EXAM READY BIOLOGY

# Exam Ready Biology

## GRADE 9

Study Guide, Worked Examples and Practice Tests for the Grade 9 Examination



- ✓ 6 units with clear key ideas, worked examples and “Watch out!” boxes
- ✓ 120 worked examples and 192+ practice questions at three levels
- ✓ 120 unit-quiz questions and 3 full mock exams (60 MCQ each)
- ✓ Diagnostic test · Key Facts Sheet · Top 20 Mistakes · teacher notes

Follows the units and order of the Ethiopian Grade 9 Biology textbook

ERMIAS WEDAJE TEGBARU

# Exam Ready Biology

## Grade 9 · Study Guide, Worked Examples and Practice Tests

**By Ermias Wedaje Tegbaru**
Civil engineer and author, Addis Ababa
First edition, 2026

© 2026 Ermias Wedaje Tegbaru. All rights reserved. This book is licensed to its reader for personal study on the Exam Ready Ethiopia website. It may not be copied, photographed, shared or sold, in whole or in part, without the author's written permission.

This is an independent study guide. It follows the units and order of the Ethiopian Grade 9 Biology student textbook, but it is not published or endorsed by the Ministry of Education. All explanations, examples and questions are original. Keep your textbook and your teacher's notes beside this book.

The answers were calculated and checked before printing, but no book is free of errors. If you find a mistake or disagree with an answer, please tell the author on Telegram (@Ermias_Wedaje) and it will be reviewed for the next edition.

# How to Use This Book

Each unit follows the same pattern, so you always know where to look.

**Key ideas**
The rules and facts of the section, short and clear.

**Worked examples**
Step-by-step solutions. Cover the solution and try first.

**⚠ Watch out!**
The mistakes students make most often, and the right way.

**Practice**
Level 1 Basic · Level 2 Standard · Level 3 Challenge.

**Unit quiz**
20 multiple-choice questions in the style of the national examination.

**For the Teacher**
Timing, starters, misconceptions, activities and assessment.

## For students

- Begin with the Diagnostic Test. It shows which units need the most work.
- Read the key ideas, then study each example with the solution covered.
- Do Level 1 and Level 2 practice for every section; try Level 3 when you are ready.
- Take each quiz in 30 minutes, mark it, and redo every question you got wrong.
- In the last weeks, learn the Key Facts Sheet and the Top 20 Mistakes page, and sit the three mock exams. Their answer keys show which unit each question comes from.

## For teachers

- Each unit follows the textbook sections, so the book can sit beside your lessons.
- The “For the Teacher” page gives timing, starters, misconceptions and activities.
- The quizzes and mock exams can be used as class tests; every answer has a short reason.

## For parents

- Ask your child to explain one worked example to you each day. Teaching is the best way to learn.
- Look at the quiz score after each unit, and celebrate progress, not only high marks.

# Contents


| | | |
|---|---|---|
| **Start** | Diagnostic Test · Where Should I Start? | 5 |
| **Unit 1** | Introduction to Biology | 7 |
| **Unit 2** | Characteristics and Classification of Organisms | 18 |
| **Unit 3** | Cells | 29 |
| **Unit 4** | Reproduction | 40 |
| **Unit 5** | Human Health, Nutrition, and Disease | 51 |
| **Unit 6** | Ecology | 62 |
| **Reference** | Key Facts Sheet | 73 |
| **Reference** | Top 20 Mistakes to Avoid | 74 |
| **Reference** | Exam Strategy | 75 |
| | Mock Examination 1 | 76 |
| | Mock Examination 2 | 80 |
| | Mock Examination 3 | 84 |
| | Answers to the Mock Examinations | 88 |


Page numbers are the numbers shown at the foot of each page (and in the online reader).

# Diagnostic Test · Where Should I Start?

14 questions · 15 minutes. Take this test before you start the book. There are two questions on each unit. Your score only shows you where to spend your time.

1. Biology is the study of
   A. rocks B. weather C. living things D. machines
2. Microbiology studies
   A. stars B. micro-organisms
   C. large mammals D. rocks
3. Which is a characteristic of living things?
   A. reproduction B. burning C. melting D. rusting
4. Respiration releases
   A. seeds B. wastes only C. light D. energy
5. Cell theory says all living things are made of
   A. organs only B. atoms only C. cells D. tissues only
6. The nucleus
   A. does photosynthesis B. stores water
   C. makes energy D. controls the cell
7. Asexual reproduction needs
   A. fertilisation B. two parents C. one parent D. gametes
8. Yeast reproduces by
   A. budding B. eggs C. fertilisation D. flowers
9. Protein is needed for
   A. growth and repair B. digestion only
   C. vision only D. quick energy only
10. Calcium is needed for
    A. bones and teeth B. sight
    C. blood sugar D. digestion
11. Ecology is the study of
    A. organisms and environment B. machines
    C. rocks D. stars
12. An abiotic factor is
    A. bacteria B. temperature C. fungi D. grass
13. The factor changed on purpose is the
    A. control B. independent variable
    C. result D. dependent variable
14. Lack of vitamin C causes
    A. scurvy B. goitre C. rickets D. anaemia

