GCSE Biology: Triple Science

Curriculum Overview, Years 9–11

AQA GCSE Biology (8461) · Teaching sequence from the Curriculum Road Map (Biology: Triple Science)

Course at a glance

This overview sets out the AQA GCSE Biology (8461) course in the order taught on the Triple Science route, with the specification content for each unit. Unit codes (B1–B18) follow the textbook chapters. Specification references are to the AQA 8461 specification.

Assessment

Paper	Specification content	Road map units	Format
Paper 1	4.1 Cell biology 4.2 Organisation 4.3 Infection and response 4.4 Bioenergetics	B1, B2, B3, B4, B5, B6, B7, B8, B9	Written exam, 1 h 45 min, 100 marks, 50% of GCSE
Paper 2	4.5 Homeostasis and response 4.6 Inheritance, variation and evolution 4.7 Ecology	B10, B11, B12, B13, B14, B15, B16, B17, B18	Written exam, 1 h 45 min, 100 marks, 50% of GCSE

- Both papers are sat at Foundation tier (grades 1–5) or Higher tier (grades 4–9) and include multiple choice, structured, closed short answer and open response questions.
- At least 15% of marks draw on the ten required practical activities; at least 10% assess mathematical skills.
- Assessment objectives: AO1 knowledge and understanding 40%, AO2 application 40%, AO3 analysis, interpretation and evaluation 20%.

