 | Organisation and maintenance of life

### Sub-topic: Support and locomotion

#### UNIT 10 Skeletal systems of organisms

**Key unit competence:** To be able to analyse the different types of skeletons and identify the main parts of a human skeleton.

##### At the end of this unit, learners should be able to:

- Recall the different types of skeleton in organisms
- List the characteristics of hydrostatic skeletons, exoskeletons and endoskeletons
- Explain the role of the different types of skeletons
- State the functions of the human/ mammalian skeletal system
- Describe the general structure of the human skeleton and identify the bones of the central and peripheral parts
- Recognise the different parts of the human skeleton from models in class
- Practice illustrating and labelling the major bones
- Research on the skeleton and presentation of the findings
- Take care of your bones so your skeleton stays strong and healthy.

#### 1. Content summary

- Types of skeletons (hydrostatic, exoskeleton, endoskeleton).
- Parts of human skeleton: Central skeleton consisting of the skull, vertebral column and thoracic cage
- The peripheral skeleton consisting of the upper and lower limbs, the shoulder and pelvic girdles
- Functions of human skeleton
- Practices that favour good health of the skeletal system.

#### 2. Key vocabulary

Support system, skeleton, hydrostatic skeleton, exoskeleton, moulting, joints, flexible, endoskeleton, cartilage, chordates, backbone, central skeleton, peripheral skeleton, vertebrae, spinal cord, thorax, ribs, hip bones

#### 3. Competences practised

Basic competence

- Literacy: Listening carefully for understanding and seeking clarification when necessary

Generic competence

- Research and team work: Work together in activities to collect data and present their findings.

#### 4. Cross-cutting issue

Inclusive Education: When you are working in groups during an activity, make sure everyone is involved and allowed to give their input or opinion.

#### 5. Classroom organisation

Pairs and groups in classroom

## 6. Teaching materials

Illustrations and computer-aided study materials; prepared slides, microscopes; pictures of small animals (rat/rabbit/ guinea pig, toad/frog, and cockroach/ locust); specimens of different bones; specimen jars

## 7. Before you start

- This unit describes skeleton types and structures. Try to obtain some bones to show learners. Discuss how different animals' skeletons are suited to their locomotion.
- Teacher: Arrange learners in groups for the oral activity.
- Learners: Complete the oral activity.

## 8. Teaching steps [6 periods]

### Guidance on Introductory activity

Guide students to work on the introductory activity that is in the student textbook.

Answers will vary depending on learners' observations and findings.

### Lesson 1 Types of skeletons

- Learners: Do the introductory activity
- Teacher: Review the introductory activity. Arrange learners in groups to complete it.
- Learners: Complete introductory activity.
- Teacher: Describe the need for skeletons, and mention the three types: hydrostatic, exoskeleton and endoskeleton. Give examples of animals that have each type. Discuss hydrostatic and exoskeletons in more detail.
- Learners: Understand types of skeletons and refer to Figures 10.2–10.5 on in the Student's Book.

### Characteristics of hydrostatic skeletons, exoskeletons and endoskeletons

- Teacher: Consolidate work from previous lesson. Give guidelines to learners for completing activity 10.1.
- Learners: Complete activity 10.1.
- Teacher: Describe endoskeletons in more detail. Refer to Table 10.1 in the Student's Book to compare the three types of skeletons. Arrange learners in pairs for Activity 10.1.
- Learners: Complete Activity 10.1.
- Teacher: Monitor learners' progress and assist where necessary. Discuss the learners' answers in class.
- Learners: Provide feedback and ensure learning outcomes have been met.

### Lesson 2 Human skeleton

- Teacher: Arrange learners in groups for Activity 10.2. Allow learners to go outside to collect some specimens. Emphasise that they need to treat their specimens with care and that they must return them unharmed to the place where they found them. Provide collecting bottles.
- Learners: Complete Activity 10.2.
- Teacher: Describe the human skeleton. Use charts to help you, and Figure 10.6 in the Student's Book.
- Learners: Understand the structure of the human skeleton.
- Teacher: Talk about the central skeleton, which is made up of the skull, vertebral column and thoracic cage.

### Peripheral skeleton

- Teacher: Consolidate the previous lesson, and revise the structure of the skeleton.
- Learners: Ask questions about the skeleton.



- Teacher: Describe the peripheral skeleton, which is made up of the upper and lower limbs, pectoral girdle and pelvic girdle. Give guidelines on activity 10.2.
- Learners: Complete activity 10.2.
- Teacher: Discuss the answers to activity 10.2, and mark in class.
- Learners: Provide feedback, and ensure learning outcomes have been met.

### Lesson 3 Functions of the skeleton

- Learners do activity 10.3
- Teacher: Review the functions of the skeleton as outlined in Table 10.2 in the Student's Book. Set up some bones for learners to observe, and draw as required in activity 10.3. Arrange learners in pairs.
- Learners: Complete activity 10.3.
- Teacher: Facilitate learners as they work on activity 10.3. Offer assistance if needed.
- Learners: Provide feedback, and ensure learning outcomes have been met.

### Lesson 4 Looking after our skeletal system

- Learners do the case study
- Teacher: Ask learners if they can think of ways we can look after our skeletons. Read through the section 'Looking after our skeletal system' in the Student's Book. Help with vocabulary if necessary.
- Learners: Read the section 'Looking after our skeletal system' in the Student's Book.
- Teacher: Ask learners to complete the self assessment task.
- Learners: Complete the self assessment.

## 9. Support for learners with learning difficulties

### Remedial

1. Name three bones in the human skeleton found in the:
  - a) upper limbs
  - b) lower limbs.
2. Name three different types of skeletons, and give an example of an animal that has each type.
3. Give three functions of the skeleton.

### Answers

1. a) Humerus, radius and ulna, carpals, metacarpals and phalanges  
b) Femur, patella, tibia and fibula, tarsals, metatarsals and phalanges
2. Exoskeleton – crab, locust, beetle; hydrostatic skeleton – earthworm; endoskeleton – human, cow, gorilla
3. Support, protection and movement

### Consolidation

1. Group these animals into three groups according to the type of skeleton that they have.  
frog snake fly goat centipede butterfly flatworm caterpillar mosquito donkey octopus
2. Name two animals that have:
  - a) a hydrostatic skeleton
  - b) an exoskeleton
  - c) an endoskeleton.
3. Make a neat, labelled drawing to show the bones of the pectoral girdle.

### Answers

1.

Hydrostatic skeleton	Exoskeleton	Endoskeleton
flatworm, caterpillar, octopus	fly, centipede, butterfly, mosquito	frog, snake, goat, donkey

2. a) Snail, slug, worm, jelly fish  
b) Locust, spider, crab, scorpion  
c) Human, dog, elephant, bird
3. Learners should draw a diagram similar to Figure 10.10 in the Student's Book.

### Extension

1. Find out about how bones heal after they have been fractured.
2. Find out about the incidence of osteoporosis in women worldwide. In which country are the women worst affected? What tests are available to find out if a woman has osteoporosis?
3. Find out about the exoskeleton of insects. What are the skeletons made from? How are the muscles attached to them?

### Answers

1. Use the following websites for information:  
[http://www.foothealthfacts.org/footankleinfo/Bone\\_Healing.htm](http://www.foothealthfacts.org/footankleinfo/Bone_Healing.htm)  
[http://kidshealth.org/kid/ill\\_injure/aches/broken\\_bones.html](http://kidshealth.org/kid/ill_injure/aches/broken_bones.html)
2. Use the following websites for information:  
<http://www.iofbonehealth.org/facts-statistics>  
<http://www.osteoporosis.ca/osteoporosis-and-you/osteoporosis-facts-and-statistics/>
3. Use the following websites for information:  
<http://animals.mom.me/insects-skeleton-outside-body-9265.html>  
<http://www.cals.ncsu.edu/course/ent425/tutorial/integ.html>

## 10. Suggested answers for activities

### Introductory activity

1. The bones of the skeleton
2. Muscles
3. Vital organs such as the brain, heart and lungs
4. No, some organisms have a fluid skeleton, e.g. worms, and some have an external skeleton, e.g. insects.
5. Yes, animals are able to move differently. Animals can fly, crawl, swim, run, etc. Their bodies are adapted in different ways, for example, by having wings, fins, long legs, etc.

### Self assessment 10.1

1. Worms, leeches, slugs, snails, flatworms, jellyfish
2. Fluid
3. Crabs, spiders, scorpions
4. a) When an outer skeleton is shed as the animal grows  
b) Their bodies get too big for their exoskeleton.
5. They have muscles attached to their skeletons.
6. It gives protection against injury and predators; it can help camouflage the animal; it prevents water loss.

### Activity 10.1

1. Learners should group the animals according to their skeletons.
2. Answers will vary, depending on the specimens.

### Self assessment 10.2

1. It protects the brain.
2. There are 12 pairs of ribs.
3. a) Backbone  
b) Vertebrae
4. The ribs, sternum and vertebral column
5. Femur, vertebrae
6. It protects the spinal cord; it provides points of attachment for muscles.
7. a) Ribs, sternum, vertebrae  
b) Scapula, clavicle  
c) Femur, patella, tibia and fibula, tarsals, metatarsals and phalanges
8. A – clavicle; B – sternum;  
C – scapula; D – humerus

### Self assessment 10.3

1. a) An outer skeleton found in invertebrates and made of a substance called chitin  
b) A structure found at the place where two bones meet  
c) A skeleton found inside the body of an animal  
d) A skeleton made up of fluid
2. a) Locust, crab, scorpion  
b) Worm, slug, snail, jelly fish
3. a) Humerus, radius and ulna, carpals, metacarpals and phalanges  
b) Clavicle, scapula  
c) Vertebrae, hip bones
4. Support, protection and movement

### Activity 10.3

Learners should draw diagrams similar to those in Figures 10.10 and 10.11 on pages 104 and 105 in the Student's Book.

### 11. End unit assessment 10

1. Bones
2. They moult and produce a new exoskeleton.
3. Heart, lungs

4. Joint
5. Skull
6. Vertebrae
7. To protect the spinal cord
8. They have joints where the exoskeleton is flexible, and muscles.
9. a) As the amount of calcium a person eats increases, so does their bone density.  
b) Exercise, sunshine, age

### 12.

#### Formal assessment answers for topic 2

(SB pp. 109-110)

1. a)  $10 \times 40 = 400\times$  (3)  
b)  $6\times$  (1)
2. Complete the table below by filling in the correct information.

	Plant cell	Animal cell
Shape	Regular	Irregular
Outer covering	Cell wall and cell membrane	Cell membrane
Organelles	Nucleus, mitochondria, chloroplasts, cytoplasm, vacuoles	Nucleus, mitochondria, cytoplasm, vacuoles
Vacuoles	Large	Small or none

3. a) i) A group of similar cells that perform a particular function  
ii) A group of similar tissues that work together to form a particular function (2 × 2 = 4)  
b) A – xylem;  
B – red blood cells (2 × 2 = 4)  
c) Xylem transports water and mineral salts. Red blood cells transport oxygen. (4)
4. a) 1 – nose;  
2 – right bronchus;  
3 – cartilage rings;

- 4 – bronchioles;  
 5 – trachea;  
 6 – left bronchus;  
 7 – diaphragm (7)
5. a) i) Carbohydrate (2)  
 ii) Vitamin C (2)  
 b) Vitamin B and vitamin C (2)  
 c) Iron (2)  
 d) i) Anaemia (2)  
 ii) Scurvy (2)
6. a) i) Starch and proteins (3)  
 ii) Lipids (3)  
 b) Place food sample on a white tile.  
 Use a dropper to place a few drops  
 of iodine on the sample. Observe  
 colour change. If the sample turns  
 blue-black, starch is present. If the  
 colour remains orange-brown, no  
 starch is present. (6)
7. Use rubric 3 to assess learners'  
 research:

### Rubric 3

	5	4	3	2	1
<b>Examples</b>	All given	Three examples given	Two examples given	One example given	No examples given
<b>Drawings</b>	Very clear, neat and labelled	Clear and some labels	Quite clear and a few labels	Not very clear and very few labels	Unclear and no labels
<b>Specialisation related to function</b>	Well explained; excellent grasp of concept	Very good explanation; very good grasp of concept	Good explanation; good grasp of concept	Fair explanation; fair grasp of concept	Not understood
<b>Presentation</b>			Neat	Fairly neat	Untidy

(18)

Total mark: 68

## Sub-topic: Infectious and non-infectious diseases

### UNIT 11 Classification of diseases

**Key unit competence:** To be able classify diseases and explain ways of preventing the spread of infectious diseases.

**At the end of this unit, learners should be able to:**

- Define good health as a state of mental, social and physical wellbeing
- Define disease as any physical or mental disorder or malfunction with a characteristic set of signs and symptoms
- Explain how infectious diseases (cholera, tuberculosis, malaria, Ebola, HIV/AIDS) are spread
- Explain ways in which infectious and non-infectious diseases can be prevented
- Classify diseases into infectious, non-infectious, inherited, degenerative, social, mental, eating disorder and deficiency diseases
- Adopt and encourage the practices that enhance good health
- Be aware that the clearing of bushes and grasses in the habitats of the anopheles mosquitoes and the treatment of the stagnant water for the anopheles larvae are necessary for eradicating malaria.