# Unit 1 · Introduction to Biology

**By the end of this unit you will be able to:**

- define biology and explain why we study it
- list and apply the steps of the scientific method
- name laboratory and field tools of a biologist
- identify the parts of a light microscope and use it correctly
- apply laboratory safety rules

**Before you start — check yourself.** (a) What is biology? (b) Name one tool used to see small things. (c) Why must we wear a lab coat?
*Answers: (a) the scientific study of living things (b) microscope (c) to protect the body and clothes*

**Key words:** biology · scientific method · hypothesis · experiment · magnification · objective lens · eyepiece · stage · diaphragm · safety

**How this unit is examined**

*Question types that appear again and again in Ethiopian model examinations:*

- Biology and Why We Study It
- The Scientific Method
- Tools of a Biologist
- The Light Microscope and Laboratory Safety

## 1.1 Biology and Why We Study It

**Key ideas**

- **Biology** is the **scientific study of living things** (from Greek bios = life, logos = study). It studies their structure, functions, growth, reproduction, behaviour, origin and relationships with the environment.
- **Why study biology:** to understand ourselves and other organisms; to keep **health** and fight diseases; to improve **food production** (agriculture); to **conserve the environment** and biodiversity; and to develop careers in medicine, agriculture, nutrition, environmental science and biotechnology.
- **Branches: botany** (plants), **zoology** (animals), **microbiology** (micro-organisms), **ecology** (organisms and environment), **genetics** (heredity), **anatomy** (structure) and **physiology** (functions).
- **Biological levels:** cell → tissue → organ → organ system → organism → population → community → ecosystem → biosphere.

**Example 1.1 — Define**

What is biology?

**Solution.** The scientific study of living things.

**Example 1.2 — Match**

Match the branch: (a) plants, (b) animals, (c) heredity.

**Solution.** (a) botany; (b) zoology; (c) genetics.

**Example 1.3 — Why**

Give two reasons for studying biology.

**Solution.** To fight diseases and improve food production.

**Example 1.4 — Exam Booster · Order**

Arrange: organ, cell, tissue, organ system.

**Solution.** Cell, tissue, organ, organ system.

**Example 1.5 — Exam Booster · Career**

Name two careers that need biology.

**Solution.** Medicine and agriculture.

**⚠ Watch out!**

| × Wrong | ✓ Right |
|---|---|
| Botany is the study of animals. | Botany is the study of plants; zoology is animals. |
| Biology studies only humans. | It studies all living things. |
| A tissue is bigger than an organ. | Cell → tissue → organ. |

## Practice 1.1

**Level 1 — Basic**

1. What is biology?
2. What is zoology?
3. What is botany?

**Level 2 — Standard**

4. Name a biological level.
5. What is genetics?
6. Give a use of biology.

**Level 3 — Challenge**

7. Explain why we study biology.
8. Describe biological levels of organisation.

## 1.2 The Scientific Method

**Key ideas**

- The **scientific method** is an organised way of solving problems. **Steps:** (1) **observation**, (2) **question**, (3) **hypothesis** (a testable, educated guess), (4) **experiment** (testing the hypothesis), (5) **results and conclusion**, (6) **communication** with other scientists.
- A fair experiment has a **control group** (no treatment, for comparison) and an **experimental group**. Only **one variable** is changed (the **independent variable**); the one measured is the **dependent variable**; everything else is kept constant. Repeat the experiment to confirm results.
- **Example:** Observation: plants near a window grow taller. Question: does light affect growth? Hypothesis: plants with more light grow taller. Experiment: grow identical seedlings in light and in dark, measure height weekly. Conclusion: accept or reject the hypothesis.
- A **hypothesis** can be rejected; a **conclusion** must be based on the data, not on opinion.

**Example 1.6 — List**

Give the steps of the scientific method in order.

**Solution.** Observation, question, hypothesis, experiment, conclusion, communication.

**Example 1.7 — Define**

What is a hypothesis?

**Solution.** A testable, educated guess to answer a question.

**Example 1.8 — Design**

In an experiment on light and plant growth, what is the independent variable?

**Solution.** The amount of light.

**Example 1.9 — Exam Booster · Control**

Why do we need a control group?

**Solution.** For comparison with the treated group.

**Example 1.10 — Exam Booster · Fair**

Name two things kept constant in the experiment.