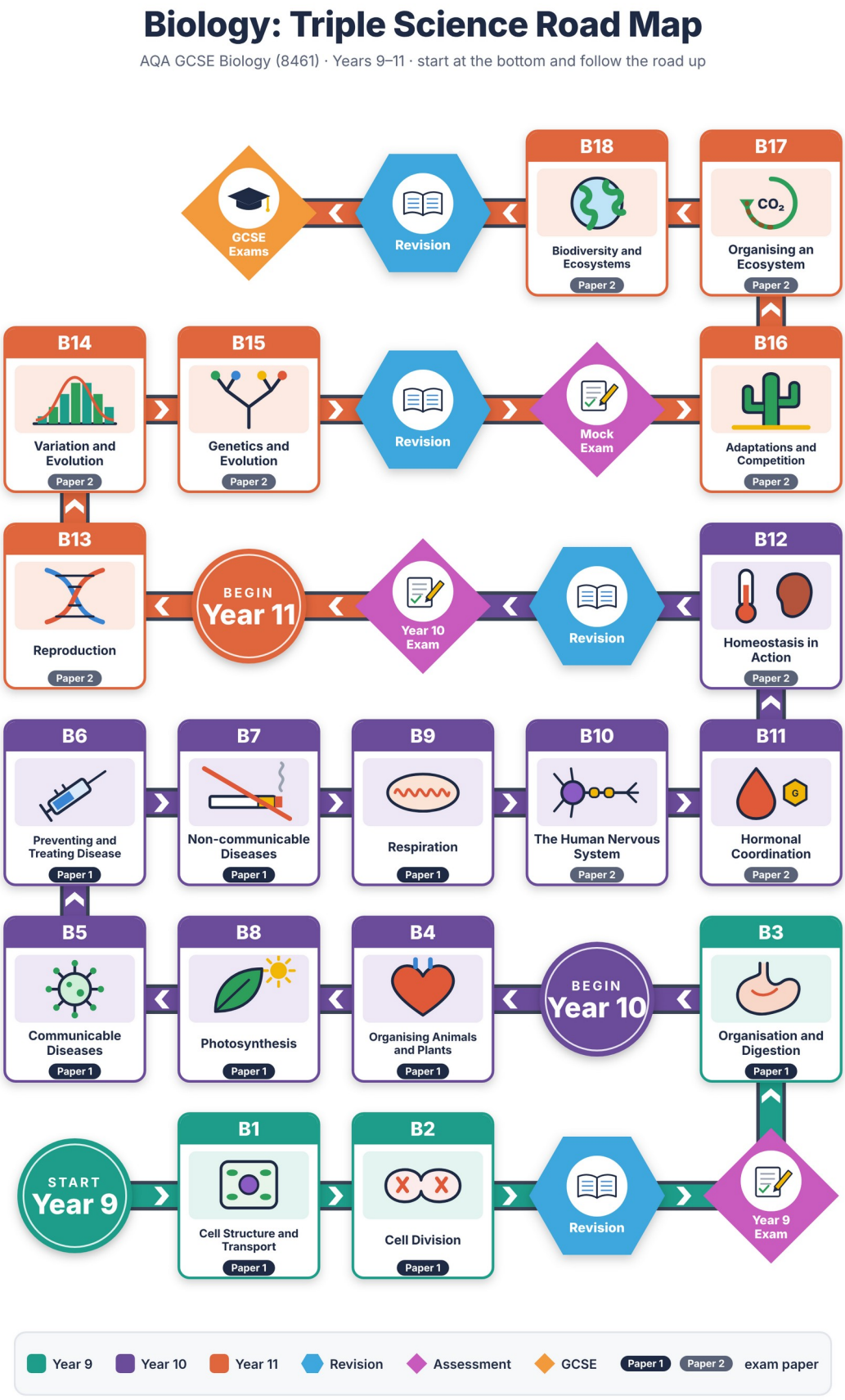
Key to labels

Triple only Content in GCSE Biology that is not in Combined Science: Trilogy.

HT only Assessed on the Higher tier paper only.

A label beside a topic heading applies to the whole subsection; a label at the start of a bullet applies to that point only.

Teaching sequence



#	Unit	AQA spec ref	Paper	Triple-only content
Year 9				
1	**B1 Cell Structure and Transport**	4.1.1, 4.1.3	1	–
2	**B2 Cell Division**	4.1.2, 4.1.1.4	1	–
Revision → Year 9 assessment				
3	**B3 Organisation and the Digestive System**	4.2.1, 4.2.2.1	1	–
Year 10				
4	**B4 Organising Animals and Plants**	4.2.2.2–4.2.2.4, 4.2.3	1	–
5	**B8 Photosynthesis**	4.4.1	1	–
6	**B5 Communicable Diseases**	4.3.1, 4.1.1.6, 4.3.3	1	Culturing microorganisms (RP2); plant disease
7	**B6 Preventing and Treating Disease**	4.3.1.7–4.3.1.9, 4.3.2	1	Monoclonal antibodies
8	**B7 Non-communicable Diseases**	4.2.2.5–4.2.2.7	1	–
9	**B9 Respiration**	4.4.2	1	–
10	**B10 The Human Nervous System**	4.5.1, 4.5.2.1–4.5.2.3	2	The brain; the eye
11	**B11 Hormonal Coordination**	4.5.3, 4.5.4	2	Plant hormones (RP8)
12	**B12 Homeostasis in Action**	4.5.2.4, 4.5.3.3	2	Whole unit
Revision → Year 10 exams				
Year 11				
13	**B13 Reproduction**	4.6.1	2	Sexual vs asexual; DNA structure
14	**B14 Variation and Evolution**	4.6.2	2	Cloning
15	**B15 Genetics and Evolution**	4.6.3, 4.6.4	2	Theory of evolution; speciation; history of genetics
Revision → Year 11 mock exam (B1–B13)				
16	**B16 Adaptations, Interdependence and Competition**	4.7.1 (RP9)	2	–
17	**B17 Organising an Ecosystem**	4.7.2.1–4.7.2.3	2	Decomposition (RP10)
18	**B18 Biodiversity and Ecosystems**	4.7.3, 4.7.2.4, 4.7.4, 4.7.5	2	Environmental change; trophic levels; food production
Revision → GCSE exams (Paper 1 and Paper 2)				

Year 9

Year 9 begins with B1 and B2, which build the cell biology that underpins the whole course, followed by revision and the Year 9 assessment, and then B3.

B1 Cell Structure and Transport

Specification: 4.1.1 (except 4.1.1.4, 4.1.1.6) and 4.1.3 **Exam:** Paper 1 **Required practicals:** RP1 Microscopy; RP3 Osmosis

The first GCSE unit: the structure of animal, plant and bacterial cells, microscopy, and how substances move into and out of cells by diffusion, osmosis and active transport.