#### 1. Content summary

- Health and disease
- Classification of diseases
- The spread and prevention of infections
- Non-infectious diseases: sickle cell, allergies, ageing, osteoporosis, cancer, cardiovascular diseases, eating disorders, deficiency diseases.

#### 2. Key vocabulary

Health, disease, pathogens, communicable, infections, quarantine, gene, haemoglobin, carrier, immune system, menopause, obesity, calories, prevalent

#### 3. Competences practised

Basic competence

- Literacy: Listening carefully for understanding and seeking clarification when necessary

Generic competence

- Cooperation: Understand diseases and how to prevent them.

#### 4. Cross-cutting issue

Comprehensive sexuality education: Rwandans need to ensure that they lead healthy lifestyles so that they can contribute to the Rwandan economy. HIV/AIDS is a serious disease that impacts on the lives of many Rwandans as well as the country's economy.

#### 5. Classroom organisation

Individuals, pairs and groups in classroom

#### 6. Teaching materials

Charts and computer-aided materials

## 7. Before you start

- Learners always enjoy learning about diseases. Try to elicit responses about learners' own communities to add context to this unit. However, be sensitive to learners' situations as they may have lost family members to different diseases.
- Teacher: Arrange learners in groups for the oral activity.
- Learners: Complete oral activity.

## 8. Teaching steps [5 periods]

### Guidance on Introductory activity

Guide students to work on the introductory activity that is in the student textbook.

Answers will vary depending on learners' observations and findings.

### Lesson 1 Health and disease

- Teacher: Explain the learning objectives and any associated assessment. Review prior learning. Collect learners' ideas for achieving the objective(s). Facilitate oral activity.
- Learners: Complete introductory activity in groups.
- Teacher: Discuss the terms 'good health' and 'disease'. Arrange learners in groups for Activity 11.1.
- Learners: Complete Activity 11.1.
- Teacher: Provide feedback and facilitate discussion about practices that promote good health. Arrange groups to make a poster in Activity 11.2. Give guidelines as to what makes a good poster. This task can be completed for homework.
- Learners complete the self assessment 11.1

### Lesson 2 Infectious diseases

- Learners do activity 11.2 and present.
- Teacher: Distinguish between infectious and non-infectious diseases, and give examples of each. Review Activity 11.2, and arrange learners in groups.
- Learners: Complete Activity 11.2.
- Teacher: Give feedback and monitor progress. Define a communicable disease, and describe ways that communicable diseases can be spread from one person to another. This will consolidate information that learners included on their posters.

### Experiment to make an ORS

- Teacher: Revise types of diseases, and give guidelines for Activity 11.1.
- Learners: Complete Activity 11.1.
- Teacher: Set up materials for Experiment 11.1.
- Learners: Complete Experiment 11.1.
- Teacher: Capture feedback from Experiment 11.1. Reinforce learning outcomes.
- Learners: Contribute to feedback and ensure all learning outcomes have been met.

### Lesson 3 Non-infectious diseases

- Learners do activity 11.3
- Teacher: Introduce learners to some non-infectious diseases. Give guidance on Activity 11.3.
- Learners: Collect information for Activity 11.3.
- Teacher: Capture feedback from activity. Reinforce learning outcomes.
- Teacher: Reinforce the meaning of 'non-infectious disease'.
- Learners: Make sure that 'non-infectious disease' is understood.
- Teacher: Describe sickle cell anaemia,

allergies, ageing, osteoporosis, cancer, cardiovascular diseases, eating disorders, deficiency diseases and mental illnesses. Mention signs and symptoms, and treatments for each disease. Review self assessment 11.2. This could be set as a homework task.

- Learners: Complete self assessment 11.2 and Activity 11.4.
- Teacher: Capture feedback from exercises and activities. Reinforce learning outcomes.

## 9. Support for learners with learning difficulties

### Remedial

1. Name two infectious and two non-infectious diseases.
2. Mention three ways to prevent the spread of disease.
3. List any three practices that promote good health.

### Answers

1. Infectious – TB, cholera; non-infectious – scurvy, osteoporosis
2. Warn people about a disease outbreak; improve public hygiene; quarantine people with a disease; immunise against diseases.
3. Eat a balanced diet; eat at regular intervals; get enough sleep; maintain good hygiene of the body, clothes, the home and foods; drink safe water; exercise regularly; avoid eating too much salt; wash your hands before each meal and after going to the toilet.

### Consolidation

1. List five types of diseases.
2. Give the meaning of each of these terms:
  - a) infectious disease
  - b) hypertension
  - c) immunisation

d) haemoglobin.

3. Draw a table like the one below, and complete it.

Name of disease	Causes
Sickle cell anaemia	
Allergies	
Stroke	

### Answers

1. Infectious disease, non-infectious disease, inherited disease, eating disorder, deficiency disease
2. a) A disease that can spread from one person to another  
b) High blood pressure  
c) An injection that helps our bodies to fight disease  
d) A pigment in red blood cells that carries oxygen molecules

3.

Name of disease	Causes
Sickle cell anaemia	A gene passed from parents
Allergies	Reaction by immune system to a substance
Stroke	Too little oxygen reaching the brain

### Extension

1. Do research in the library or on the Internet to find out about ageing and osteoporosis.
  - a) What are the signs of ageing?
  - b) Which diseases occur more often in older people?
  - c) How can you take care of a person suffering from ageing?
  - d) Explain how a person gets osteoporosis.
  - e) What can a person do to avoid getting osteoporosis?
2. Find out about malaria in Rwanda – the incidence, steps to eradicate it, and ways people can avoid getting it.

## Answers

1. a) Slowing down physically, mentally and socially
- b) Cancer, osteoporosis, mental illnesses
- c) Learners should mention patience, caring and tolerance in their answers.
  
- d) Lack of vitamin D, calcium, lack of exercise and lack of sunshine
- e) Eat foods that contain vitamin D and calcium, and do exercise.
2. Use the following websites for information:  
<http://www.rw.undp.org/content/rwanda/en/home/mdgoverview/overview/mdg6.html>  
[http://www.who.int/malaria/publications/country-profiles/profile\\_rwa\\_en.pdf](http://www.who.int/malaria/publications/country-profiles/profile_rwa_en.pdf)  
<http://www.cdc.gov/malaria/>

## 10. Suggested answers for activities

### Introductory activity

1. Being able to lead an active life
2. Answer will vary, depending on the learners' community.
5. Learners should come up with their own definitions.

### Activity 11.1

- Eat a balanced diet.
- Eat at regular intervals.
- Get enough sleep.
- Maintain good hygiene of the body, clothes, the home and foods.
- Exercise regularly.
- Avoid eating too much salt.
- Wash your hands before each meal and after going to the toilet.
- Drink safe water.

### Activity 11.2

1. An infection is a disease caused by an organism inside a person's body.
2. a) HIV/AIDS, tuberculosis (TB), malaria, measles, mumps, flu
- b) Learners to research these diseases:

	Transmission	Prevention
<b>Tuberculosis</b>	Spread by people living in crowded conditions. Spread in droplets in the air when people cough.	Treat infected people with antibiotics.
<b>Malaria</b>	Transmitted by mosquitoes that carry the pathogen.	Destroy mosquitoes.
<b>Ebola fever</b>	Spread in droplets when people touch each other.	Quarantine and isolate infected people.
<b>HIV/AIDS</b>	Transmitted through sexual intercourse with an infected person.	Use condoms.

3. a) Wash hands after going to the toilet. Wash hands before eating. Drink safe water.
- b) Keep food covered. Ensure rubbish and sewage are properly removed.
- c) Take them for treatment at a hospital. Give the person rehydration fluid.



### Activity 11.3

1. 'Ageing' is the natural process that takes place when people get older. Osteoporosis occurs mostly in older women, as a result of their bones becoming brittle.
2. Slowing down mentally and physically
3. We can take care of ageing people by helping them to prepare meals, assisting them with shopping and visiting them.

### Activity 11.4

1. a) Infectious disease – HIV/AIDS, tuberculosis (TB), malaria  
b) Non-infectious disease – anaemia, kwashiorkor, obesity, high blood pressure (hypertension)  
c) Inherited disease – cystic fibrosis  
d) Eating disorder – obesity, kwashiorkor  
e) Deficiency disease – anaemia
2. Cholera – infectious disease; scurvy – deficiency disease; sickle cell anaemia – inherited disease; stroke – non-infectious disease

### 11. Answers for end unit assessment 11

1. a) Cholera, malaria, tuberculosis  
b) Sickle cell anaemia, haemophilia, cystic fibrosis  
c) Arthritis
2. a) A disease characterised by a gradual decline in function; often associated with ageing.  
  
b) Negative social behaviour, such as drug dependence; often caused by social pressure.  
  
c) A disease caused by a poor diet that lacks one or more essential nutrients)
3. a) Vitamin C  
b) Vitamin D
4. refer to student book
5. a) Cardiovascular disease  
b) Diabetes
6. Education and awareness campaigns; improved public hygiene; quarantine and immunisation
7. Crowded conditions
8. a) Spraying with insecticides; removal of sources of stagnant water; spraying with oil  
b) Resistance of the malarial parasite to medicines
9. Sport is beneficial for people as it results in healthy, fit individuals; it promotes social interactions; it teaches sportsmanship and perseverance.

## Sub-topic: Reproductive health

### UNIT 12 Human reproductive system

**Key unit competence:** To be able to analyse the structure, functions and processes of the human sexual and reproductive system and relate to the understanding of sex and gender.

**At the end of this unit, learners should be able to:**

- Describe the structure and function of the human sexual and reproductive system
- List the external and internal organs of the male reproductive system
- List the external and internal organs of the female reproductive system
- Explain the production of sex cells: gametogenesis
- Compare the size and shape of ovum and sperm
- Explain the role of hormones in growth, development and the regulation of the reproduction organs and sexual functions
- Define sex determination
- Analyse how culture, tradition and religious practices influence one's thinking about sex, gender and reproduction
- Appreciate that gender stereotypes are not biologically determined and can be challenged.

#### 1. Content summary

- External and internal reproductive organs
- The process of sperm and ovum production
- Determination of sex
- Role of hormones in growth, development, and the regulation of reproductive organs and sexual functions
- Influence of culture, tradition and religious practices on one's thinking about sex, gender and reproduction.

#### 2. Key vocabulary

Neutralise, prostate gland, ejaculation, ova, oestrogen, progesterone, erectile, vagina, hymen, cervix, uterus, endometrium, ovaries, ovulation, oviduct, gametogenesis, germinal cells, puberty,

hypophysis, menstrual cycle, chromosomes, gender equality, germinal cells

#### 3. Competences practised

Basic competence

- Literacy: Listening carefully for understanding and seeking clarification when necessary

Generic competence

- Cooperation: Practising positive ethical and moral attitudes with respect to socially acceptable behaviour - gender equality

#### 4. Cross-cutting issue

Comprehensive sexuality education:

- HIV/AIDS, STIs, family planning, gender equality and reproductive health are important issues in Rwanda.

- Healthy people can work to sustain themselves. People with HIV/AIDS have a greater chance of slipping into poverty or to remain in poverty.

## 5. Classroom organisation

Individuals, pairs and groups in classroom

## 6. Teaching materials

Charts and computer-aided materials

## 7. Before you start

- Learners enjoy this topic, as it is relevant to their lives as teenagers. Be sensitive to learners' development – some are more mature than others, and they may respond differently to the information in this topic. You should also be open and honest when answering learners' questions; treat the questions in a scientific and objective manner. When discussing gender issues and equality, encourage learners to respect other learners' opinions.
- Teacher: Arrange learners in groups for the oral activity.
- Learners: Complete oral activity.

## 8. Teaching steps [10 periods]

### Guidance on Introductory activity

Guide students to work on the introductory activity that is in the student textbook.

Answers will vary depending on learners' observations and findings.

### Lesson 1 Reproductive organs

- Learners do activity 12.1.
- Teacher: Introduce the topic of reproduction and gender using the introductory activity.
- Learners: Learners complete the introductory activity.

- Teacher: Monitor learners' progress and facilitate the discussion. Explain the functions of the reproductive organs in terms of gamete production, transport of the male gametes to the ovum, production of hormones, and as a site for development of the embryo. Describe the external structure of the male reproductive organs using any charts, models or diagrams you have available to help your explanation.
- Learners: Use any available visual materials to help with understanding the structure and function of the external male structures.

### Male reproductive organs

- Teacher: Consolidate what was learnt in the previous lesson. Move on to discuss the internal organs as shown in Figure 12.3 in the Student's Book. Review Table 12.1 in the Student's Book.
- Learners: Complete self assessment 12.1.
- Teacher: Facilitate learners' progress and ensure learning outcomes have been met. Discuss answers to assessment 12.1.
- Learners: Provide feedback.

