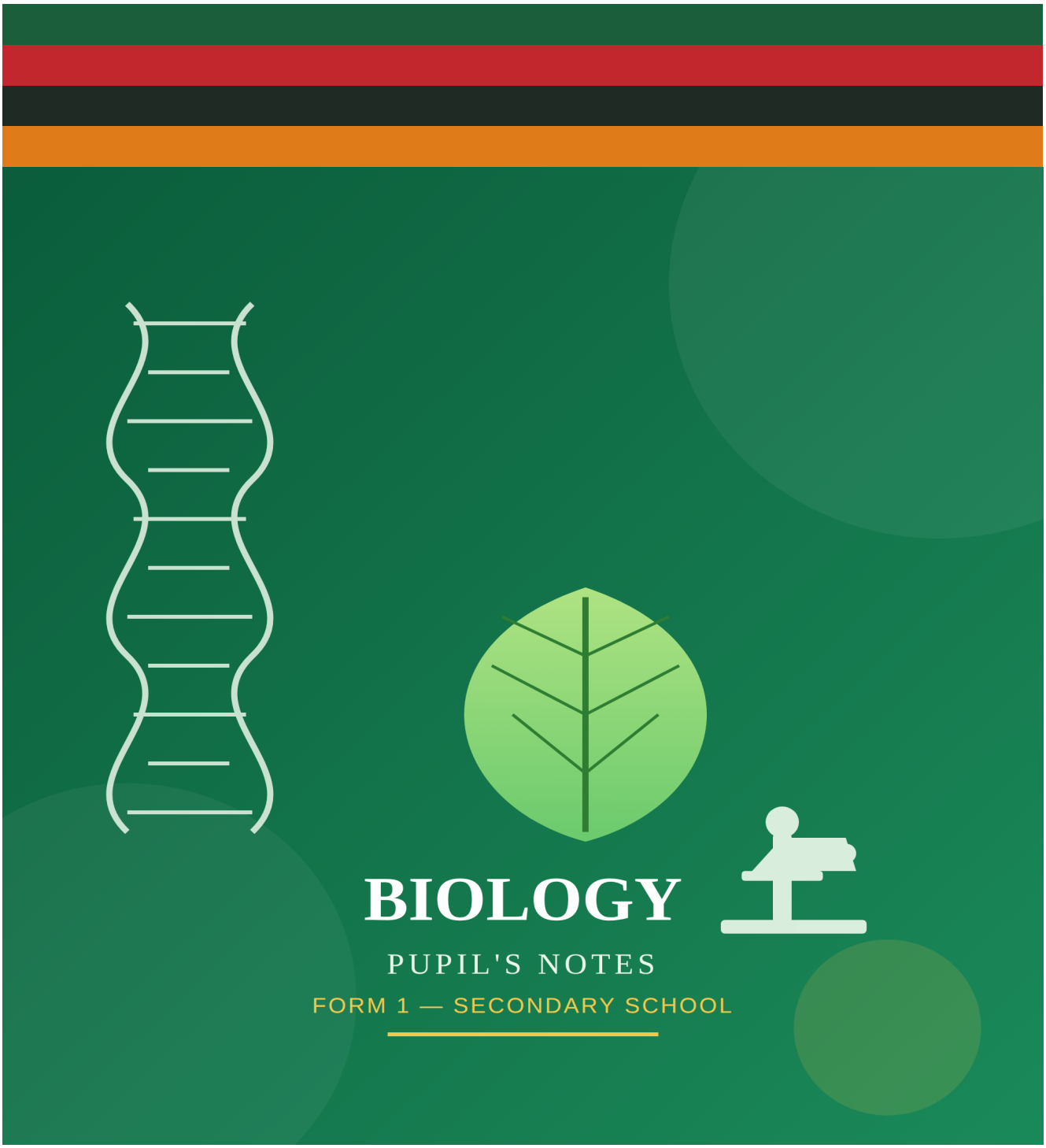


SECONDARY EDUCATION — ORDINARY LEVEL

Competency-Based Curriculum (CBC)

Covering Topics 1.1 – 1.6 of the Form 1 Biology Syllabus

For complete Pupil's Notes WhatsApp **0978484441**

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How To Use This Book

These notes cover every concept, sub-topic, specific competency and learning activity of the Form 1 Biology syllabus (Topics 1.1.0 – 1.6.0). Each sub-topic follows the same easy-to-follow layout so that you can revise effectively on your own or with your classmates.