**Solution.** Type of seedling and amount of water.

# Unit 2 · Characteristics and Classification of Organisms

**By the end of this unit you will be able to:**

- list the characteristics of living things
- explain the principles and relevance of classification
- arrange the taxonomic hierarchy and use binomial nomenclature
- describe the five kingdoms
- name some Ethiopian taxonomists

**Before you start — check yourself.** (a) Name two characteristics of living things. (b) Give one plant and one animal. (c) What is classification?
*Answers: (a) growth and reproduction (b) maize; cow (c) grouping organisms by similarities*

**Key words:** taxonomy · species · genus · binomial nomenclature · Linnaeus · Monera · Protista · Fungi · Plantae · Animalia

**How this unit is examined**

*Question types that appear again and again in Ethiopian model examinations:*

- Characteristics of Living Things
- Taxonomy and Nomenclature
- The Five-kingdom System: Monera, Protista, Fungi
- Kingdoms Plantae and Animalia

## 2.1 Characteristics of Living Things

**Key ideas**

- All living things share these characteristics: **nutrition** (taking in food), **respiration** (releasing energy), **excretion** (removing wastes), **growth**, **reproduction**, **movement**, **sensitivity/irritability** (responding to stimuli), **made of cells** and **adaptation**. A memory aid: **MRS GREN** (Movement, Respiration, Sensitivity, Growth, Reproduction, Excretion, Nutrition).
- **Nutrition:** autotrophs (plants) make their own food; heterotrophs (animals) feed on others. **Excretion** is removing metabolic wastes ($CO_2$, urea); **egestion** is removing undigested food.
- **Sensitivity:** plants respond to light (shoot bends toward it); animals respond with nerves. **Movement:** animals move the whole body; plants move parts (leaves, flowers).
- **Non-living things** (stone, water, car) may move or change but do not show all these characteristics.

# Unit 4 · Reproduction

**By the end of this unit you will be able to:**

- compare asexual and sexual reproduction
- describe types of asexual reproduction
- describe the human reproductive systems, the menstrual cycle, fertilisation and pregnancy
- explain methods of birth control
- describe transmission and prevention of sexually transmitted infections

**Before you start — check yourself.** (a) What is reproduction? (b) Name the male sex cell. (c) Name one way to prevent HIV.
*Answers: (a) producing offspring (b) sperm (c) abstinence, faithfulness, condoms*

**Key words:** asexual · sexual · fission · budding · fertilisation · zygote · menstruation · contraception · STI · HIV

**How this unit is examined**

*Question types that appear again and again in Ethiopian model examinations:*

- Asexual Reproduction
- Human Reproductive Systems
- Menstrual Cycle, Fertilisation and Pregnancy
- Birth Control and Sexually Transmitted Infections

## 4.1 Asexual Reproduction

**Key ideas**

- **Reproduction** is the production of new individuals of the same species. **Asexual reproduction** needs **one parent**, no gametes; offspring are **genetically identical** (clones) and produced quickly. **Sexual reproduction** needs **two parents** and **gametes**, producing varied offspring.
- **Types of asexual reproduction: fission** (a cell divides into two; bacteria, Amoeba; binary fission), **fragmentation** (a body breaks into pieces that each grow into a new individual; Spirogyra, planarians), **budding** (a bud grows on the parent and separates; yeast, Hydra), **vegetative propagation** (new plants from roots, stems or leaves; e.g. potato tubers, sweet potato roots, sugarcane stems, Bryophyllum leaves, enset suckers) and **spore formation** (fungi, ferns).
- **Artificial vegetative propagation:** cuttings, layering, grafting (joining a shoot to another plant's root), and tissue culture.
- **Advantage** of asexual reproduction: fast, needs no mate. **Disadvantage:** no variation, so a disease can kill the whole population.

# Unit 5 · Human Health, Nutrition, and Disease

**By the end of this unit you will be able to:**

- describe the classes of nutrients and balanced diet
- explain deficiency diseases and malnutrition
- describe the effects of substance abuse
- distinguish infectious and non-infectious diseases and their prevention
- name renowned Ethiopian nutritionists

**Before you start — check yourself.** (a) Name two food nutrients. (b) What disease is caused by lack of vitamin C? (c) Name a disease spread by mosquitoes.
*Answers: (a) protein and carbohydrates (b) scurvy (c) malaria*

**Key words:** nutrient · carbohydrate · protein · vitamin · balanced diet · kwashiorkor · malnutrition · pathogen · substance abuse · vaccine

**How this unit is examined**

*Question types that appear again and again in Ethiopian model examinations:*

- Food, Nutrients and Balanced Diet
- Deficiency Diseases and Malnutrition
- Substance Abuse
- Infectious and Non-infectious Diseases

