Cornwallis Academy
Ambitions for All

SMILE
SUCCESSFUL | MOTIVATED | INSPIRED | LEARNING | EXCITED & ENGAGED

GCSE Biology

B1 Cells

Learning Objectives

- Identify animal, plant, and bacterial cells; compare eukaryotes vs prokaryotes.
- Explain organelle functions (nucleus, cytoplasm, cell membrane, mitochondria, ribosomes, chloroplasts, vacuole, cell wall, plasmids).
- Use microscopes to observe cells; calculate magnification.
- Describe cell specialisation and adaptations (sperm, nerve, muscle, root hair, xylem, phloem).
- Explain mitosis and the cell cycle; link to growth, repair, replacement.
- Define diffusion, osmosis, and active transport; explain factors affecting them.
- Complete required practicals: microscopy and osmosis experiments.

What previous knowledge is required?

- Cells are the basic unit of life.
- Differences between plants and animals.
- Substances move in and out of cells (diffusion, osmosis, active transport).
- Basic lab skills and measurements.
- Particle model and basic chemical processes.

How will this topic content help with future learning?

- Foundation for **tissues, organs, and organ systems** (B2 Organisation).
- Supports understanding of **gas exchange, bioenergetics, homeostasis, and genetics**.
- Enables practical and investigative skills in later units.

Common Misconceptions

- All cells have a nucleus → Bacteria do not.
- Mitochondria make energy → they release energy via respiration.
- Diffusion requires energy → it is passive.
- Osmosis is the movement of water only → not other solutes.
- Active transport is the same as diffusion → it requires energy and can go against a gradient.

National Curriculum / Specification

- *KS4 Biology:* "All living things are made of cells; differences between plant, animal, bacterial cells."
- "Understand transport across membranes: diffusion, osmosis, active transport."
- *AQA GCSE Biology 8461 (B1 Cell Biology)*: Sections 1.1–1.6, Paper 1.
- Required practical skills: using a microscope, investigating osmosis.

B2 Organisation

Learning Objectives

- Digestive system: organs, enzyme roles (amylase, protease, lipase), digestion, and absorption.
- Enzymes: function, effect of temperature, pH, substrate concentration.
- Circulatory system: heart, arteries, veins, capillaries; blood components and transport.
- Plant transport: xylem, phloem, root and leaf adaptations.
- Health & disease: coronary heart disease, risk factors, treatments.
- Required practicals: investigate enzyme activity, analyse data.

What previous knowledge is required?

- Cells and organelles (B1 Cells).
- Diffusion, osmosis, active transport.
- Nutrition, plant and human structure basics.
- Particle model and chemical reactions in organisms.
- Simple lab and maths skills.

How will this topic content help with future learning?

- Builds foundation for **B3 Infection & Response** (immune system, disease).
- Supports **B4 Bioenergetics** (photosynthesis, respiration).
- Links to **B5 Homeostasis & Response** (transport, kidneys, regulation).
- Prepares for understanding **B6 Inheritance & Variation** and **B7 Ecology**.
- Reinforces practical and analytical skills for all units.

Common Misconceptions

- Enzymes digest food themselves → they catalyse reactions.
- Pulmonary arteries/veins carry the "wrong" blood → oxygenation must be considered.
- Xylem carries food → it transports water/minerals; phloem carries sugars.
- Water in xylem moves actively → it moves passively via transpiration.
- Enzymes are "used up" → they are reusable.
- Villi actively "push" nutrients → absorption is passive.

National Curriculum / Specification

- *KS4 Biology:* "Structure and function of digestive and circulatory systems, plant transport, enzymes, and disease."
- *AQA GCSE Biology 8461 (B2 Organisation)*: Sections 2.1–2.6, Paper 1.
- Required practicals: investigating enzyme activity and analysis of data.

B3 Infection and response

Learning Objectives

- Describe pathogens: bacteria, viruses, fungi, protists.
- Explain how infectious diseases spread and can be prevented.
- Describe the human immune system (white blood cells, antibodies, antitoxins).
- Explain vaccination and herd immunity.
- Understand antibiotics and antibiotic resistance.
- Describe drug development and testing.
- Explain plant diseases and plant defence responses.

What previous knowledge is required?

- Cells and organelles (B1 Cells).
- Transport in cells (diffusion, osmosis, active transport).
- Basic understanding of disease and hygiene.
- Enzymes and chemical reactions (B2 Organisation).

How will this topic content help with future learning?

- Foundation for **B5 Homeostasis (immune responses, hormones)**.
- Links to **B6 Genetics (variation in pathogens, evolution of resistance)**.
- Supports understanding of **public health and epidemiology**.
- Builds understanding of **drug development and biotechnology**.

Common Misconceptions

- Antibiotics kill viruses → they only work on bacteria.
- Vaccines cure disease → they prevent infection.
- White blood cells "eat all pathogens instantly" → different types act in stages.
- All microbes are harmful → many are beneficial.
- Antibiotics are effective against all diseases → resistance and specificity matter.

National Curriculum / Specification

- KS4: "The immune system and vaccination."
- "Communicable diseases and prevention."
- AQA 8461 B3: Infection and Response.