- **Expected standard —** A short statement (in italics) telling you what you should be able to do by the end of the sub-topic.
- **Key Vocabulary —** A table of important terms and their meanings — learn these first, as they unlock the rest of the notes.
- **Main notes —** Clear explanations, organised under helpful headings, with bullet points and local (Zambian) examples.
- **Diagrams —** Labelled illustrations to help you visualise structures and processes.
- **Worked Examples —** Gold boxes that walk you step-by-step through applying what you have learnt to a real problem or investigation.
- **Key Points to Remember —** A blue summary box at the end of the notes — perfect for quick revision before a test.
- **Check Your Understanding —** Self-test questions with answers provided, so you can test yourself and check your progress.

A NOTE ON REVISION

Biology is best learnt actively. As you go through each sub-topic: (1) read the notes and key vocabulary; (2) study the diagrams and worked examples carefully; (3) attempt the 'Check Your Understanding' questions WITHOUT looking at the answers first; (4) then check your answers and revise any areas you got wrong. Where possible, carry out the suggested practical activities using materials available in your home or school environment.

1.1.0 CONCEPTS AND METHODS IN BIOLOGY

In this topic you will learn what Biology is, how scientists investigate the living world, how living things are organised, and what makes something "alive".

1.1.1 Nature of Science: Scientific Inquiry in Biology

Expected standard: *Scientific inquiry method in scientific investigation applied correctly.*

KEY VOCABULARY

Term	Meaning
Science	An organised way of studying the natural world through observation and experiment.
Scientific inquiry	A step-by-step method scientists use to investigate a problem and find reliable answers.
Observation	Using the senses (or instruments) to gather information about something.
Hypothesis	An educated guess or possible explanation that can be tested.
Variable	Any factor that can change or be changed in an investigation.
Data	Facts, measurements or observations collected during an investigation.
Conclusion	A statement of what the data shows, and whether the hypothesis was supported.

The stages of scientific inquiry

Biology is a science, and like all sciences it uses a special method of finding out facts called the scientific inquiry method. This method helps us to investigate biological facts and phenomena (things that happen) in a fair and reliable way, instead of just guessing.

- Observation — noticing something interesting or unusual in nature, for example, "the beans planted near the window grow taller than those in the dark store-room."
- Identifying a problem — turning the observation into a clear question, for example, "Does sunlight affect the growth of bean plants?"
- Forming a hypothesis — suggesting a possible, testable answer, for example, "Bean plants that receive more sunlight grow taller than those that receive less sunlight."
- Testing the hypothesis through experimentation — planning and carrying out a fair test, keeping all conditions the same except the one factor (variable) being tested.
- Recording and analysing data — writing down measurements/observations clearly, often in tables, and studying them to look for patterns.
- Forming a conclusion — deciding whether the results support or reject the hypothesis, and explaining why.

Applying the scientific method to real problems

A good scientist does not keep results to themselves. After an investigation, the findings should be shared with others (classmates, the community, or the scientific world) so that the information can be checked and used.

The findings of an investigation can also be used to solve real-life problems. For example, if farmers in your community discover through investigation that a certain type of manure increases maize yield, this finding can be shared and used by other farmers to improve food production.

- Sharing findings: through class presentations, wall charts, school science fairs, written reports, or radio/community talks.
- Using findings to solve problems: e.g., using investigation results on water purification to help a community get safe drinking water; using pest-control investigations to protect crops such as maize and cassava.

WORKED EXAMPLE — Investigating whether sunlight affects bean seedling growth

Step 1: Observation: Beans near the classroom window seem taller than beans kept in the store-room.

Step 2: Problem: Does the amount of sunlight affect how tall bean seedlings grow?

Step 3: Hypothesis: Bean seedlings that get more sunlight will grow taller than those that get less sunlight.

Step 4: Experiment: Plant two identical sets of bean seeds in the same type of soil and give them the same amount of water. Place Set A on a sunny windowsill and Set B in a dark cupboard. Measure the height of each seedling every 3 days for 15 days.

Step 5: Data: Record the heights in a table (Day 3, 6, 9, 12, 15) for both sets.

Step 6: Conclusion: If Set A seedlings are consistently taller than Set B, the data supports the hypothesis that sunlight promotes growth in bean seedlings.