## 5.1 Food, Nutrients and Balanced Diet

**Key ideas**

- **Food** is any substance that provides materials for energy, growth and repair. **Nutrition** is the process of obtaining and using food. **Nutrients** are the useful substances in food: **carbohydrates, proteins, fats (lipids), vitamins, minerals, water and fibre**.
- **Carbohydrates** (energy: injera, bread, potato, sugar); **proteins** (growth and repair: meat, eggs, milk, beans, lentils); **fats** (stored energy, insulation: oil, butter); **vitamins** (A, B, C, D, K, protect health); **minerals** (iron for blood, calcium for bones and teeth, iodine for the thyroid); **water** (solvent, transport); **fibre** (prevents constipation).
- **Food tests:** starch + iodine → blue-black; reducing sugar + Benedict's solution (heat) → brick red; protein + Biuret → purple/violet; fat + ethanol (emulsion test) → cloudy white.
- **Balanced diet:** contains all nutrients in the right amounts for age, sex, activity and health. Children and pregnant women need more protein; athletes need more energy.

# Key Facts Sheet

Learn these by heart. Cover the right-hand side and say each fact from memory.

## Unit 1 · Introduction

Biology = study of living things

Scientific method: observe, question, hypothesis, experiment, conclude, communicate

Total magnification = eyepiece × objective

Start on the lowest power ; fine focus at high power

Independent variable changed ; dependent measured

Field tools: net, quadrat, binoculars

## Unit 2 · Classification

MRS GREN: movement, respiration, sensitivity, growth, reproduction, excretion, nutrition

Kingdom → phylum → class → order → family → genus → species

Binomial: Genus species (Homo sapiens)

Five kingdoms: Monera, Protista, Fungi, Plantae, Animalia

Prokaryote: no true nucleus ; eukaryote: true nucleus

Fungi: chitin walls, spores

## Unit 3 · Cells

Cell theory: made of cells ; basic unit ; from cells

Nucleus controls ; mitochondria energy ; ribosomes protein

Plant cell: wall, chloroplasts, large vacuole

Diffusion: high → low, no energy

Osmosis = diffusion of water

Active transport: low → high, uses ATP

## Unit 4 · Reproduction

Asexual: one parent, identical offspring

Fission, budding, fragmentation, vegetative propagation

Testes make sperm ; ovaries make eggs

Fertilisation in oviduct ; embryo in uterus

Cycle 28 days ; ovulation about day 14

Condom protects from STIs and pregnancy

## Unit 5 · Health and nutrition

Seven nutrients incl. water and fibre

Iodine: starch ; Benedict: sugar ; Biuret: protein

Iron – anaemia ; iodine – goitre ; vitamin C – scurvy ; vitamin D – rickets

Kwashiorkor: protein ; marasmus: energy and protein

Infectious: pathogens ; non-infectious: diabetes, cancer

Malaria: Plasmodium, Anopheles

## Unit 6 · Ecology

Habitat = where ; niche = role

Producer, consumer, decomposer

About 10% of energy passes up

Organism → population → community → ecosystem → biome → biosphere

Primary succession starts on bare rock

Pioneers: lichens, mosses ; end: climax community

# Mock Examination 1

60 multiple-choice questions · 90 minutes · one mark each. Circle one answer. Mark with the answer key at the back and use the unit number to see where to revise.

1. Biology is the study of
   A. rocks  B. weather  C. living things  D. machines
2. Botany studies
   A. fungi only  B. animals  C. rocks  D. plants
3. Zoology studies
   A. stars  B. plants  C. animals  D. minerals
4. Microbiology studies
   A. stars  B. micro-organisms
   C. large mammals  D. rocks
5. Genetics is the study of
   A. heredity  B. weather  C. digestion  D. ecosystems
6. Ecology studies
   A. only cells  B. only plants
   C. organisms and their environment  D. only tools
7. The smallest level of organisation is the
   A. organ  B. cell  C. tissue  D. organism
8. A group of similar cells forms a
   A. system  B. organism  C. tissue  D. organ
9. The first step of the scientific method is
   A. observation  B. experiment  C. conclusion  D. communication
10. A hypothesis is a
    A. conclusion  B. proven fact
    C. tool  D. testable educated guess
11. Which is a characteristic of living things?
    A. reproduction  B. burning  C. melting  D. rusting
12. Removal of metabolic wastes is
    A. growth  B. nutrition  C. excretion  D. egestion
13. Response to stimuli is
    A. excretion  B. respiration  C. growth  D. sensitivity
14. Respiration releases
    A. seeds  B. wastes only  C. light  D. energy
15. Plants make their own food, so they are
    A. autotrophs  B. heterotrophs  C. parasites  D. decomposers