### Female reproductive organs

- Teacher: Describe the female reproductive organs using any charts and diagrams that you may have. Use Table 12.2 in the Student's Book to assist your explanation of the structure and function of the external organs.
- Learners: Review structure and function of external organs.
- Teacher: Describe the structure and function of the internal organs.
- Learners: Complete self assessment 12.1.
- Teacher: Observe learners, and monitor their progress and timing. Mark self assessment 12.1 in class and discuss.

- Learners: Contribute to feedback, and ensure all learning outcomes have been met.

### **Lesson 2** The process of sperm and ovum production

- Learners do activity 12.2
- Teacher: Remind learners that the reproductive organs are responsible for the production of gametes. Explain the word 'gametogenesis'. Refer to Figure 12.5 in the Student's Book and describe the structure of a sperm cell.
- Learners: Review structure of a sperm cell, and understand the functions of the different parts.
- Teacher: Refer to Figure 12.6 in the Student's Book. Ask learners for the differences between the male and female gametes.
- Learners: Try to work out the differences between the male and female gametes.

### **Lesson 3** The role of hormones in reproduction

- Learners do activity 12.3
- Teacher: Mention that the reproductive organs are also responsible for the production of hormones. Explain the word 'hormone'. Refer to Table 12.5 in the Student's Book and describe the male and female hormones: where they are made and their functions.
- Learners: Understand the reproductive hormones.
- Teacher: Give guidance on the homework activity. Reinforce learning outcomes.

### **Lesson 4** Sex determination

- Learners do activity 12.4
- Teacher: Arrange learners in pairs for Activity 12.4. Distribute coloured cards, and explain what the learners have to do.
- Learners: Complete Activity 12.4 in pairs.
- Teacher: Monitor progress against planned timing.
- Teacher: Ask learners how males and females/boys and girls come about. Discuss learners' ideas, and then describe the sex hormones. Use diagrams to help your explanation of sex determination.
- Learners: Complete self assessment 12.3.
- Teacher: Observe and assist learners when necessary. Reinforce learning outcomes.
- Learners: Contribute to feedback, and ensure all learning outcomes have been met.

### **Lesson 5** Influence of culture, tradition and religion on sex, gender and reproduction

- Learners do activity 12.5
- Teacher: Gender equality and gender issues are topical subjects for teenagers. The influence of religion, traditions and culture is important. Exercise sensitivity when discussing this topic, and respect other peoples' views. Arrange learners in groups, and read through Activity 12.5.
- Learners: Complete Activity 12.5.
- Teacher: Observe learners and facilitate learners' discussion. Monitor progress against planned timing.
- Teacher: Discuss gender equality. Refer to the table in the Student's Book.
- Learners: Complete self assessment 12.4.

- Teacher: Observe learners and facilitate learners' discussions. Monitor progress against planned timing. Take in learners' paragraphs for marking.

## 9. Support for learners with learning difficulties

### Remedial

1. Give the function of each of these parts of the male reproductive system:
  - a) testes
  - b) penis
  - c) prostate gland.
2. Give the function of each of these parts of the female reproductive system:
  - a) uterus
  - b) oviducts
  - c) ovaries.
3. a) Name:
  - i) one male hormone
  - ii) two female hormones.
 b) Give the function of each hormone mentioned in question (a).

### Answers

1. a) Produce testosterone; the place where sperm cells are made
- b) The organ that is placed in the vagina during sexual intercourse for delivery of semen
- c) Produces fluid that neutralises the acidity of the urine in the urethra, improves the mobility of sperm
2. a) Involved in the menstrual cycle; is the place where the baby develops during pregnancy
- b) Where fertilisation takes place
- c) Where an ovum is produced each month
3. a) i) testosterone
- ii) oestrogen, progesterone, follicle stimulating hormone (FSH), luteinising hormone (LH)

- b) Testosterone – produces secondary male sexual characteristics.  
Oestrogen – produces secondary female sexual characteristics; is involved in the development of the ovum; plays a role in the menstrual cycle. Progesterone – is important in the menstrual cycle and pregnancy. FSH – is involved in the production of ova. LH – causes ovulation to take place.

### Consolidation

1. Give a reason for each of the following:
  - a) The uterus has powerful muscles.
  - b) The oviducts are lined with ciliated epithelium.
2. Draw a table to show the structure and functions of each internal part of the female reproductive system.
3. Draw a table to show the differences between the production of sperm cells and the production of ova.

### Answers

1. a) To contract during childbirth and expel the foetus
- b) To move the ovum along the oviduct towards the uterus
2. Learners should draw a table similar to Table 12.3 in the Student's Book.
3. Learners should draw a table similar to Table 12.4 in the Student's Book.

### Extension

1. Find out about some diseases that affect the human reproductive system, for example, sexually transmitted infections (STIs) and types of cancer.
2. Conduct research about gender equality in two countries.
3. Make models of the male and female reproductive systems using coloured plasticine.

## Answers

1. Learners can use the following websites to find information:

<https://www.dmu.edu/medterms/male-reproductive-system/male-reproductive-system-diseases/>

<https://www.dmu.edu/medterms/female-reproductive-system/female-reproductive-system-diseases/>

2. Use the following websites to find information:

<http://www.adb.org/features/12-things-know-2012-gender-equality>

<http://www.peacecorps.gov/wvs/articles/global-issues-gender-equality-and-womens-empowerme/>

3. Learners should build models of the reproductive organs using the diagrams in the Student's Book.

## Rubric 4

	3	2	1	0
Includes own opinions			Yes	No
Written in a logical way			Yes	No
Neat			Yes	No
Includes information on cultural, traditional and religious practices	Extensive and appropriate information included	Fairly extensive and mostly appropriate information included	Some appropriate information included	No appropriate information included
<b>TOTAL = 6</b>				

## 10. Suggested answers for activities

### Self assessment 12.1

1. Learners' table must be similar to Table 12.3 in the Student's Book.
2. a) Oestrogen, progesterone, follicle stimulating hormone (FSH), luteinising hormone (LH)  
b) Oestrogen and progesterone are produced in the ovaries. (FSH and LH are produced in the pituitary gland.)

3. a) To expel the foetus from the uterus during childbirth  
b) To move the ovum along the oviduct towards the uterus

### Self assessment 12.2

1. Learners should draw diagrams similar to Figures 12.5 and 12.6 in the Student's Book.
2. Testosterone
3. a) Oestrogen, progesterone, follicle stimulating hormone (FSH), luteinising hormone (LH)  
b) Oestrogen – produces secondary female sexual characteristics; is involved in the development of the ovum; plays a role in the menstrual cycle. Progesterone – important in the menstrual cycle and pregnancy. FSH – involved in the production of ova. LH – causes ovulation to take place.

### Self assessment 12.3

1. By the presence of external reproductive organs and by the type of sex chromosomes they have in their cells.
2. A chromosome is a structure found in the nucleus of a cell that carries information about an organism's characteristics.
3. The X chromosomes and the Y chromosomes
4. The baby will be a boy – XY.
5. The father has some sperm cells that have an X chromosome and some that have a Y chromosome. The ovum has an X chromosome. If a sperm cell with an X chromosome fuses with the ovum, then the resulting baby will be a girl (XX). If a sperm cell with a Y chromosome fuses with the ovum, then the resulting baby will be a boy (XY).

### Self assessment 12.4

Learners should discuss gender equality/inequality in their community and how cultural, traditional and religious practices influence peoples' views.

After their discussion, they should write a paragraph about this and hand it in for marking.

## 11. Answer for end unit assessment 12

- 1 a) A – Diagram to show the structure of the male reproductive system (front view)  
B – Diagram to show the structure of the female reproductive system (front view)  
b) 1 – epididymis  
2 – sperm duct  
3 – bladder  
4 – ureter  
5 – seminal vesicles  
6 – prostate gland  
7 – penis  
8 – urethra  
c) 9 – ovary  
10 – oviduct  
11 – cervix  
12 – vagina  
d) Epididymis – stores sperm; sperm duct – transports sperm from epididymis; bladder – stores urine; ureter – transports urine from kidneys to bladder; seminal vesicles – produce neutralising fluid; prostate gland – produces neutralising fluid that helps sperm motility; penis – transfers semen to female body; urethra – transports urine and semen out of male body.  
e) Ovary – produces ova and female hormones; oviduct – passage for ova to uterus, site of fertilisation; cervix – ring of muscle, important in childbirth; vagina – place where penis is placed during intercourse, the passage for the baby out of female body during childbirth.

## Sub-topic: Reproductive health

### UNIT 13 Puberty and sexual maturation

**Key unit competence:** To be able to analyse the physical, emotional and social changes related to puberty.

**At the end of this unit, learners should be able to:**

- Define puberty and how it affects the body emotionally and physically
- State the key emotional and physical changes during puberty
- Describe the hormones that bring about these changes
- Describe the various phases of the menstrual cycle
- Analyse the physical, emotional, and social changes associated with puberty between girls and boys
- Show respect for diversity in when and how peers develop and change during puberty

#### 1. Content summary

- Puberty is a time of sexual maturation which leads to major physical and emotional changes and can be stressful.
- Puberty occurs at different times for different people, and has different effect on boys and girls.
- Male and female hormones differ and have a major influence on the emotional and physical changes that occur over one's lifetime.
- Hormones can affect body shape and size, body hair growth, development and other changes.
- The menstrual cycle.

#### 2. Key vocabulary

Puberty, primary sexual characteristics, secondary sexual characteristics, testosterone, oestrogen, menarche, menopause

#### 3. Competences practised

Basic competence

- Literacy: Listening carefully for understanding and seeking clarification when necessary

Generic competence

- Cooperation: Understanding puberty and its social challenges

#### 4. Cross-cutting issue

Comprehensive sexuality education:

Pressure to have sex at an early age could lead to social and economic problems.

Understand the consequences of unplanned pregnancies. Honour yourself and your body.

#### 5. Classroom organisation

Individuals, pairs and groups in classroom

#### 6. Teaching materials

Illustrations and computer-aided materials



## 7. Before you start

- As in the previous unit, you will need to be sensitive to learners' contribution or lack of contribution to discussions. Be sensitive to learners' development – some are more mature than others, and they may respond differently to the information in this unit. You should also be open and honest when answering learners' questions; treat the questions in a scientific and objective manner.
- Teacher: Explain the learning objectives and any associated assessment. Review prior learning. Collate learners' ideas for achieving the objectives.
- Learners: Ensure they understand clearly the objectives, activities and assessment.

## 8. Teaching steps [8 periods]

### Lesson 1 Puberty

- Learners do activity 13.1
- Teacher: Arrange learners in groups of girls and boys for the introductory activity.
- Learners: Complete introductory activity about teenage issues.
- Teacher: Facilitate introductory activity. Be sensitive to the issues raised as these may be difficult for some shy learners to discuss.
- Learners: Contribute to feedback, and ensure all learning outcomes have been met.
- Explain the word 'puberty'. Ensure that learners understand the difference between primary and secondary sexual characteristics.
- Learners: Contribute to an understanding of what puberty is.
- Teacher: Refer learners to Figure 13.2 to consolidate changes that occur during puberty in males and females.

- Learners: Contribute to feedback, and ensure all learning outcomes have been met.

### Hormones and puberty

- Teacher: Consolidate the material covered in the previous lesson by referring to Table 13.1.
- Learners: Ensure that secondary sexual changes that occur during puberty are understood.
- Teacher: Introduce learners to the hormones that bring about these changes. They will need to use this information when discussing the menstrual cycle.
- Learners: Ensure the role of hormones is understood.

### Lesson 2 The menstrual cycle

- Learners do activity 13.2
- Teacher: Remind learners about the term 'menstrual cycle', and mention that hormones are involved, as discussed in the previous lesson.
- Learners: Use Figure 13.3 to visualise the changes that take place in the uterus during the menstrual cycle. Relate events to the days of the cycle.
- Teacher: Discuss the phases of the menstrual cycle using Figure 13.3 to help you.
- Teacher: Consolidate the events of the menstrual cycle. Arrange learners in pairs for Activity 13.2.
- Learners: Complete Activity 13.2 in class.
- Teacher: Spend time going over the answers to Activity 13.2.
- Learners: Contribute to feedback, and ensure all learning outcomes have been met.
- Learners complete the self assessment 13.1

### Lesson 3 Social issues and puberty

- Learners do activity 13.3.
- Teacher: Discuss the consequences of teenage pregnancy and unintended pregnancy. Be aware that this is a sensitive issue and take care that you do not offend any learners during the discussion. Arrange learners in groups so that they can plan their role-play, as outlined in Activity 13.3.
- Learners: Plan and prepare the role-play.
- Teacher: Facilitate the discussion of the role-play.
- Learners: In the next lesson, perform the role-play.
- Teacher: Facilitate discussion with the class after each role-play, highlighting important points that may have been demonstrated.