- Required practical understanding of microbial growth and drug testing.

B4 Bioenergetics

Learning Objectives

- Explain photosynthesis and its equation.
- Investigate rate of photosynthesis and limiting factors.
- Describe respiration (aerobic and anaerobic).
- Compare aerobic vs anaerobic respiration.
- Explain oxygen debt and fermentation.
- Understand metabolism and energy use in organisms.

What previous knowledge is required?

- Cell structure (chloroplasts, mitochondria).
- Enzymes and chemical reactions (B2).
- Gas exchange and transport systems (B2).
- Movement of substances in cells (B1).

How will this topic content help with future learning?

- Essential for **B5 Homeostasis (energy use, metabolism control)**.
- Links to **ecology (food chains, energy transfer)**.
- Supports **fitness, exercise, and human physiology**.
- Foundation for **biotechnology and plant biology**.

Common Misconceptions

- Plants only respire at night → they respire all the time.
- Photosynthesis and respiration are the same → they are opposite processes.
- Oxygen is only needed for breathing → it is used in respiration.
- Anaerobic respiration is efficient → it releases much less energy.
- Energy is "made" in cells → energy is released from reactions.

National Curriculum / Specification

- KS4: "Photosynthesis and respiration in living organisms."
- AQA 8461 B4: Bioenergetics.
- Required practical: photosynthesis rate investigations

B5 Homeostasis and Response

Learning Objectives

- Define homeostasis and negative feedback.
- Describe nervous system structure and reflex actions.
- Explain hormonal control (adrenaline, insulin, glucagon).
- Describe the menstrual cycle and hormonal control.
- Understand plant hormones and tropisms.
- Explain control of body temperature, water balance, and glucose levels.

What previous knowledge is required?

- Nervous system basics and cells (neurons).
- Hormones as chemical messengers.
- Blood glucose and digestion (B2).
- Transport systems (circulatory system).

How will this topic content help with future learning?

- Links to **B6 inheritance (hormones and development)**.
- Supports understanding of **health, diabetes, and medical treatments**.
- Builds understanding of **physiology and control systems**.
- Important for **medicine and human biology careers**.

Common Misconceptions

- Homeostasis keeps conditions constant → it maintains an optimum range.
- Hormones act instantly → they act more slowly than nerves.
- Reflexes involve thinking → they are automatic responses.
- Insulin lowers blood sugar by "removing glucose" → it helps cells absorb/store it.
- Nerves carry hormones → they transmit electrical impulses, not hormones.

National Curriculum / Specification

- KS4: "Hormonal and nervous coordination in humans."
- AQA 8461 B5: Homeostasis and Response.
- Required practical: reaction time investigations.

B6 Inheritance, variation and Evolution

Learning Objectives

- Describe DNA, genes, and chromosomes.
- Explain inheritance and genetic crosses.
- Understand variation (genetic and environmental).
- Explain evolution by natural selection.
- Describe selective breeding and genetic engineering.
- Understand classification systems and fossils.

What previous knowledge is required?

- Cell division (mitosis).
- Reproduction basics.
- Variation in organisms.
- Adaptations and survival.

How will this topic content help with future learning?

- Links to **medicine and genetics research**.
- Supports understanding of **disease resistance (B3)**.
- Builds foundation for **biotechnology and cloning**.
- Essential for **ecology and population changes (B7)**.

Common Misconceptions

- Acquired characteristics are inherited → only genes are inherited.
- Evolution happens to individuals → it happens to populations.
- Humans evolved from monkeys → humans and monkeys share a common ancestor.
- Strongest organisms survive → survival depends on adaptation, not strength.
- Genetic engineering is "unnatural" cloning → it involves targeted gene transfer.

National Curriculum / Specification

- KS4: "Heredity and genetic variation."
- AQA 8461 B6: Inheritance, Variation and Evolution.
- Includes evolution, genetics, and classification systems.

B7 Ecology

Learning Objectives

- Define ecosystems, biotic and abiotic factors.

- Describe energy flow through food chains/webs.
- Explain nutrient cycles (carbon and water cycles).
- Describe biodiversity and its importance.
- Understand human impacts on ecosystems.
- Explain sampling techniques and fieldwork methods.
- Describe food security and sustainable farming.

What previous knowledge is required?

- Photosynthesis and respiration (B4).
- Organisms and food chains.
- Adaptation and natural selection (B6).
- Basic understanding of ecosystems and environments.

How will this topic content help with future learning?

- Links to **environmental science and climate change**.
- Supports understanding of **conservation and sustainability**.
- Builds foundation for **food production and agriculture science**.
- Connects biology to real-world environmental issues.

Common Misconceptions

- Energy is recycled in food chains → energy is lost as heat.
- Humans are outside ecosystems → humans are part of ecosystems.
- More biodiversity always increases stability → generally true but context matters.
- Fertilisers only increase plant growth → they can cause eutrophication.
- All species in food chains are equally important → keystone species have larger impacts.

National Curriculum / Specification

- KS4: “Interdependence of organisms in ecosystems.”
- AQA 8461 B7: Ecology.
- Required practicals: field sampling, quadrats, transects, decomposition investigations.