Spec ref and topic	Content to be covered
4.1.1.1 **Eukaryotes and prokaryotes**	• Plant and animal cells are eukaryotic (genetic material in a nucleus); bacterial cells are prokaryotic, smaller, with a single DNA loop and possibly plasmids. • Use orders of magnitude and prefixes (centi, milli, micro, nano) to compare sizes of cells and sub-cellular structures.
4.1.1.2 **Animal and plant cells**	• Functions of the nucleus, cytoplasm, cell membrane, mitochondria and ribosomes; plant cells also have chloroplasts, a permanent vacuole and a cellulose cell wall. • Estimate relative sizes and areas of structures. **Required practical 1:** use a light microscope to observe, draw and label plant and animal cells, including a magnification scale.
4.1.1.3 **Cell specialisation**	• Relate structure to function in specialised animal cells (sperm, nerve, muscle) and plant cells (root hair, xylem, phloem).
4.1.1.5 **Microscopy**	• Compare light and electron microscopes: electron microscopes have much higher magnification and resolving power, revealing sub-cellular structures. • Use magnification = size of image ÷ size of real object; use standard form.
4.1.3.1 **Diffusion**	• Net movement of particles from higher to lower concentration; examples in gas exchange and urea removal. • Factors: concentration gradient, temperature and surface area. Calculate and compare surface area to volume ratios. • Single-celled organisms rely on diffusion; multicellular organisms need exchange surfaces and transport systems (small intestine, lungs, gills, roots, leaves).
4.1.3.2 **Osmosis**	• Diffusion of water from a dilute to a concentrated solution through a partially permeable membrane. • **Required practical 3:** effect of salt or sugar concentration on the mass of plant tissue; calculate percentage change and plot results.
4.1.3.3 **Active transport**	• Movement against a concentration gradient using energy from respiration, e.g. mineral ions into root hair cells and sugar absorption in the gut. • Compare diffusion, osmosis and active transport.

B2 Cell Division

Specification: 4.1.2 and 4.1.1.4 **Exam:** Paper 1 **Required practicals:** None

Chromosomes, mitosis and the cell cycle, cell differentiation, and the use of stem cells, including the ethical issues.

Spec ref and topic	Content to be covered
4.1.2.1 **Chromosomes**	• The nucleus contains chromosomes made of DNA; each carries many genes. Body cells have chromosomes in pairs.
4.1.2.2 **Mitosis and the cell cycle**	• In the cell cycle, DNA is replicated and sub-cellular structures increase before mitosis separates the chromosomes; the cytoplasm and membrane then divide to form two identical cells. • Mitosis is used for growth, repair and asexual reproduction. Recognise the stages and use data on the cell cycle.

Spec ref and topic	Content to be covered
4.1.1.4 **Cell differentiation**	• Cells differentiate to become specialised; most animal cells differentiate early, whereas many plant cells keep the ability to differentiate throughout life.
4.1.2.3 **Stem cells**	• Embryonic stem cells, adult bone marrow stem cells and plant meristems; uses in medicine (e.g. diabetes, paralysis) and therapeutic cloning. • Evaluate practical risks and benefits, and social and ethical issues, of using stem cells; meristems used to clone plants quickly and cheaply.

Revision → Year 9 assessment. Revision and assessment on the units taught so far.

B3 Organisation and the Digestive System

Specification: 4.2.1 and 4.2.2.1 **Exam:** Paper 1 **Required practicals:** RP4 Food tests; RP5 Enzymes

Levels of organisation in living things, and the human digestive system as an organ system, including enzyme action. The RP5 enzymes practical is caught up in Year 10.

Spec ref and topic	Content to be covered
4.2.1 **Principles of organisation**	• Cells are the building blocks of life; similar cells form tissues, tissues form organs, and organs work together in organ systems.
4.2.2.1 **The human digestive system**	• The digestive system is an organ system in which several organs work together to digest and absorb food. • Enzymes catalyse reactions; the lock and key model. Effects of temperature and pH; calculate rate of reaction. • Carbohydrases (amylase), proteases and lipases: where they are produced and the products of digestion. Bile neutralises acid and emulsifies fat. • **Required practical 4:** food tests for sugars, starch, lipids and proteins using qualitative reagents. • **Required practical 5:** effect of pH on the rate of reaction of amylase.

Year 10

Year 10 completes the Paper 1 content: organising animals and plants, photosynthesis, disease and its prevention, non-communicable disease and respiration, then moves on to the Paper 2 topic of homeostasis and response (nervous system, hormones and homeostasis in action), followed by the Year 10 exams.

B4 Organising Animals and Plants

Specification: 4.2.2.2–4.2.2.4 and 4.2.3 **Exam:** Paper 1 **Required practicals:** None

Organ systems for transport and exchange: blood, blood vessels, the heart and lungs, coronary heart disease and its treatments, and plant tissues, transport and transpiration.