## 9. Support for learners with learning difficulties

### Remedial

1. On which days in the menstrual cycle do the following occur?
  - a) ovulation
  - b) menstruation
  - c) the time when falling pregnant after unprotected sex is most likely
2. Make a list of changes that occur during puberty in:
  - a) boys
  - b) girls.
3. Name three hormones that are involved in reproduction in males and females.

### Answers

1. a) Between days 10 and 15    b) On days 1 to 5  
c) Between days 10 and 15
2. a) Facial, pubic and underarm hair starts to grow; voice deepens; body size increases and becomes more muscular; sex organs increase in size; sperm are produced in the testes; acne may occur.

- b) Pubic and underarm hair starts to grow; breasts enlarge; fatty tissue is deposited on the hips and thighs; hips broaden; menstruation starts; ova are released from the ovaries; acne may occur.
3. Oestrogen, progesterone, testosterone

### Consolidation

1. Define each of the following words:
  - a) puberty
  - b) menarche
  - c) menstruation.
2. During which phase of the menstrual cycle do the following occur?
  - a) ovulation
  - b) preparation of the endometrium for possible pregnancy
3. List three consequences of an unintended pregnancy.

### Answers

1. a) The time when boys and girls become sexually mature  
b) The first menstrual cycle  
c) When the lining of the uterus is shed
2. a) Ovulatory phase    b) Luteal phase
3. Negative impact on education and career prospects; family disruption

### Extension

1. Find out about the impact of family planning on a woman's health and her pregnancies.
2. Do research on the different types of family planning available, and list the advantages and disadvantages of each type.

## Answers

1. and 2. Use the following websites for information:

[http://www.who.int/topics/family\\_planning/en/](http://www.who.int/topics/family_planning/en/)

[http://www.fpa.org.uk/factsheets/](http://www.fpa.org.uk/factsheets/teenagers-sexual-health-behaviour)

[teenagers-sexual-health-behaviour](http://www.slideshare.net/luciennzayirata/family-planning-in-rwanda)

[http://www.slideshare.net/luciennzayirata/](http://www.slideshare.net/luciennzayirata/family-planning-in-rwanda)

[family-planning-in-rwanda](http://www.slideshare.net/luciennzayirata/family-planning-in-rwanda)

## 10. Suggested answers for activities

### Activity 13.2

1. Approximately 28 days
2. Menstruation begins.
3. Six days
4. An ovum is released from the ovary.
5. Between days 11 and 18. The ovum has been released and is moving along the oviduct at this time. If it meets sperm, fertilisation could occur.
6. If the egg is not fertilised, it dies, and the uterus lining is shed during menstruation, after a few days.

### Self assessment 13.1

1. Primary sexual characteristics are present from birth; secondary sexual characteristics develop during puberty.
2. a) Testosterone b) Oestrogen and progesterone
3. b) Between days 11 and 18  
c) No, the day can vary in different women.  
d) Day 28 or day 1  
e) No, the day can vary in different women.
4. a) The time in a woman's life when the menstrual cycle stops  
b) The phase during the menstrual cycle when the egg is produced in an ovary in preparation for ovulation; the endometrium starts to get thicker.

## 11. Answer for end unit assessment 13

1. 1.1 – E  
1.2 – A  
1.3 – F  
1.4 – B  
1.5 – C  
1.6 – D
2. 30 July

## Sub-topic: Reproductive health

### UNIT 14 Reproduction, pregnancy and childbirth

**Key unit competence:** To be able to analyse the process of reproduction, pregnancy and childbirth.

#### At the end of this unit, learners should be able to:

- Describe male and female reproductive systems
- Explain the process of fertilisation
- Explain how a pregnancy occurs
- Describe the signs of pregnancy, and the stages of foetal development and childbirth
- Define maternal mortality and list major causes of maternal mortality
- Describe ways that poverty and gender inequality lead to death among pregnant women and how these outcomes can be prevented
- List health risks associated with early pregnancy and birth
- Analyse using simulations of stages of pregnancy and discuss the signs and behavioural symptoms of pregnancy
- Appreciate the importance of the steps that should be taken to promote safe pregnancy and childbirth
- Show concern about maternal mortality as an issue in the region.

#### 1. Content summary

- Reproduction: Male and female reproductive systems
- Intercourse and fertilization
- Pregnancy and its signs
- Foetal development
- Ante-natal care
- Childbirth and
- Health risks associated with teenage pregnancy and early child birth
- Steps to promote safe pregnancies and childbirth.

#### 2. Key vocabulary

Ejaculation, fertilisation, conception, zygote, implantation, embryo, foetus, placenta, umbilical cord, labour, Caesarian section, maternal mortality, abortion, unintended pregnancy

#### 3. Competences practised

Basic competence

- Literacy: Listening carefully for understanding and seeking clarification when necessary

Generic competence

- Cooperation: Understand the risks and consequences of teenage pregnancies
- Critical thinking: Think reflectively, broadly and logically about challenges encountered in all situations

#### 4. Cross-cutting issue

Comprehensive sexuality education: Unintended pregnancies and teenage pregnancies may lead to health problems as well as social and economic difficulties. Healthy pregnancies, childbirth, antenatal and postnatal care are essential for all Rwandan women.

## 5. Classroom organisation

Individuals, pairs and groups in classroom

## 6. Teaching materials

Illustrations and computer-aided materials

## 7. Before you start

- As in the previous two units, you will need to be sensitive to learners' contribution or lack of contribution to discussions. Be sensitive to learners' development – some are more mature than others, and they may respond differently to the information in this unit. You should also be open and honest when answering learners' questions; treat the questions in a scientific and objective manner.
- Teacher: Explain the learning objectives and any associated assessment. Review prior learning. Collate learners' ideas for achieving the objectives.
- Try to access computer simulations of the stages of pregnancy to show to learners.
- Arrange for a medical official to visit the school to discuss health risks associated with early pregnancy and birth.

## 8. Teaching steps [8 periods]

### Guidance on Introductory activity

Guide students to work on the introductory activity that is in the student textbook.

Answers will vary depending on learners' observations and findings.

#### Lesson 1 Sexual intercourse and fertilisation

- Teacher: Arrange learners in groups of girls and boys for the introductory activity.
- Learners: Complete the introductory activity about reproduction.

- Teacher: Facilitate the introductory activity. Be sensitive to the issues raised, as these may be difficult for some shy learners to discuss.
- Learners: Contribute to feedback and ensure all learning outcomes have been met.
- Learners: Learners complete activity 14.1 on their own.
- Teacher: Discuss the answers to activity 14.1 in class. Revise any areas about which learners seem unsure. Use charts and models of the reproductive system to help you.
- Learners: Contribute to feedback, and ensure all learning outcomes have been met.
- Teacher: Discuss sexual intercourse, fertilisation and foetal development. Be sensitive to learners' levels of maturity. Discuss these topics in a scientific and objective manner whilst allowing time for learners to ask sensible questions.
- Learners: Ensure that all new words are understood. Draw up a list of new words and their meanings.
- Learners complete the self assessment 14.1

#### Lesson 2 Foetal development

- Learners do activity 14.2
- Teacher: Consolidate foetal development, and explain the importance of the placenta.
- Learners: Complete activity 14.2 in class.
- Teacher: Discuss the answers to activity 14.2 with learners in class, and let them mark their own work. You could set this as a homework task if you do not have time for its completion in class.
- Learners: Contribute to feedback, and ensure all learning outcomes have been met. They also complete the self assessment 14.2.

### Lesson 3 Process of childbirth

- Teacher: Describe the signs of pregnancy and the stages of childbirth.
- Learners: Learners should refer to Figure 14.6.
- Teacher: Discuss problems that may occur during childbirth. Be sensitive to learners' experiences.
- Learners: Contribute to feedback, and ensure all learning outcomes have been met.

### Lesson 4 Teenage pregnancy

- Learners do activity 14.4
- Teacher: Reinforce the risks associated with pregnancy and childbirth, and state the ways that these can be mitigated by attendance at health clinics, and antenatal and postnatal care.
- Learners: Discuss dangers in their community associated with pregnancy and childbirth, and the facilities available to help.

### Unintended pregnancy

- Teacher: Use this lesson to build on the role-play of an unintended pregnancy in Unit 13.
- Learners: Complete self assessment 14.3 in class.
- Teacher: Discuss the answers to self assessment 14.3 with learners, and revise any misconceptions or inaccurate facts.
- Learners: Contribute to feedback, and ensure all learning outcomes have been met.
- Teacher: Discuss teenage pregnancy, and arrange learners in groups for Activity 14.1.
- Learners: Complete self assessment 14.3 in groups and discuss unintended pregnancy, the consequences of teenage pregnancy and maternal mortality.

## 9. Support for learners with learning difficulties

### Remedial

1. Make a neat, labelled drawing to show the fusion of a sperm and an ovum.
2. Give any three functions of the placenta.

### Answers

1. Learners should draw a diagram similar to Figure 14.2.
2. Provide the foetus with nutrients; remove waste products from the foetus' blood; exchange oxygen and carbon dioxide between the foetus' blood and the mother's blood; act as a filter for harmful substances, although some substances, such as nicotine, drugs and alcohol, as well as viruses such as HIV, can pass through it and reach the foetus; secrete hormones

### Consolidation

1. What is another name for each of the following?
  - a) pregnancy
  - b) birth
2. Explain why the baby must position itself with its head down during childbirth.

### Answers

1. a) Gestation b) Parturition
2. The baby positions itself so that its head will move through the birth canal first. This prevents the arms and legs from getting stuck, which would make the birth difficult.

### Extension

1. Design a poster for a clinic in Rwanda to display, which shows the steps a pregnant woman should take for a healthy pregnancy and childbirth.

2. Two people are needed to make a baby.  
Are two people needed to look after it?  
Write a paragraph to express your views.
3. Find out the gestation time for any three mammals.

### Answers

1. Use the rubric below to mark the poster:

CRITERIA	5	4	3	2	1
	Excellent	Very good	Good	Fair	Needs help
Content: Main points, facts/ concepts	Excellent. Bold heading. Relevant facts. Interesting, with evidence of research and insight	Clear heading. Facts clear and ordered. Well researched	Clear heading. Facts mostly clear and well ordered	Heading clear but not appropriate. Facts clear but not well ordered	Not clear/ muddled. Important facts left out/ lost in detail
Interesting information	Excellent information. Evidence of extensive research	Very good information. Evidence of good research	Good information. Evidence of some research	Adequate information. Little evidence of research	Poorly researched. Insufficient information
Organisation, layout, aesthetic appeal, use of colour	Excellent layout and organised use of relevant visuals/ colour. Strikingly appealing	Very good use of colour/ additional relevant pictures. Appealing layout	Good use of colour/ additional relevant pictures. Layout could be more eye-catching	Adequate use of colour and order in layout. A good effort	Partially ordered layout. Incomplete/ not easy to follow. Some use of colour

2. Learners should write a paragraph to give their opinion on whether one or both parents are needed to raise a child. Each will have, and is entitled to, his or her own opinion.
3. Answers will vary. Examples of gestation times: elephant – 21 months; dog – 63 days; donkey – 12 months.

## 10. Suggested answers for activities

### Introductory activity

1. Production of hormones; development of the foetus
2. Around the time of ovulation (days 11 to 18)
3. Circumstances differ, but usually an unintended pregnancy occurs when an unmarried woman or teenager falls pregnant, or after rape. Other causes of unintended pregnancy include not using contraception or not using it properly, lack of education about unprotected sex and lack of family planning.
4. Unintended pregnancies can have negative emotional, social and health consequences.

### Self assessment 14.1

1. a) Testes            b) Penis
2. Ovary, oviduct, uterus, cervix, vagina
3. a) Oviducts        b) Uterus

### Self assessment 14.2

1. a) The single cell that forms after an egg and sperm cell fuse
- b) The fusion of an egg and sperm cell
- c) The moment when fertilisation takes place
- d) The structure that forms to provide the developing foetus with oxygen and nutrients and to remove carbon dioxide and waste products
2. a) Provide the foetus with nutrients; remove waste products from the foetus' blood; exchange oxygen and carbon dioxide between the foetus' blood and the mother's blood; act as a filter for harmful substances, although some substances, such as nicotine, drugs and alcohol, as well as viruses such as HIV, can pass through it and reach the foetus; secrete hormones
- b) Drugs and alcohol can cross the placenta and enter the foetus' blood if the mother consumes them during her pregnancy. This can harm the baby and lead to mental and physical disabilities.

### Self assessment 14.3

1. a) The structure that develops eight weeks after fertilisation
- b) The single cell that forms after fusion of the male and female sex cells
- c) The process during which a child is born
2. An embryo consists of mainly undifferentiated tissue; a foetus has developed different tissues and organs.
3. Complications from delivery, such as severe bleeding; infection; unsafe abortion
4. An unintended pregnancy is an unplanned pregnancy.