KEY POINTS TO REMEMBER

- Scientific inquiry is a systematic method: observe → identify problem → hypothesise → experiment → record & analyse data → conclude.
- A hypothesis must be testable.
- A fair test changes only ONE variable at a time and keeps all others constant.
- Sharing and applying findings helps solve real community problems, e.g. in agriculture and health.

CHECK YOUR UNDERSTANDING

1. State the six stages of the scientific inquiry method in the correct order.

2. What is a hypothesis?

3. Why must a scientist change only one variable at a time during an experiment?

4. Give one way the findings of a school investigation could be shared with the wider community.

5. A pupil notices that clothes dry faster on a sunny day than on a cloudy day. Write a suitable hypothesis for this observation.

Answers

1. *Observation → Identifying a problem → Forming a hypothesis → Experimentation → Recording & analysing data → Forming a conclusion.*

2. *A testable, educated guess that gives a possible explanation for an observation.*

3. *So that any change in the results can be confidently linked to that one variable, making the test fair/valid.*

4. *Any reasonable answer, e.g. a class presentation, a wall chart, a community radio talk, a written report.*

5. *Sample answer: Clothes exposed to more sunlight dry faster than clothes exposed to less sunlight.*

1.1.2 Nature of Biology

Expected standard: *Study of Biology categorised correctly.*

KEY VOCABULARY

Term	Meaning
Biology	The scientific study of living organisms and their life processes.
Botany	The branch of Biology that studies plants.
Zoology	The branch of Biology that studies animals.
Entomology	The branch of Biology that studies insects.
Genetics	The branch of Biology that studies heredity — how characteristics are passed from parents to offspring.
Mycology	The branch of Biology that studies fungi (e.g. mushrooms, moulds, yeast).

What is Biology?

The word Biology comes from two Greek words: 'bios' meaning life, and 'logos' meaning study. Biology is therefore the science that studies living organisms — their structure, how they function, where they live, how they grow, and how they relate to each other and to their environment.

Because life is so varied — from tiny bacteria to huge trees like the baobab, and from insects to elephants — Biology is divided into many specialised branches. Each branch focuses on a particular group of organisms or a particular aspect of life.

Branches of Biology

Other branches you will meet later include microbiology (study of micro-organisms), ecology (study of organisms and their environment), and physiology (study of how living things function).

- Botany — the study of plants, e.g. maize, cassava, groundnuts, msasa trees.
- Zoology — the study of animals, e.g. cattle, goats, fish, birds.
- Entomology — the study of insects, e.g. mosquitoes, termites, bees, locusts.
- Genetics — the study of heredity and variation, e.g. why children resemble their parents.
- Mycology — the study of fungi, e.g. mushrooms that grow after the rains, bread mould, yeast used in brewing.

WORKED EXAMPLE — Concept map of the Nature of Biology

Step 1: Centre: BIOLOGY (study of living things)

Step 2: Branch 1 → Botany → studies PLANTS (e.g. maize, cassava)

Step 3: Branch 2 → Zoology → studies ANIMALS (e.g. cattle, chickens)

Step 4: Branch 3 → Entomology → studies INSECTS (e.g. termites, bees)

Step 5: Branch 4 → Genetics → studies HEREDITY (e.g. why you look like your parents)

Step 6: Branch 5 → Mycology → studies FUNGI (e.g. mushrooms, yeast)

Step 7: You can draw this as a spider diagram in your notebook, with 'Biology' in the centre circle and each branch in its own linked circle.

KEY POINTS TO REMEMBER

- Biology is the scientific study of living things.
- Biology has many branches; each branch specialises in one group of organisms or one aspect of life.
- Botany = plants, Zoology = animals, Entomology = insects, Genetics = heredity, Mycology = fungi.
- A concept map is a useful way to organise and remember the branches of Biology.

CHECK YOUR UNDERSTANDING

1. Define Biology.

2. Which branch of Biology would a scientist studying mosquitoes belong to?

3. A scientist is investigating why some goats in a herd have spotted coats while others are plain white. Which branch of Biology is this?