Spec ref and topic	Content to be covered
4.2.2.2 **The heart and blood vessels**	• Double circulatory system; structure of the heart, the pacemaker and artificial pacemakers. • Structure and function of arteries, veins and capillaries; calculate rate of blood flow. • Structure of the lungs (trachea, bronchi, alveoli, capillary network) and adaptations for gas exchange.
4.2.2.3 **Blood**	• Blood is a tissue of plasma, red blood cells, white blood cells and platelets; relate each to its function and recognise them in images.
4.2.2.4 **Coronary heart disease**	• Fatty build-up in coronary arteries reduces blood flow; treatments include stents and statins. • Faulty valves replaced with biological or mechanical valves; heart transplants and artificial hearts. Evaluate the advantages and disadvantages of treatments.
4.2.3.1 **Plant tissues**	• Epidermal tissues, palisade and spongy mesophyll, xylem, phloem and meristem tissue; relate the structure of the leaf to its function.
4.2.3.2 **Plant organ system**	• Roots, stem and leaves form a system for transporting substances. Xylem carries water and mineral ions (transpiration stream); phloem carries dissolved sugars (translocation). • Role of stomata and guard cells; effect of temperature, humidity, air movement and light intensity on transpiration rate.

B8 Photosynthesis

Specification: 4.4.1 **Exam:** Paper 1 **Required practicals:** RP6 Photosynthesis

Opens Year 10: the photosynthesis reaction, factors that limit its rate, and how plants use the glucose they make.

Spec ref and topic	Content to be covered
4.4.1.1 **Photosynthetic reaction**	• Photosynthesis is endothermic; energy is transferred from the environment to chloroplasts by light. • Word and symbol equations: $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$.
4.4.1.2 **Rate of photosynthesis**	• Limiting factors: temperature, light intensity, carbon dioxide concentration and amount of chlorophyll. • **Required practical 6:** investigate the effect of light intensity on the rate of photosynthesis using an aquatic organism such as pondweed. • HT only How factors interact to limit rate; graphs with two or three factors; inverse square law for light intensity; using data to judge the cost-effectiveness of greenhouse conditions.
4.4.1.3 **Uses of glucose from photosynthesis**	• Glucose is used for respiration, converted to starch for storage, fats or oils, cellulose for cell walls, and amino acids (using nitrate ions) for proteins.

B5 Communicable Diseases

Specification: 4.2.2.5, 4.1.1.6, 4.3.1.1–4.3.1.6 and 4.3.3 **Exam:** Paper 1 **Required practicals:** RP2 Microbiology

Health and disease, pathogens and how they spread, growing bacteria safely in the lab, named diseases, and human defences. Triple Science adds culturing microorganisms and plant diseases and defences.

Spec ref and topic	Content to be covered
4.2.2.5 **Health issues**	• Health is a state of physical and mental well-being. Communicable and non-communicable diseases are major causes of ill health; other factors include diet, stress and life situations. • Different types of disease may interact. Translate disease incidence information between graphical and numerical forms.
4.1.1.6 **Culturing microorganisms** Triple only	• Bacteria multiply by binary fission. Prepare uncontaminated cultures using aseptic technique; calculate the number of bacteria after a given time and the area of clear zones. • HT only Express bacterial numbers in standard form. • **Required practical 2:** investigate the effect of antiseptics or antibiotics on bacterial growth using agar plates and measuring zones of inhibition.
4.3.1.1 **Communicable diseases**	• Pathogens (viruses, bacteria, protists, fungi) infect plants and animals and spread by direct contact, water or air. • Spread can be reduced by hygiene, destroying or isolating vectors, isolation of infected individuals and vaccination.
4.3.1.2–4.3.1.5 **Viral, bacterial, fungal and protist diseases**	• Viral: measles, HIV and tobacco mosaic virus. Bacterial: salmonella and gonorrhoea. • Fungal: rose black spot. Protist: malaria (including the mosquito vector). • Symptoms, transmission and control for each.
4.3.1.6 **Human defence systems**	• Non-specific defences: skin, nose, trachea and bronchi, stomach. • The immune system: phagocytosis, antibody and antitoxin production by white blood cells.
4.3.3.1 **Detection and identification of plant diseases** Triple only	• Plant pathogens and pests (e.g. aphids); ion deficiency conditions (nitrate deficiency causes stunted growth; magnesium deficiency causes chlorosis). • HT only Methods of detection and identification: symptoms, position, pattern of affected plants, reference sources, testing kits with monoclonal antibodies.
4.3.3.2 **Plant defence responses** Triple only	• Physical (cellulose cell walls, waxy cuticle, layers of dead cells), chemical (antibacterial chemicals, poisons) and mechanical (thorns, drooping leaves, mimicry) adaptations.

B6 Preventing and Treating Disease

Specification: 4.3.1.7–4.3.1.9 and 4.3.2 **Exam:** Paper 1 **Required practicals:** None

Vaccination, antibiotics and painkillers, and how new drugs are discovered and tested. Triple Science adds monoclonal antibodies (Higher tier).