### Extension

Use the rubric on page 17 of this Teacher's Guide to mark the posters.

### 11. Answers for end unit assessment 14

1. Production of hormones; development of the foetus
2. a) When the penis is placed in the vagina  
b) When the ball of cells (blastocyst) burrows into the lining of the uterus  
c) The process during which a child is born through the vagina
3. Not using contraception, or not using it properly; lack of education about unprotected sex; lack of planning; rape
4. Taking vitamins; resting; eating healthily; avoiding alcohol, caffeine and cigarettes; seeing a health worker to assist at the birth; eating well-cooked foods; not changing cat litter boxes
5. Menstruation stops; slight bleeding or cramping as the embryo implants in the uterus; tender breasts; extreme tiredness; backache; nausea or sickness; needing to urinate more often; headaches, due to the sudden rise of hormones in the body; darkening of the skin around the nipples; food cravings or aversions; emotional sensitivity and outbursts, due to high hormone levels
6. It has cultural significance for some Rwandans. Some Rwandans bury it to keep away evil spirits.

### 12.

#### Formal assessment answers for topic 3

1. 1.1 – C  
1.2 – B  
1.3 – B  
1.4 – C  
1.5 – C  
1.6 – B  
1.7 – C (7 × 2 = 14)
  2. a) 1 – bladder  
2 – urethra  
3 – testis  
4 – scrotum  
5 – epididymis  
6 – sperm duct  
7 – seminal vesicles  
8 – prostate gland (8)  
b) 1 – oviducts  
2 – ovary  
3 – cervix  
4 – vagina;  
5 – muscular wall of uterus  
6 – egg (6)
  3. a) i) 27 % ii) 14 % (2 × 2 = 4)  
b) i) Rural areas (2)  
ii) Less access to health care; lack of information; cultural practices; poverty (2 × 2 = 4)
  4. Health issues – premature labour; maternal death  
Social/emotional issues – stigmatisation and/or exclusion from family or community  
Socio-economic issues – dropping out of school; reduced employment opportunities (3 × 2 = 6)
  5. Awareness/health education; improved public hygiene; quarantine/isolation; immunisation; improved health care (3 × 2 = 6)
- Total marks: 50**

# Worksheet 1

## UNIT 1 Introduction to Biology

1. a) List any two aspects of biology. (2)  
b) Which aspect of biology deals with:  
i) the study of insects  
ii) the study of microscopic living things? (2)

2. Matching columns. Match the term or description in Column A with the term in Column B.

Column A	Column B
2.1 Characteristic	A. toxic
2.2 A dangerous situation	B. feature
2.3 Poisonous	C. genetics
2.4 The study of the structure of living things	D. hazard
	E. anatomy

(4)

3. Complete the following sentences using the words below:

movement	growth	organisms	reproduce
----------	--------	-----------	-----------

Biologists call living things \_\_\_\_\_. All living things produce offspring when they \_\_\_\_\_. \_\_\_\_\_ is more easily seen in animals than in plants. When living things get bigger and increase in mass, it is called \_\_\_\_\_. (4)

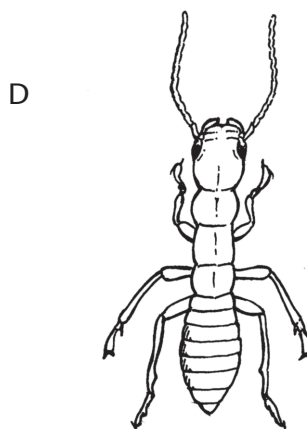
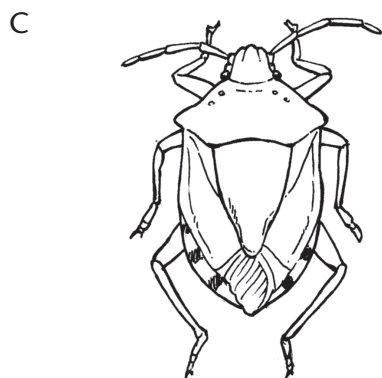
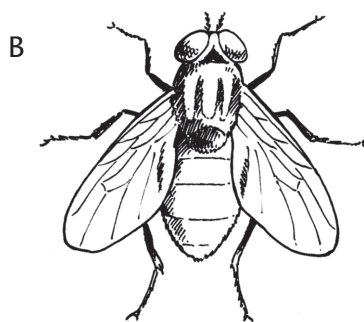
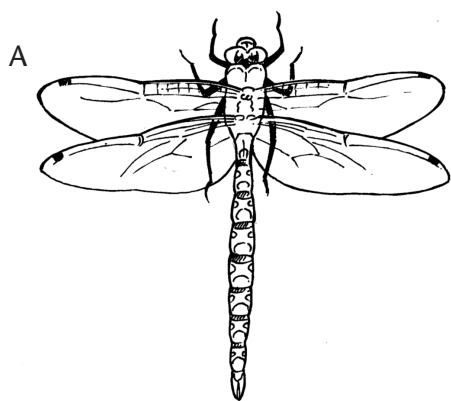
4. List any three safety rules that should be followed in a laboratory. (3)  
5. Explain how you would treat a student who has splashed a chemical into his or her eye. (3)  
6. Explain why it is important to wash your hands after handling chemicals. (2)

[20 marks]

# Worksheet 2

## UNIT 2 Introduction to classification

1. Write down two sentences to explain why scientists need to classify living things. (2)
2. Give an example of a non-living thing that:
  - a) has always been dead
  - b) was once alive but is now dead. (2)
3. Write down the scientific names below correctly.
  - a) Rhizopus Nigrans
  - b) panthera leo (2)
4. List two characteristics of all organisms in the following kingdoms:  
animals  
plants  
fungi. (3 x 2 = 6)
5. Draw a dichotomous key that could be used to identify the following insects.  
A – dragonfly;  
B – housefly;  
C – beetle;  
D – termite (8)



[20 marks]

# Worksheet 3

## UNIT 3 The external structure and importance of flowering plants

1. Draw a table like the one below to show four differences between monocotyledonous and dicotyledonous plants.

	Monocotyledons	Dicotyledons
Number of seed leaves		
Type of root system		
Number of flower parts		
Pattern of veins on leaves		

(8)

2. List:

- a) three functions of the stem
- b) two functions of the veins in leaves
- c) two functions of roots.

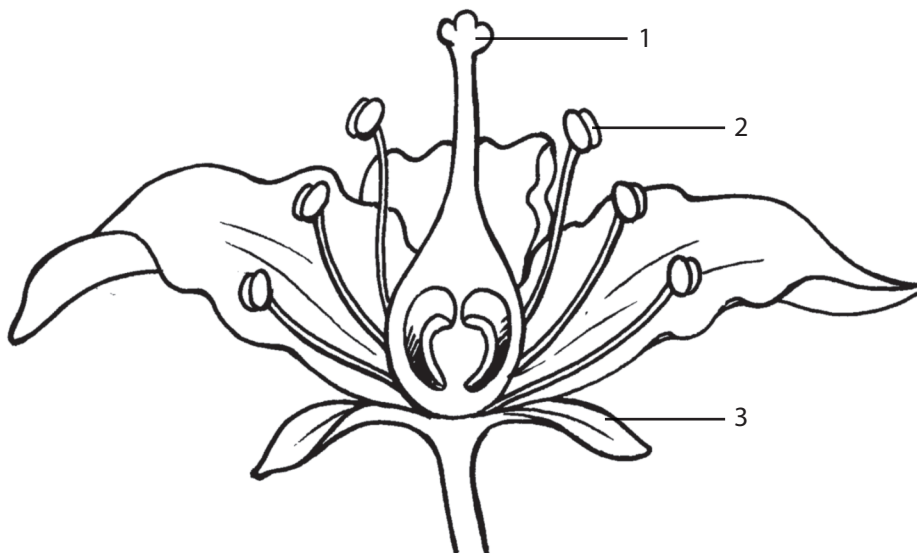
(7)

3. Give two reasons why plants can have modified leaves.

(2)

4. Redraw the diagram below and label the parts 1-3.

(3)

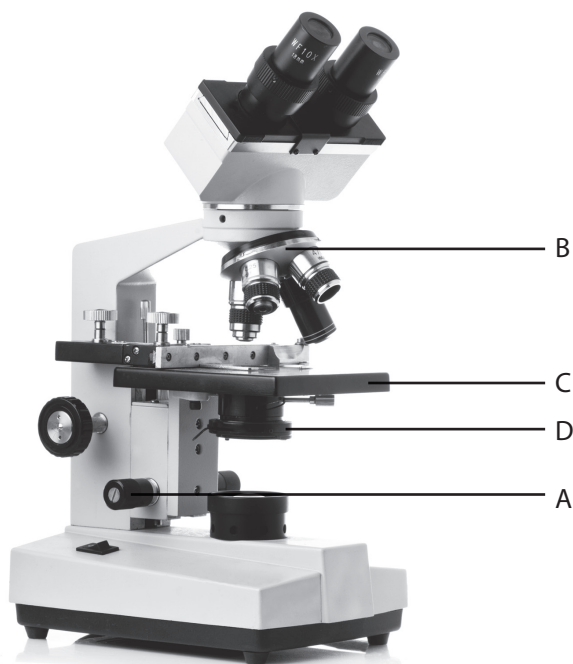


[20 marks]

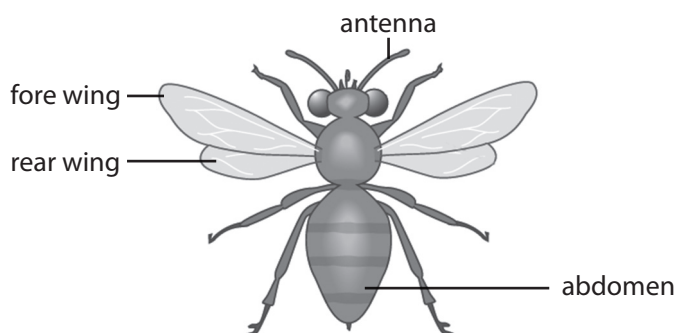
# Worksheet 4

## UNIT 4: Magnifying instruments and biological drawings

1. Eric measures the length of a flower. It is 4 cm long. He makes a biological drawing of it. The flower is 12 cm. By how much has the flower been magnified? (3)
2. A student uses a microscope with the 20x eyepiece lens and a nosepiece lens of 40x. What is the total magnification? Show your working. (3)
3. Provide labels for the microscope parts A to D. (4)



4. Make a labelled biological drawing of the bee shown below. Remember to give your drawing a heading. (10)



[20 marks]

# Worksheet 5

## UNIT 5 Plant and animal cells

1. Matching columns. Match the description in Column A with the term in Column B.

Column A	Column B
1.1 structures inside cells that perform special functions	A. cytoplasm
1.2 single celled organisms	B. muscle cells
1.3 a jelly like substance inside all cells	C. organelles
1.4 animal cells that contain many mitochondria	D. skin cells
	E. unicellular

(4)

2. Give the main function(s) of each of the following organelles:

- a) two functions of the nucleus
- b) cell membrane
- c) chloroplast
- d) vacuole
- e) mitochondria.

(6)

3. Draw a table to show the differences between a plant and an animal cell.

(10)

[20 marks]

# Worksheet 6

## UNIT 6 Levels of organisation in multicellular organisms

1. Define the following terms:
  - a) tissue
  - b) organ
  - c) system.(3)
2. Make a labelled drawing of the following cells:
  - a) root hair cell (5)
  - b) nerve cell (4)
3. Arrange the terms below in the correct order starting with the smallest. tissue, organism, cell, organ, organelle, organ system (3)
4. Write down two advantages that cell specialisation gives to organisms. (2)
5. Matching columns. Match the description in Column A with the term in Column B.

Column A	Column B
5.1 a structure in the head of a sperm cell that contains enzymes	A. motile
5.2 when water can pass easily through a membrane	B. acrosome
5.3 a red substance found in red blood cells	C. permeable
	D. haemoglobin
	E. selectively permeable

(3)

[20 marks]

# Worksheet 7

## UNIT 7 Food nutrients and diet

1. Write down any two reasons why we need food nutrients. (2)
2. List three elements that are found in all food nutrients. (3)
3. Complete the table below.

Food nutrient	Two foods it is found in
proteins	
fats	
carbohydrates	

 (6)

4. Give any two reasons why the following nutrients are important:
  - a) proteins
  - b) fats. (4)
5. Explain what is meant by the term balanced diet. (2)
6. A learner tested a food sample for food nutrients. He recorded his results in a table.