4. Name the branch of Biology that studies mushrooms and yeast.

5. Draw a simple concept map showing Biology and at least 4 of its branches.

Answers

1. *The scientific study of living organisms and their life processes.*

2. *Entomology.*

3. *Genetics.*

4. *Mycology.*

5. *Pupil's own diagram — must show Biology in the centre linked to Botany, Zoology, Entomology, Genetics and/or Mycology with correct examples.*

1.1.3 Levels of Biological Organisation

Expected standard: *Levels of biological organisation classified from simple to complex correctly.*

KEY VOCABULARY

Term	Meaning
Atom	The smallest basic unit of an element, e.g. a carbon atom.
Molecule	Two or more atoms joined together, e.g. a water molecule (H2O).
Cell	The smallest structural and functional unit of life.

Term	Meaning
Tissue	A group of similar cells performing the same function.
Organ	A structure made up of different tissues working together to perform a specific function.
Organ system	A group of organs working together to carry out a major body function.
Organism	A complete, individual living thing.
Population	All the organisms of the same species living in the same area at the same time.
Community	All the different populations living and interacting in the same area.
Ecosystem	A community of living organisms interacting with their non-living (physical) environment.
Biosphere	The part of the Earth (and its atmosphere) in which living organisms exist.

Building up from simple to complex

Living things are organised in a series of levels, starting with tiny particles of matter and building up to the whole of life on Earth. Each level is built from units of the level below it. Understanding these levels helps us to see how the very small (an atom) connects to the very large (the biosphere).

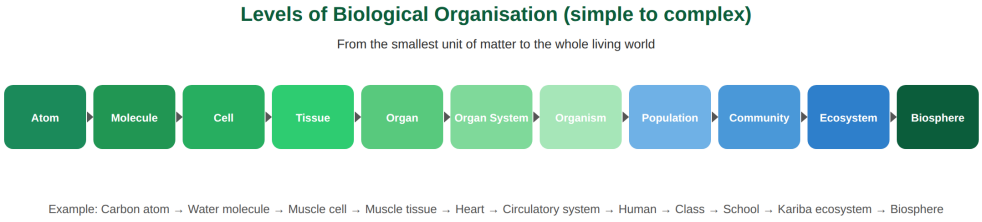


Figure: The levels of biological organisation, from atom to biosphere.

WORKED EXAMPLE — Tracing the levels of organisation using the human body

Step 1: Atom: a single oxygen atom.

Step 2: Molecule: oxygen atoms combine with hydrogen to form a water molecule (H2O).

Step 3: Cell: water and other molecules make up a muscle cell.

Step 4: Tissue: many muscle cells together form muscle tissue.

Step 5: Organ: muscle tissue, together with nervous and connective tissue, forms the heart (an organ).

Step 6: Organ system: the heart works with blood vessels and blood to form the circulatory system.

Step 7: Organism: all the organ systems working together form a complete human being.

Step 8: Population: all the pupils of the same species (Homo sapiens) in your school form a population.

Step 9: Community: the pupils, teachers, trees, birds and insects at the school interacting together form a community.

Step 10: Ecosystem: the school community interacting with soil, air, water and sunlight forms an ecosystem.

Step 11: Biosphere: all ecosystems on Earth combined make up the biosphere.

KEY POINTS TO REMEMBER

- The levels of organisation, from simplest to most complex, are: Atom → Molecule → Cell → Tissue → Organ → Organ system → Organism → Population → Community → Ecosystem → Biosphere.
- Each higher level is made up of units from the level below it.
- This organisation applies to all living things, from a single bacterium to a whole forest.

CHECK YOUR UNDERSTANDING

1. Arrange the following in order from simplest to most complex: Organ, Cell, Tissue, Atom.

2. Define 'population' as used in Biology.

3. What is the difference between a community and an ecosystem?

4. Give an example of an organ system in the human body and name two organs found in it.

5. What is the biosphere?

Answers

1. *Atom → Cell → Tissue → Organ.*

2. *All the organisms of the same species living in the same area at the same time.*

3. *A community is made up only of living organisms (populations) interacting; an ecosystem includes the community PLUS the non-living (physical) environment such as soil, water and air.*

4. *Example: Digestive system — organs include the stomach and small intestine (accept other valid organ systems).*

5. *The part of the Earth and its atmosphere where living organisms are found.*

1.1.4 Characteristics of Living Things

Expected standard: *Characteristics of living things analysed correctly; life processes of living organisms categorised appropriately.*

KEY VOCABULARY

Term	Meaning
Nutrition	The process of taking in and using food for energy, growth and repair.
Respiration	The release of energy from food inside cells.
Excretion	The removal of waste products made inside the body (metabolic waste).
Reproduction	The production of new individuals of the same kind (offspring).
Sensitivity/Irritability	The ability to detect and respond to changes (stimuli) in the environment.
Movement/Locomotion	The ability to change position or move from one place to another.
Growth	A permanent increase in size and/or number of cells.