Spec ref and topic	Content to be covered
4.3.1.7 **Vaccination**	• A vaccine contains a small amount of dead or inactive pathogen, stimulating white blood cells to produce antibodies; herd immunity reduces spread.
4.3.1.8 **Antibiotics and painkillers**	• Antibiotics kill bacteria inside the body; specific bacteria need specific antibiotics. Antibiotic resistance is a growing problem. • Painkillers and other medicines treat symptoms but do not kill pathogens; antibiotics cannot kill viruses.
4.3.1.9 **Discovery and development of drugs**	• Traditional drugs from plants and microorganisms (digitalis, aspirin, penicillin, discovered by Alexander Fleming). • New drugs are tested for toxicity, efficacy and dose: preclinical testing on cells, tissues and animals, then clinical trials with healthy volunteers and patients, double blind trials and placebos.

Spec ref and topic	Content to be covered
4.3.2.1 **Producing monoclonal antibodies** Triple only HT only	• Mouse lymphocytes are combined with a tumour cell to make a hybridoma cell that divides and produces one type of antibody.
4.3.2.2 **Uses of monoclonal antibodies** Triple only HT only	• Pregnancy tests, laboratory diagnosis, research to locate molecules in cells, and treating diseases such as cancer by carrying drugs or toxins to cells. • Evaluate the advantages and disadvantages, including side effects.

B7 Non-communicable Diseases

Specification: 4.2.2.5–4.2.2.7 **Exam:** Paper 1 **Required practicals:** None

Risk factors for non-communicable diseases, including lifestyle factors, and cancer.

Spec ref and topic	Content to be covered
4.2.2.6 **The effect of lifestyle on non-communicable diseases**	• Risk factors at individual, local, national and global level; diet, smoking and exercise and cardiovascular disease; obesity and Type 2 diabetes. • Effects of alcohol on the liver and brain, smoking on the lungs, and smoking and alcohol on unborn babies; carcinogens including ionising radiation. • Causal mechanisms for some risk factors; human and financial costs. Interpret data on risk factors, including correlation and causation.
4.2.2.7 **Cancer**	• Cancer results from changes in cells leading to uncontrolled growth and division. Benign tumours are contained; malignant tumours invade tissues and spread to form secondary tumours. • Lifestyle and genetic risk factors for some types of cancer.

B9 Respiration

Specification: 4.4.2 **Exam:** Paper 1 **Required practicals:** None

Aerobic and anaerobic respiration, the body's response to exercise, and metabolism.

Spec ref and topic	Content to be covered
4.4.2.1 **Aerobic and anaerobic respiration**	• Respiration is an exothermic reaction continuously occurring in living cells to supply energy. • Aerobic: glucose + oxygen → carbon dioxide + water. Anaerobic in muscles: glucose → lactic acid; in plants and yeast: glucose → ethanol + carbon dioxide (fermentation, used for bread and alcoholic drinks). • Compare aerobic and anaerobic respiration, including the amount of energy transferred.
4.4.2.2 **Response to exercise**	• Heart rate, breathing rate and breath volume increase during exercise; anaerobic respiration in muscles causes lactic acid build-up and muscle fatigue. • HT only Oxygen debt; lactic acid is taken to the liver and converted back to glucose.
4.4.2.3 **Metabolism**	• Metabolism is the sum of all reactions in a cell or the body, e.g. converting glucose to starch, glycogen and cellulose; making lipids and proteins; respiration; breaking down excess proteins to form urea.

B10 The Human Nervous System

Specification: 4.5.1 and 4.5.2.1–4.5.2.3 **Exam:** Paper 2 **Required practicals:** RP7 Reaction time

Principles of homeostasis and the structure and function of the nervous system, including reflexes. Triple Science adds the brain and the eye.

Spec ref and topic	Content to be covered
4.5.1 **Homeostasis**	• Homeostasis regulates internal conditions (blood glucose, body temperature, water levels) for optimal cell and enzyme function. • Control systems include receptors, coordination centres and effectors, using nervous or chemical responses.
4.5.2.1 **Structure and function**	• The nervous system lets humans respond to the environment: stimulus → receptor → coordinator → effector → response. • Reflex actions are automatic and rapid; the reflex arc including sensory, relay and motor neurones and synapses. • **Required practical 7:** plan and carry out an investigation into the effect of a factor on human reaction time.
4.5.2.2 **The brain** Triple only	• The brain controls complex behaviour; cerebral cortex, cerebellum and medulla and their functions. • HT only How neuroscientists map regions of the brain; benefits and risks of procedures; difficulties of investigating and treating brain damage and disease.
4.5.2.3 **The eye** Triple only	• Structure and function of the retina, optic nerve, sclera, cornea, iris, ciliary muscles and suspensory ligaments. • Accommodation for near and distant objects; myopia and hyperopia and their treatment with lenses, laser surgery and replacement lenses.