Name of reagent used	Colour before test	Colour after test
Iodine	orange	blue-black
ethanol	clear	milky
Sodium hydroxide and copper sulphate	blue	blue

Which nutrients are:

- a) present in the food sample
  - b) absent in the food sample?
- (3)

[20 marks]



# Worksheet 8

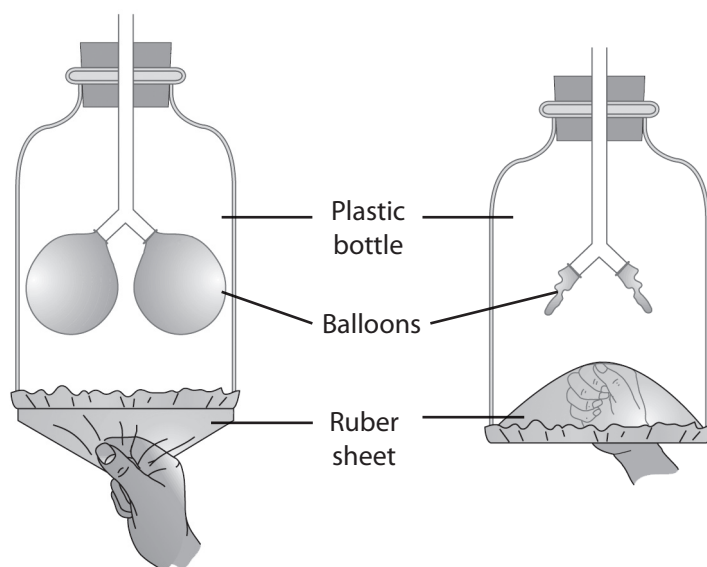
## UNIT 8 Structure and functions of the human gas exchange system

1. Multiple choice. Choose the correct answer.

1.1 Blood that flows to the alveoli in the lungs has:

- A) a high concentration of oxygen and a low concentration of carbon dioxide
- B) a low concentration of oxygen and a high concentration of carbon dioxide
- C) equal concentrations of oxygen and carbon dioxide
- D) no carbon dioxide and a high concentration of oxygen

1.2 The diagram shows a model that can be used to show breathing. Which of the following statements is correct?



- A) When the rubber sheet is pulled down the balloons inflate
- B) When the rubber sheet is pushed up the balloons inflate
- C) The balloons represent the thorax
- D) The plastic bottle represents the lungs. (2 x 2 = 4)

2. Distinguish between:

- a) respiration, gaseous exchange and breathing (6)
- b) diffusion and gaseous exchange (4)

3. List the structures through which air passes from the time when it enters the nostrils to when it is inside the alveoli. (4)

4. Name two places where gaseous exchange takes place. (2)

[20 marks]

# Worksheet 9

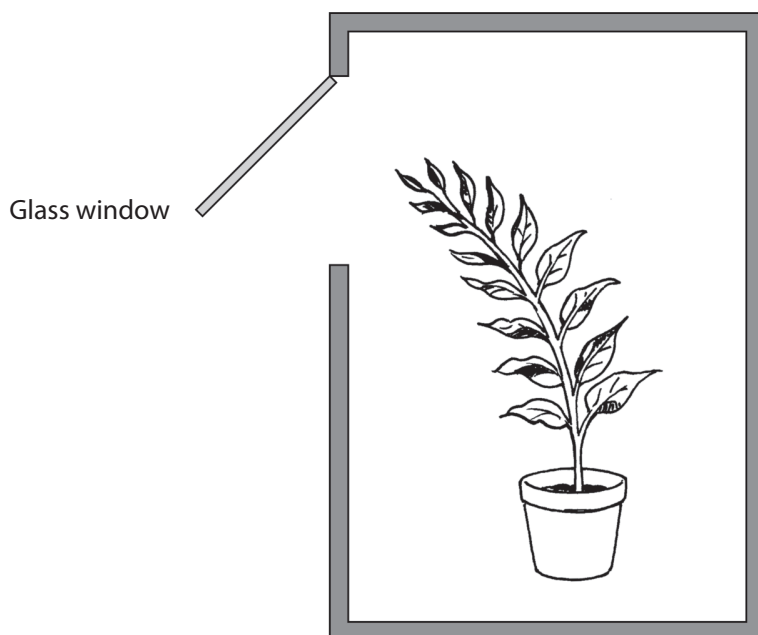
## UNIT 9 Tropic responses

1. Matching columns. Match the description in Column A with the term in Column B.

Column A	Column B
1.1 A roots response to gravity	A. tropism
1.2 Growth towards or away from a stimulus	B. clinostat
1.3 An apparatus that turns	C. positive gravitropism
1.4 Response to touch	D. thigmotropism
	E. negative gravitropism

(4)

2. A student set up the apparatus below.



- What was the aim of this experiment? (2)
- If the plant had been placed on a clinostat, what would you expect the result to be? Explain your answer. (2)
- If the glass window was blocked out, what would you expect the result to be? Explain your answer. (2)
- Why do plants respond to light in the way shown in the experiment? (2)

3. Describe how you would set up an experiment using seedlings to show the response of roots and shoots to gravity.

(10)

[20 marks]

# Worksheet 10

## UNIT 10 Skeletal systems of organisms

1. Copy and complete the table below.

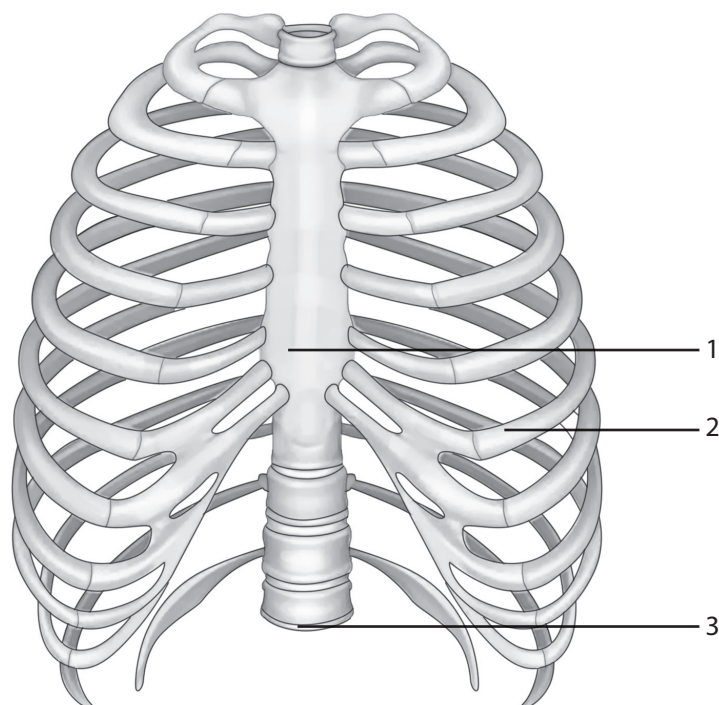
Type of skeleton	Two characteristics of this type of skeleton	Example of an animal that has this type of skeleton

(12)

2. List three functions of the human skeleton. (3)

3. Explain why it is important for our bones if we receive plenty of sunshine. (2)

4. Identify the bones labelled 1 to 3 in the diagram below. (3)



[20 marks]

# Worksheet 11

## UNIT 11 Classification of diseases

1. Matching columns. Match the description in Column A with the term in Column B.

Column A	Column B
1.1 an eating disorder	A schizophrenia
1.2 a deficiency disease	B cholera
1.3 an organism that causes disease	C rickets
1.4 an infectious disease	D obesity
1.5 a mental illness	E pathogen
	F alcoholism

(5)

2. List four ways that the spread of infectious diseases can be prevented. (4)
3. a) An elderly lady was frequently breaking bones. Which disease could she have? (1)  
b) A person was found to have unusually shaped red blood cells.  
Which disease could he have? (1)  
c) A student started to get itchy eyes and a rash. What is this called? (1)
4. The incidence of three diseases, rickets, scurvy and anaemia at a clinic in 2015 was recorded. The results are shown in the table. Draw a graph to show these results.

Disease	Number of people with the disease in 2015
rickets	100
scurvy	275
anaemia	400

(8)

[20 marks]

# Worksheet 12

## UNIT 12 Human reproductive system

1. Multiple choice. Choose the correct answer.

1.1 The function of the urethra is:

- A) to provide a passage for urine
- B) to provide a passage for semen
- C) to provide a passage for both semen and urine
- D) to lubricate the passage of semen

1.2 The function of the oviduct is:

- A) to produce the ovum
- B) to provide a passage for the ovum from the ovaries to the uterus
- C) to produce female hormones
- D) to provide a place for the foetus to develop

1.3 Sperm are produced in:

- A) the epididymis
- B) the prostate gland
- C) the sperm ducts
- D) the seminiferous tubules

(3 x 2 = 6)

2. Explain the difference between sex and gender. (4)

3. Write a paragraph to explain how the father determines the sex of a baby. (6)

4. Draw a table to show two differences between sperm and ova. (4)

[20 marks]

# Worksheet 13

## UNIT 13 Puberty and sexual maturation

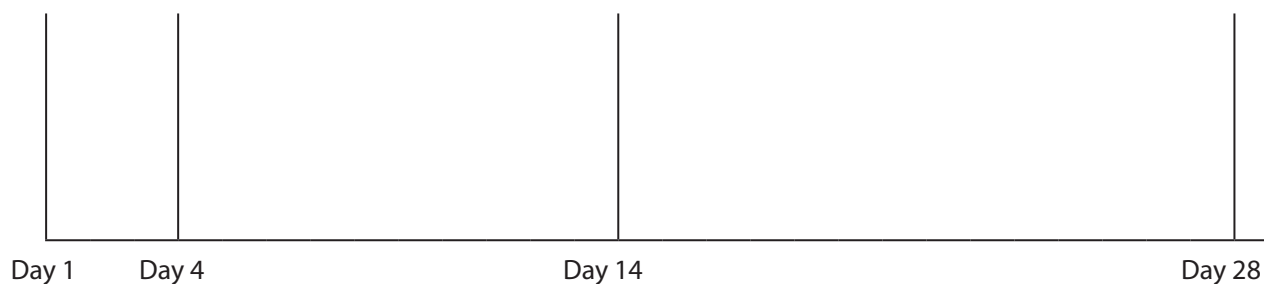
1. Define the following terms:

- a) puberty
- b) ovulation
- c) conception
- d) menopause
- e) menstrual cycle
- f) secondary sexual characteristics

(6 x 2 = 12)

2. Draw a labelled diagram to show how the endometrium changes during the menstrual cycle. Use the axes below to help you.

(6)



3. Write down two sentences to explain why unintended pregnancies should be avoided by young people.

(2)

[20 marks]

# Worksheet 14

## UNIT 14 Reproduction, pregnancy and childbirth

1. a) List three health risks associated with teenage pregnancy. (3)  
b) Give two ways that teenage pregnancies can be avoided. (2)
2. Explain the difference between postnatal and antenatal care. (2)
3. Write down two other terms that mean the same as childbirth. (2)
4. List five functions of the placenta. (5)
5. Define the following terms:
  - a) implantation
  - b) embryo
  - c) foetus. (6)
6. Complications during childbirth at a rural clinic were recorded over a one year period. The results are shown in the table. Draw a bar chart to show these results.

Complication	Number of women
Infections	4
High blood pressure	7
Pre-existing condition	5
Blood clots	1

(8)

[28 marks]

# Answers: Worksheet 1

## UNIT 1 Introduction to Biology

1. a) genetics ✓, entomology ✓, physiology ✓, microbiology ✓,  
biotechnology ✓, cytology ✓, taxonomy ✓, ecology ✓, taxonomy ✓. (any 2 = 2)
- b) i) entomology ✓  
ii) microbiology ✓ (2)
2. 2.1 – B ✓;  
2.2 – D ✓;  
2.3 – A ✓;  
2.4 – E ✓ (4)
3. Biologists call living things *organisms* ✓. All living things produce offspring when they *reproduce* ✓. *Movement* ✓ is more easily seen in animals than in plants. When living things get bigger and increase in mass, it is called growth. (4)
4. Any three safety rules on page 10 in the SB. (3)
5.
  - Remove contact lenses immediately ✓
  - Flush immediately with cool water and continue for about 15 minutes ✓.
  - Seek medical attention eye ✓. (3)
6. The chemicals could be poisonous ✓ or they could burn your hands. ✓ (2)

[20 marks]



# Answers: Worksheet 2

## UNIT 2 Introduction to classification

1. Scientists need to classify living things as there are so many living organisms on Earth ✓. They need to sort them into groups so that they can study them recognise them more easily. ✓ (2)
2. a) steel objects, plastic etc. ✓  
b) wood. ✓ (2)
3. a) *Rhizopus nigrans* ✓  
b) *Panthera leo* ✓ (2)
4. a) Animals - Their cells do not have a cell wall ✓. They are multicellular ✓ and feed on other organisms ✓. They move around ✓. (any 2)  
b) Plants – Contain a green substance called chlorophyll ✓ and make their own food by photosynthesis ✓. Their cells have a cell wall ✓. (any 2)  
c) Fungi – Reproduce using spores instead of seeds ✓. Do not photosynthesise ✓ (any 2)  
(3 x 2 = 6)
5.
  1. Has wings go to 2  
Does not have wings go to 3
  2. Has a long thin body dragonfly  
Has a round body housefly
  3. Has long antennae and a diamond shaped abdomen beetle  
Has a short antennae and a rounded abdomen termite (8)

[20 marks]

# Answers: Worksheet 3

## UNIT 3 The external structure and importance of flowering plants

1.