Term	Meaning
Metabolism	All the chemical reactions taking place inside a living organism.
Catabolism	Breaking down of complex substances into simpler ones, usually releasing energy.
Anabolism	Building up of simple substances into complex ones, usually using up energy.

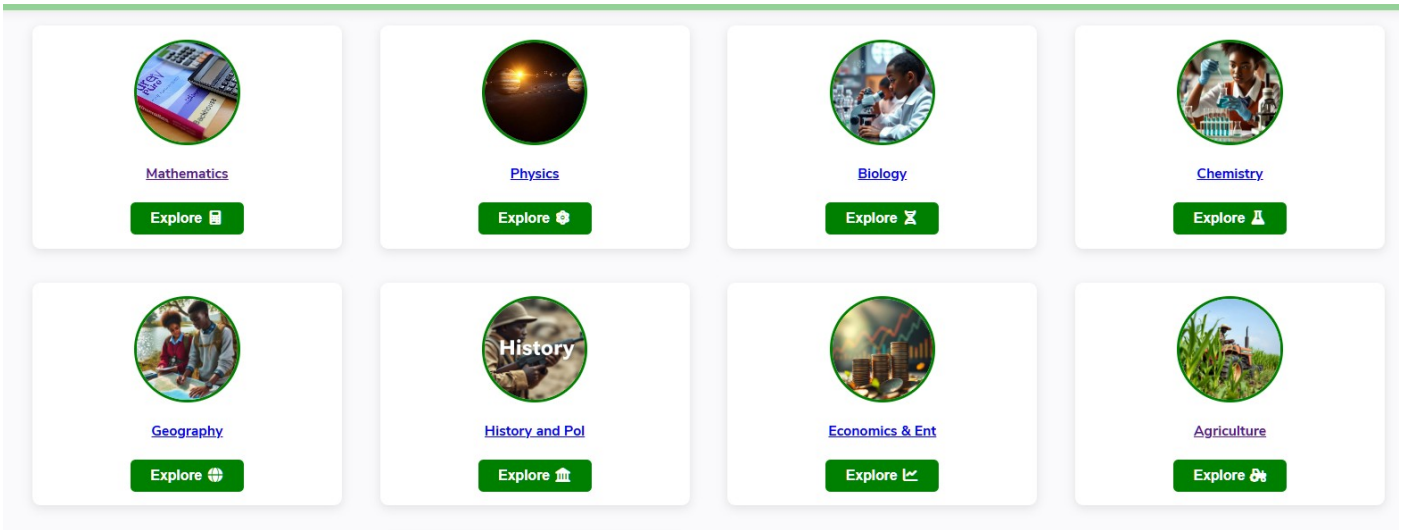
The seven characteristics of living things (MRS GREN)

All living things, whether a tiny bacterium or a huge elephant, share seven basic characteristics. Scientists remember these using the mnemonic MRS GREN: Movement, Respiration, Sensitivity, Growth, Reproduction, Excretion, Nutrition.

- Movement — living things move all or part of their bodies. Animals like goats walk from place to place; plants show slower movements, e.g. leaves turning towards light.
- Respiration — living things release energy from food through respiration, which occurs continuously in every living cell.
- Sensitivity (Irritability) — living things detect and respond to stimuli such as light, heat, sound, touch and chemicals, e.g. a chameleon changing colour, or a mimosa plant folding its leaves when touched.
- Growth — living things grow by increasing in size and number of cells, e.g. a maize seedling growing into a tall plant.
- Reproduction — living things produce offspring of their own kind to ensure the survival of the species, e.g. a hen laying eggs that hatch into chicks.
- Excretion — living things remove waste products of metabolism from their bodies, e.g. humans excrete carbon dioxide and urea; plants excrete oxygen and other waste through their leaves.
- Nutrition — living things take in and use food (nutrients) to obtain energy and materials for growth and repair.

Categorising the life processes: catabolism and anabolism

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