B11 Hormonal Coordination (The Endocrine System)

Specification: 4.5.3 (except 4.5.3.3) and 4.5.4 **Exam:** Paper 2 **Required practicals:** RP8 Plant responses

The endocrine system, control of blood glucose, hormones in reproduction, contraception and infertility treatment. Triple Science adds plant hormones.

Spec ref and topic	Content to be covered
4.5.3.1 **Human endocrine system**	• Glands secrete hormones into the bloodstream; effects are slower but longer-lasting than nervous responses. • Positions of the pituitary, pancreas, thyroid, adrenal gland, ovary and testes; the pituitary as a master gland.
4.5.3.2 **Control of blood glucose concentration**	• The pancreas monitors blood glucose and releases insulin, causing glucose to move into cells and be stored as glycogen. • Type 1 diabetes (no insulin produced; treated with insulin injections) and Type 2 (cells stop responding to insulin; treated with diet and exercise). • HT only Glucagon and the negative feedback cycle between insulin and glucagon.
4.5.3.4 **Hormones in human reproduction**	• Oestrogen and testosterone; roles of FSH, LH, oestrogen and progesterone in the menstrual cycle. • HT only How the four hormones interact; interpret graphs of hormone levels.
4.5.3.5 **Contraception**	• Hormonal methods (pill, patch, implant, injection) and non-hormonal methods (barrier methods, spermicides, abstaining around ovulation, sterilisation, IUDs); evaluate each.
4.5.3.6 **Use of hormones to treat infertility** HT only	• FSH and LH as fertility drugs; IVF treatment; evaluate the emotional, physical and ethical issues and success rates.
4.5.3.7 **Negative feedback** HT only	• Adrenaline prepares the body for fight or flight; thyroxine regulates metabolic rate and is controlled by negative feedback.

Spec ref and topic	Content to be covered
4.5.4.1 **Control and coordination in plants** Triple only	• Auxin controls phototropism and gravitropism through unequal distribution. • **Required practical 8:** investigate the effect of light or gravity on the growth of newly germinated seedlings. • HT only Gibberellins in seed germination; ethene controls cell division and fruit ripening.
4.5.4.2 **Use of plant hormones** Triple only HT only	• Auxins as weed killers, rooting powders and in tissue culture; ethene in the food industry to control ripening; gibberellins to end dormancy, promote flowering and increase fruit size.

B12 Homeostasis in Action

Specification: 4.5.2.4 and 4.5.3.3 **Exam:** Paper 2 **Required practicals:** None Triple only

Triple-only unit applying homeostasis to body temperature and the kidneys. Follows B10 and B11 so pupils can draw on nervous and hormonal control.

Placement: in the 2026–27 plan, B12 ends Year 10. The 2026–27 Year 11 cohort, who did not cover it in Year 10, start Year 11 with it instead.

Spec ref and topic	Content to be covered
4.5.2.4 **Control of body temperature** Triple only	• The thermoregulatory centre in the brain monitors blood temperature, with temperature receptors in the skin. • Responses to being too hot (sweating, vasodilation) and too cold (vasoconstriction, shivering). • HT only Explain how these mechanisms raise or lower body temperature in a given context.
4.5.3.3 **Maintaining water and nitrogen balance in the body** Triple only	• Water leaves via the lungs, skin and kidneys; excess ions and urea removed by the kidneys. Kidneys filter blood and selectively reabsorb glucose, some ions and water. • Kidney failure treated by dialysis or kidney transplant; evaluate each. • HT only Deamination of amino acids forms ammonia, converted to urea in the liver; ADH from the pituitary controls water reabsorption by negative feedback.

Revision → Year 10 exams. Revision and exams on the units taught so far.

Year 11

Year 11 covers the remaining Paper 2 content: inheritance, variation and evolution, followed by revision and the Year 11 mock, and then ecology, before revision for the GCSE exams.

B13 Reproduction

Specification: 4.6.1 **Exam:** Paper 2 **Required practicals:** None

Sexual and asexual reproduction, meiosis, DNA and the genome, inheritance and inherited disorders. Triple Science adds the advantages of each type of reproduction and DNA structure and protein synthesis.