	Monocotyledons	Dicotyledons
Number of seed leaves	Have one seed leaf or cotyledon ✓	Have two seed leaves ✓
Type of root system	Fibrous roots ✓	Tap root ✓
Number of flower parts	multiples of three ✓	Multiples of four or five ✓
Pattern of veins on leaves	Narrow leaves with parallel veins ✓	Leaves with a net-like pattern of veins ✓

(8)

2.

a)

- transports water and mineral salts from the roots to the leaves and to other parts of the plant ✓
  - transports sugars from the leaves to all other parts of the plant ✓
  - supports buds and the leaves so they can receive enough sunlight for photosynthesis ✓
  - holds flowers in the best position for pollination ✓
  - supports the fruits and seeds in the best position for dispersal ✓
  - manufactures food for the plant by photosynthesis ✓
- (any 3)

b) support the lamina ✓, transport water and mineral salts ✓ and collect food ✓ (any 2)

c) • hold the plant firmly in the soil ✓  
 • absorb water and minerals from the soil ✓  
 • transport water and minerals to the stem. ✓

(any 2)  
(7)

3.

- prevent animals eating the plant ✓
  - prevent water loss ✓
  - store water ✓
  - store food ✓
- ( any 2 = 2)

4. 1- stigma ✓; 2 – anther ✓ 3 – sepal ✓

(3)  
[20 marks]

## Answers: Worksheet 4

### UNIT 4 Magnifying instruments and biological drawings

1.  $12/4\checkmark = 3\checkmark\checkmark$ . The flower has been magnified three times in the drawing (3)

2. total magnification  
= eyepiece x nosepiece ✓  
=  $20 \times 40\checkmark$   
=  $800x\checkmark$  (3)

3. A – fine focus;  
B – nosepiece lens;  
C – stage;  
D – diaphragm (4)

4. Rubric for biological drawing:

Drawing ...			
1. is accurate	2	1	0
2. has correct labels for features or parts	2	1	0
3. is large and clear	2	1	0
4. has straight label lines	2	1	0
5. has a heading/title	2	1	0
<b>Total</b>			<b>10</b>

[20 marks]

# Answers: Worksheet 5

## UNIT 5 Plant and animal cells

1.

1.1 – C ✓;

1.2 – E ✓;

1.3 – A ✓;

1.4 – B ✓

(4)

2 a) nucleus – controls functioning of cell ✓; contains hereditary information ✓

b) cell membrane – controls what goes into and out of the cell ✓

c) chloroplast – place where photosynthesis occurs ✓

d) vacuole – stores substances; help keep shape of cell ✓

(any one)

e) mitochondria– produce energy ✓.

(6)

3.

	Plant cell	Animal cell
Shape	Regular ✓	Irregular ✓
Outer covering	Cell wall ✓	Cell membrane ✓
Organelles	Nucleus, ✓ mitochondria, ✓ chloroplasts, ✓ cytoplasm, vacuoles ✓ (any 2)	Nucleus, ✓ mitochondria, ✓ cytoplasm ✓, vacuoles ✓ (any 2)
Vacuoles	Large ✓	Small or none ✓

(10)

[20 marks]

# Answers: Worksheet 6

## UNIT 6 Levels of organisation in multicellular organisms

1. a) tissue – a group of similar cells that perform a function, for example, muscle tissue ✓  
b) organ – a group of tissues that form a structure that performs a function ✓  
c) system – a group of organs that work together to perform a function ✓. (3)
  
2. a) Students should draw a diagram similar to Figure 6.7 on page 61 in the Student's Book (5)  
b) Students should draw a diagram similar to Figure 6.3 on page 59 in the Student's Book. (4)
  
3. *organelle, cell, tissue, organ, organ system, organism* (3)
  
4.
  - it allows cells to get bigger ✓
  - it allows cells to carry out complex processes; different cells carry out different functions ✓
  - Specialised cells can work together to form tissues, organs and organ systems. ✓ (any 2 =2)
  
5.  
5.1 – B ✓; 5.2 – C ✓; 5.3 - D ✓ (3)

[20 marks]

# Answers: Worksheet 7

## UNIT 7 Food nutrients and diet

- 1.
- energy for daily activities ✓
  - building blocks for growth and repair of cells ✓
  - substances that keep them functioning properly and staying healthy ✓ (any 2 = 2)

2. carbon ✓, hydrogen ✓ and oxygen ✓ (3)

3.

Food nutrient	Two foods it is found in
proteins	Meat, milk, chicken, fish, eggs, groundnuts, soybeans, seeds (any 2)
fats	Nuts, fish oils, meat, milk, butter, cheese, cooking oil (any 2)
carbohydrates	Sweets, sugar, fruits, rice, bread, pasta, potatoes, cassava, maize, sorghum (any 2)

(6)

4 a) proteins – Needed for growth ✓, for repair of damaged tissues ✓  
and for producing the enzymes ✓ (any 2)

b) fats – Provide energy ✓; help with absorption of fat-soluble  
vitamins A, D, E and K ✓; they form a layer beneath the skin that  
insulates the body ✓; form a layer around organs to provide  
protection from injury ✓ (any 2)  
(4)

5. A balanced diet refers to a diet that contains all the required nutrients ✓  
in the correct amounts ✓. (2)

6. a) starch ✓ and fats ✓  
b) proteins ✓ (3)

[20 marks]

## Answers: Worksheet 8

### UNIT 8 Structure and functions of the human gas exchange system

1.1 – B ✓✓;

1.2 – A ✓✓

(2 x 2 = 4)

2. a) respiration is a process by which glucose is broken down using oxygen to release energy in cells ✓✓; gaseous exchange is the movement of gases across a surface or a membrane in opposite directions ✓✓ and breathing is movement of air into and out of the lungs in mammals ✓✓ (6)

b) diffusion is the movement of molecules from a high concentration to a lower concentration ✓✓ and gaseous exchange refers to the movement of gas molecules across a surface ✓✓ (4)

3. Nasal passages ✓, trachea ✓, bronchus ✓, bronchioles ✓ (4)

4. Gas exchange takes place in the cells ✓ and in the lungs ✓. (2)

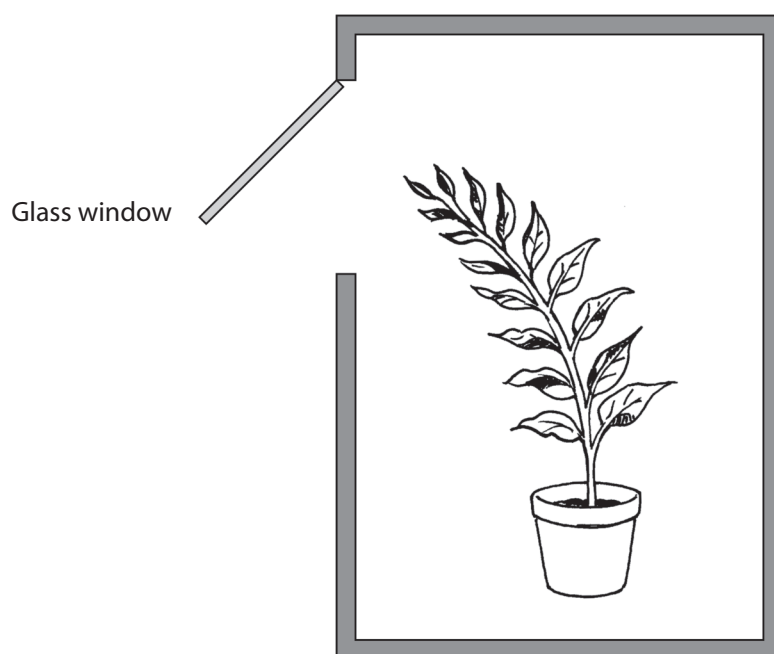
[20 marks]

## Answers: Worksheet 9

### UNIT 9 Tropic responses

1. 1.1 – C ✓;  
1.2 – A ✓;  
1.3 – B ✓;  
1.4 – D ✓ (4)

2. A student set up the apparatus below.



- a) To show that plants respond positively ✓ to one sided light ✓ (2)
- b) The plant would grow straight up ✓. It would receive light from all sides as it would be turning ✓ (2)
- c) The plant would grow straight up ✓ as there would no longer be light coming from one direction ✓. (2)
- d) Plants are positively phototropic ✓. This means that they grow towards a light source ✓. (2)

3.

#### **You will need:**

bean seeds that have been soaked in water overnight, paper towel, elastic bands, marker pens, three glass jars, a pot plant



**What to do:**

1. Fold each paper towel into 12 cm long, narrow strips.
2. Moisten the paper towel so that it is damp.
3. Place one seed on the end of each strip and roll it up.  
Keep the seed inside the paper towel using an elastic band.
4. Place the pot plant on its side and put it in a dark cupboard for a few days.
5. Leave the seeds for a few days but keep them damp with water.
6. Choose the nine best seedlings. Mark each paper towel 1, 2 or 3.
7. a) Place three paper towels with seedling in jar 1 with the roots facing downwards.  
b) Place three paper towels with seedling in jar 2 with the roots pointing sideways.  
c) Place three paper towels with seedling in jar 3 with the roots facing upwards.
8. Make sure that the jars are labelled 1, 2 and 3.
9. Check the seedlings every second day for ten days.

**Rubric for experiment:**

1. all equipment is listed	2	1	0
2. method is in point form	2	1	0
3. correct terminology is used	2	1	0
4. method is correct	2	1	0
5. neatly presented	2	1	0
<b>Total</b>			<b>10</b>

(10)  
[20 marks]

# Answers: Worksheet 10

## UNIT 10 Skeletal systems of organisms

1.

Type of skeleton	Two characteristics of this type of skeleton	Example of an animal that has this type of skeleton
Hydrostatic skeleton ✓	<ul style="list-style-type: none"> <li>• inside the body ✓</li> <li>• made of fluid ✓</li> <li>• muscles push against it to bring about movement ✓</li> </ul> (any 2)	Worms, snails, leeches (any one)
Exoskeleton ✓	<ul style="list-style-type: none"> <li>• outside the body ✓</li> <li>• made of non-living material ✓</li> <li>• does not grow ✓</li> <li>• has muscles attached to it ✓</li> </ul> (any 2)	Spiders, insects, scorpions (any one)
Endoskeleton ✓	<ul style="list-style-type: none"> <li>• inside the body ✓</li> <li>• made of living material ✓</li> <li>• grows ✓</li> <li>• muscles attached to it ✓</li> </ul> (any 2)	Birds, fish, amphibians (any one)

(12)

2. Support ✓, protection ✓, movement ✓

(3)

3. Sunshine is important for our bones as it allows vitamin D to form in our skin ✓. Vitamin D increases the strength of bones by increasing the amount of calcium absorption ✓.

(2)

4. 1 – sternum ✓; 2 – ribs ✓; 3 – vertebrae ✓

(3)

[20 marks]

# Answers: Worksheet 11

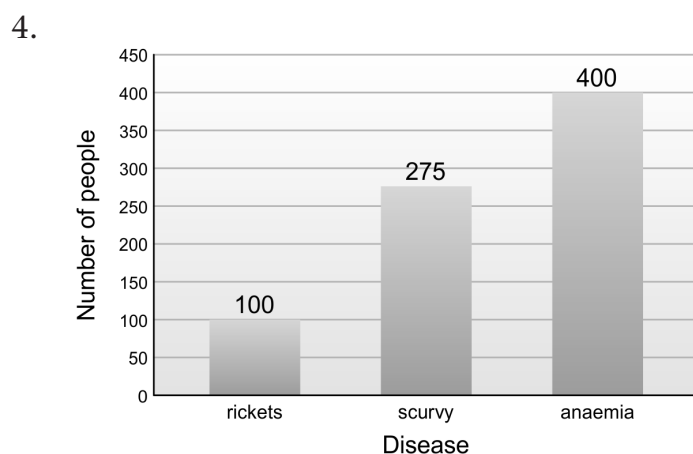
## UNIT 11 Classification of diseases

1.  
1.1 – D ✓; 1.2 – C ✓; 1.3 – E ✓; 1.4 – B ✓; 1.5 – A (5)

2.  