Spec ref and topic	Content to be covered
4.6.1.1–4.6.1.2 **Sexual and asexual reproduction; meiosis**	• Sexual reproduction joins gametes (meiosis), giving variation; asexual reproduction involves one parent and mitosis, giving genetically identical clones. • Meiosis halves the chromosome number and produces non-identical gametes; fertilisation restores the full number.
4.6.1.3 **Advantages and disadvantages of sexual and asexual reproduction** Triple only	• Compare the two; some organisms reproduce both ways, e.g. malarial parasites, fungi, and plants (seeds and runners or bulbs).
4.6.1.4 **DNA and the genome**	• DNA is a polymer of two strands in a double helix; a gene codes for a sequence of amino acids to make a protein. • The genome is all of an organism's genetic material; importance of the Human Genome Project for medicine.
4.6.1.5 **DNA structure** Triple only	• DNA is made of nucleotides (sugar, phosphate and one of four bases); the sequence of bases is the genetic code. • HT only Complementary base pairing; protein synthesis on ribosomes using carrier molecules; protein folding; effects of mutations and non-coding DNA.
4.6.1.6 **Genetic inheritance**	• Gamete, chromosome, gene, allele, dominant, recessive, homozygous, heterozygous, genotype and phenotype. Use genetic crosses and family trees. • HT only Construct Punnett squares and use probability, ratios and percentages to predict outcomes.
4.6.1.7–4.6.1.8 **Inherited disorders; sex determination**	• Polydactyly (dominant allele) and cystic fibrosis (recessive allele); embryo screening and the economic, social and ethical issues. • Humans have 23 pairs of chromosomes; one pair determines sex (XX female, XY male).

B14 Variation and Evolution

Specification: 4.6.2 **Exam:** Paper 2 **Required practicals:** None

Variation, evolution by natural selection, selective breeding and genetic engineering. Triple Science adds cloning.

Spec ref and topic	Content to be covered
4.6.2.1–4.6.2.2 **Variation and evolution**	• Variation is genetic, environmental or both; mutations occur continuously and rarely lead to a new phenotype. • Evolution by natural selection: a change in the inherited characteristics of a population over time; may lead to new species.
4.6.2.3 **Selective breeding**	• Choosing parents with desired characteristics over many generations, e.g. disease resistance, high yield, gentle nature; risk of inbreeding.
4.6.2.4 **Genetic engineering**	• Modifying genomes by introducing genes from other organisms, e.g. bacteria producing insulin and GM crops; benefits and risks, including possible gene therapy. • HT only Main steps: enzymes isolate the gene, which is inserted into a vector (plasmid or virus) and then into the target cells.

Spec ref and topic	Content to be covered
4.6.2.5 **Cloning** Triple only	• Tissue culture, cuttings, embryo transplants and adult cell cloning (e.g. Dolly the sheep); evaluate benefits and risks.

B15 Genetics and Evolution

Specification: 4.6.3 and 4.6.4 **Exam:** Paper 2 **Required practicals:** None

How scientific understanding of genetics and evolution developed, the evidence for evolution, extinction, antibiotic resistance and classification. Triple Science adds the history of the theories and speciation.

Spec ref and topic	Content to be covered
4.6.3.1–4.6.3.3 **Theory of evolution, speciation and the understanding of genetics** Triple only	• Darwin's theory of evolution by natural selection, why it was only gradually accepted, and Lamarck's alternative theory. • Wallace's work on speciation; how new species arise through isolation and natural selection. • Mendel's work on inheritance and how understanding developed with chromosomes, genes and DNA.
4.6.3.4–4.6.3.6 **Evidence for evolution, fossils and extinction**	• Evidence from fossils and antibiotic resistance; how fossils form and why the record is incomplete. • Factors that can contribute to extinction.
4.6.3.7 **Resistant bacteria**	• Bacteria evolve rapidly; antibiotic-resistant strains such as MRSA. Reducing resistance through appropriate prescribing, completing courses and restricting agricultural use.
4.6.4 **Classification of living organisms**	• Linnaean system (kingdom to species) and binomial names; the three-domain system (archaea, bacteria, eukaryota) from Carl Woese. • Use evolutionary trees.

Revision → Year 11 mock exam. Revision and mock exam on B1–B13.

B16 Adaptations, Interdependence and Competition

Specification: 4.7.1 and 4.7.2.1 (RP9) **Exam:** Paper 2 **Required practicals:** RP9 Field investigations

Communities, abiotic and biotic factors, competition and adaptations. Includes the sampling required practical.