- Increasing awareness by informing and warning people about a particular infectious disease such as cholera or Ebola fever. ✓
- Improving public hygiene ✓.
- Isolation or quarantining people in places where they do not have contact with many other people except for health workers. ✓
- Immunization can protect people against many infectious diseases. ✓
- Increase the number of health centres ✓ (any 4 = 4)

3. a) osteoporosis ✓ (1)  
 b) sickle cell anaemia ✓ (1)  
 c) allergy ✓ (1)



Rubric for graph:

Assessment criteria	Mark allocation		
Correct type of graph (bar graph)	2		
Title/heading for graph	2		
Correct label for x- axis (disease)	1		
Correct label for y-axis (number of people)	1		
Plotting the bars	2: Plots all 3 values correctly	2: Plots 2 values correctly	1: Plots 1 or no values correctly (8)

[20 marks]

# Answers: Worksheet 12

## UNIT 12 Human reproductive system

1. 1.1 – C ✓✓;  
1.2 – B ✓✓;  
1.3 – D ✓✓ (3 x 2 = 6)

2. Sex refers to biological characteristics✓✓ while gender refers to a person's behaviour, roles and activities in society✓✓. (4)

3. The father's sperm may contain either an X or Y chromosome ✓. The mother's eggs all contain an X chromosome ✓. So depending on which sperm fuses ✓ with the female X egg cell ✓, the baby will either be a boy (XY) ✓ or a girl (XX) ✓. (6)

4.

Sperm	Ova
Made in testes of males✓	Made in the ovaries of the females ✓
Produces many sperm ✓	One egg cell ✓
Small but motile ✓	Large but non-motile✓

(any 2 x2 = 4)  
[20 marks]

# Answers: Worksheet 13

## UNIT 13 Puberty and sexual maturation

1

- a) puberty – a time of sexual maturation when physical and emotional changes take place in a person's body ✓✓
  - b) ovulation – the release of an ovum from an ovary into the oviduct ✓✓
  - c) conception – the fusion of the nuclei of the male and female sex cells ✓✓
  - d) menopause – the time in a woman's life when she stops menstruating ✓✓
  - e) menstrual cycle – a series of events that prepares the uterus for possible pregnancy ✓✓
  - f) secondary sexual characteristics – features in males and females that develop at puberty ✓✓
- (6 x 2 = 12)

2. Students should draw a diagram similar to Figure 13.3 on page 138 in the Student's Book.

**Labels:**

menstruation, ovulation, thickness of endometrium, uterus lining breaks down, luteal phase, ovulation phase, menstrual phase

(any 6 = 6)

3. Young people may find it difficult to manage the responsibilities of having a child ✓. They will lose many education and career opportunities and also cause family disruption ✓.

(2)  
[20 marks]

# Answers Worksheet 14

## UNIT 14 Reproduction, pregnancy and childbirth

1 a)

- There is a greater risk of the baby having a low birth weight ✓
- The mother going into premature labour ✓
- A higher risk of maternal death ✓ (3)

b) Sex education ✓ and access to birth control ✓. (2)

2. Postnatal care is looking after the mother after the birth of her child ✓  
and antenatal care refers to looking after the health of a pregnant woman ✓. (2)

3. Labour ✓ and parturition ✓ (2)

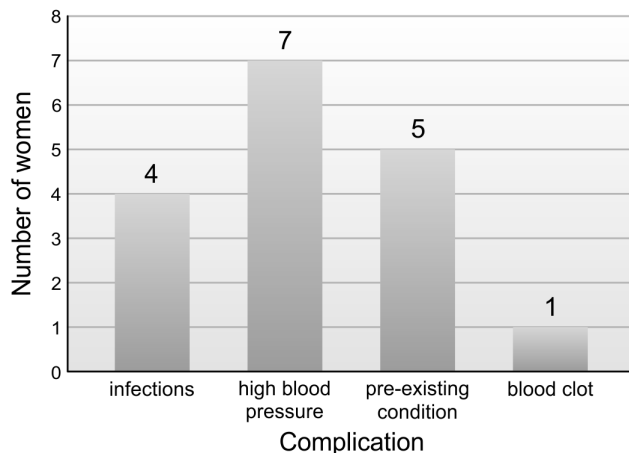
4

- to provide the foetus with nutrients ✓
- to remove waste products from the foetus' blood
- exchange oxygen and carbon dioxide between the foetus' blood and the mother's blood ✓
- act as a filter for harmful substances, although some substances like nicotine, drugs and alcohol as well as viruses like HIV can pass through it and reach the foetus ✓
- to secrete hormones ✓ (any 5)

5

- a) implantation – the burrowing of the foetus into the uterine wall ✓✓  
b) embryo – an unborn human during the first eight weeks after fertilisation ✓✓  
c) foetus – an unborn human after eight weeks after fertilisation until birth ✓✓ (6)

6.



Rubric for graph:

Assessment criteria	Mark allocation		
Correct type of graph (bar graph)	2		
Title/heading for graph	2		
Correct label for x- axis (complication)	1		
Correct label for y-axis (number of women)	1		
Plotting the bars	2: Plots all 3 values correctly	2: Plots 2 values correctly	1: Plots 1 or no values correctly (8)

[20 marks]

## Glossary

**acrosome** – a part of a sperm cell that makes enzymes

**adapted** – modified or changed to suit a particular function

**alveoli** – small sacs that enable exchange of gases

**amino acids** – the building blocks of proteins

**backbone** – a column of bones that is found in the back of an animal; also called a vertebral column

**balanced diet** – a diet that contains a combination of the food nutrients needed for healthy living, in the right amounts

**breathing** – the movement of air into and out of the lungs in mammals

**bronchi** – tubes that branch from the trachea

**bronchioles** – smaller tubes that branch from the bronchi

**Caesarian section** – a type of birth, when a surgical procedure is done

**carbohydrates** – nutrients made from carbon, hydrogen and oxygen; e.g. simple sugars and starch

**cartilage** – a type of tissue that is found in some places in an endoskeleton

**cervix** – a narrow opening at the top of the vagina

**characteristics** – features of something, such as an organism

**chlorophyll** – a green pigment molecule in leaves that is important for photosynthesis

**chordates** – animals that have a spinal cord

**chromosomes** – long coiled structures made from special molecules called DNA and that carry genetic information

**cilia** – hair-like extensions on the membrane of some animal cells

**circumcision** – a surgical procedure that is performed to remove the foreskin

**clinostat** – a motorised machine that turns

**clitoris** – a sensitive area in the female external sex organs

**communicable (disease)** – a disease that can be transmitted from one person to another

**conception** – fusion of the nuclei of the male and female sex cells

**Cowper's gland** – a gland that produces seminal fluid

**deficiency diseases** – diseases caused by a shortage of a food nutrient, such as a particular vitamin

**density** – how hard or compact a substance is

**detection** – identification

**diffusion** – the movement of molecules from a high concentration to a lower concentration

**disease** – a disorder in structure or function in a person's body

**diversity** – variety

**ejaculation** – a reflex action in which semen is released from the body

**elements** – the simplest substances on Earth; they cannot be made smaller

**flagellum** – a tail on a cell that enables it to move

**embryo** – an unborn human during the first eight weeks after fertilisation

**endometrium** – the lining of the uterus

**endoskeleton** – a type of skeleton that is found inside an organism's body

**enzymes** – special molecules that take part in chemical reactions in cells

**epidermis** – a single layer of cells on the outside of some organisms

**epididymis** – a coiled tube inside the testes that stores sperm until they are released

**erectile (tissues)** – tissues that can fill with blood and become hard

**exoskeleton** – a support system that is found on the outside of an organism's body

**fertilisation** – the fusion of male and female sex cells to form a zygote



- fibre** – substances in the diet that help food to move through the digestive system
- foetus** – an unborn human after eight weeks from fertilisation, until birth
- gametogenesis** – the process by which sex cells are made
- gas exchange** – the movement of oxygen and carbon dioxide across a membrane in opposite directions
- gender** – being masculine or female
- gender equality** – when males and females are considered to be equal
- gene** – a unit that can be passed from parents to their children
- germinal cells** – special cells that line the ovaries and the seminiferous tubules and are able to make the female and male sex cells
- gravitropism** – the response of plants to the effect of gravity
- haemoglobin** – a molecule found in red blood cells that helps to transport oxygen
- health** – a person's physical, mental and social state
- hereditary** – something that is passed on from one generation to another; inherited
- hip bones** – large flat bones to which the leg bones are attached
- hydrostatic skeleton** – a support system found inside an organism's body; the muscles work against fluid that is trapped inside spaces in the body
- hymen** – a membrane over the opening of the vagina that is broken during sexual intercourse
- hypophysis** – a part of the brain that secretes some hormones; also called the pituitary gland
- immune system** – a system in the body that fights off substances in our bodies that should not be there
- implantation** – the process during which the ball of cells burrows into the wall of the uterus
- infection** – when a person has an organism inside their body that makes them sick
- insulates** – keeps at a constant temperature
- joint** – a structure found where bones come together
- labia majora** – an external skin fold near the opening of the vagina
- labia minora** – a skin fold that protects the openings of the urethra and vagina
- labour** – the birth process
- lipids** – food nutrients made up of carbon, hydrogen and oxygen; their molecules consist of one molecule of glycerol joined to three fatty acids
- magnification** – how many times bigger an image is compared to the actual object
- magnified** – made larger using a scientific instrument or by drawing
- malnutrition** – when a person does not get enough, or gets too much of a food nutrient
- menopause** – the time in a woman's life when she stops menstruating
- menstrual cycle** – a series of events that prepares the uterus for pregnancy
- monosaccharides** – simple sugars, such as glucose
- motile** – able to move
- motility** – the ability to move
- moulting** – shedding an outer covering
- mucus** – a sticky substance that is made by some animal cells
- multicellular** – multi-celled; refers to an organism that consists of many cells
- nerve impulses** – messages that move around the nervous system
- neutralise** – to keep the level of acidity constant
- nostrils** – two openings in the nose
- nutrients** – food substances that organisms need to live and grow
- oestrogen** – a female hormone that is secreted by the ovaries and stimulates the production of secondary sexual characteristics; it is also involved in the menstrual cycle

**organ** – a group of tissues that form a structure that performs a function; e.g. the heart

**organ system** – a group of organs that work together to perform a function; e.g. the digestive system

**organelles** – structures found inside cells and that perform different functions

**ova** – female sex cells

**ovaries** – the female sex organs that produce female sex cells and hormones

**oviducts** – tubes that lead from each ovary to the uterus; the pathway for the female sex cells

**ovulation** – the release of an ovum from an ovary into an oviduct

**palisade mesophyll cells** – long thin cells found in leaves and that are specialised for photosynthesis

**pathogens** – disease-causing organisms, such as bacteria

**penis** – the part of the male reproductive system that is used to place sperm in the female vagina during intercourse

**permeable** – a structure that lets molecules pass through

**photosynthesis** – a life process that happens in green plants and that uses sunlight, carbon dioxide and water to make food molecules, such as glucose

**phototropism** – the reaction of a plant to light

**placenta** – an organ that develops in the uterus

**pleural membranes** – two membranes found inside the chest; one covers the outside of the lungs, and the other lines the inside of the chest

**polysaccharides** – nutrients made from many simple sugars joined together

**porous** – a substance that has holes in it

**sensitivity** – being able to respond to a change in the environment

**progesterone** – a female hormone that prepares the uterus for pregnancy

**proportion** – the different sizes of objects relative to one another

**prostate gland** – a gland that produces seminal fluid

**proteins** – food molecules made up of carbon, hydrogen, oxygen, nitrogen, and sometimes sulphur

**puberty** – a time during which secondary sexual characteristics develop in males and females

**reagents** – chemicals used for testing substances

**respiration** – a chemical process for the making of energy using food molecules and oxygen

**ribs** – the thin bones that protect the lungs and heart

**scrotum** – a sac that covers the testes

**selectively permeable** – a structure that allows only certain molecules to pass through it

**seminal vesicles** – structures that produce and release seminal fluid into the sperm duct

**seminiferous tubules** – long coiled tubes in which sperm are produced

**skeleton** – a structure on the inside or the outside of the body that gives support to the body and protects the softer parts

**specialised** – changed to do a special function

**sperm duct** – a tube that transports sperm out of the testes

**spinal cord** – part of the nervous system; an extension of the brain in the backbone

**spongy mesophyll cells** – cells in leaves that contain lots of chloroplasts and have air spaces between them

**stimulus** – something that causes a reaction

**support system** – a system that gives strength and holds the body upright

**surface area** – the area on the outside of a structure

**taxonomy** – the classification of things, especially organisms, into groups based on their similarities and differences

**testicles** – a male reproductive structure in which male sex cells are made; also called testes

**testosterone** – a male hormone that is important in the development of sperm and secondary sexual characteristics

**thorax** – the scientific name for the chest cavity

**tissue** – a group of similar cells that perform a function; e.g., muscle tissue

**toxic** – poisonous

**toxins** – poisons

**trachea** – a tube that leads from the throat into the lungs

**tropism** – a movement of a plant in a certain direction in response to a stimulus

**umbilical cord** – the organ that connects the foetus to the placenta

**unicellular** – single-celled; refers to an organism that consists of a single cell

**urethra** – a tube that is a passage for urine from the bladder to the outside of the body; it also transports sperm during intercourse

**uterus** – also called the womb; the place where a baby develops

**vagina** – the birth canal

**vertebrae** – bones that make up the backbone

**zygote** – a single cell that forms when the nucleus of a sperm cell fuses with the nucleus of an ovum