Spec ref and topic	Content to be covered
4.7.1.1 **Communities**	• Ecosystems; organisms compete for resources (plants for light, space, water and mineral ions; animals for food, mates and territory). Interdependence and stable communities.
4.7.1.2–4.7.1.3 **Abiotic and biotic factors**	• Abiotic: light intensity, temperature, moisture, soil pH and minerals, wind, CO_2, oxygen in water. Biotic: food availability, new predators, new pathogens, competitors. • Explain how a change in a factor affects a community; extract and interpret data.
4.7.1.4 **Adaptations**	• Structural, behavioural and functional adaptations; extremophiles living in very extreme conditions.
4.7.2.1 (RP9) **Sampling and distribution**	• **Required practical 9:** measure the population size of a common species using sampling (quadrats) and investigate the effect of a factor on its distribution (transects).

B17 Organising an Ecosystem

Specification: 4.7.2.1–4.7.2.3 **Exam:** Paper 2 **Required practicals:** RP10 Decay

Feeding relationships and the cycling of materials. Triple Science adds decomposition and the decay practical.

Spec ref and topic	Content to be covered
4.7.2.1 **Levels of organisation**	• Food chains with producers and primary, secondary and tertiary consumers; predator–prey cycles.
4.7.2.2 **How materials are cycled**	• The carbon cycle and the water cycle; the role of microorganisms in returning carbon and mineral ions to the soil.
4.7.2.3 **Decomposition** Triple only	• Effect of temperature, water and oxygen on the rate of decay; gardeners and farmers provide optimum conditions (compost); anaerobic decay produces methane for biogas. • Calculate rate changes in decay. • **Required practical 10:** investigate the effect of temperature on the rate of decay of fresh milk by measuring pH change.

B18 Biodiversity and Ecosystems

Specification: 4.7.3, 4.7.2.4, 4.7.4 and 4.7.5 **Exam:** Paper 2 **Required practicals:** None

The final unit: human impact on biodiversity and ways of reducing it. Triple Science adds the impact of environmental change, trophic levels and biomass, and food security and production.

Spec ref and topic	Content to be covered
4.7.3.1–4.7.3.4 **Biodiversity, waste management, land use and deforestation**	• Biodiversity is the variety of species on Earth; it ensures ecosystem stability. Human population growth and rising living standards increase resource use and waste. • Pollution of water (sewage, fertiliser, toxic chemicals), air (smoke, acidic gases) and land (landfill, toxic chemicals). • Land use for building, quarrying, farming and dumping waste; destruction of peat bogs; large-scale deforestation in tropical areas.
4.7.3.5 **Global warming**	• Increasing carbon dioxide and methane contribute to global warming; biological consequences including loss of habitat and changes in species distribution and migration.
4.7.2.4 **Impact of environmental change** Triple only HT only	• How seasonal and geographic changes, and human interaction, affect the distribution of species (temperature, water availability, atmospheric gases).
4.7.3.6 **Maintaining biodiversity**	• Breeding programmes, protecting rare habitats, field margins and hedgerows, reducing deforestation and carbon emissions, recycling; conflicting pressures.
4.7.4 **Trophic levels in an ecosystem** Triple only	• Trophic levels (producers, primary to apex consumers, decomposers); construct accurate pyramids of biomass. • Only about 10% of biomass is transferred to the next level; losses through waste, egestion and respiration. Calculate the efficiency of biomass transfer.
4.7.5 **Food production** Triple only	• Factors affecting food security; efficiency of food production (limiting energy transfer in animals, high-protein foods). • Sustainable fisheries (quotas, net size); biotechnology such as mycoprotein from Fusarium and GM crops (e.g. golden rice).

Revision → GCSE exams. Paper 1 covers B1–B9 (specification 4.1–4.4); Paper 2 covers B10–B18 (specification 4.5–4.7).

Required practical activities

GCSE Biology has ten required practicals; RP2, RP8 and RP10 are Triple only. Questions drawing on them make up at least 15% of the exam marks.

RP	Activity	Spec ref	Taught in
1	Use a light microscope to observe, draw and label plant and animal cells, with a magnification scale	4.1.1.2	B1 Cell Structure and Transport (Y9)
2	Triple only Investigate the effect of antiseptics or antibiotics on bacterial growth using agar plates	4.1.1.6	B5 Communicable Diseases (Y10)
3	Investigate the effect of salt or sugar solutions on the mass of plant tissue (osmosis)	4.1.3.2	B1 Cell Structure and Transport (Y9)
4	Use qualitative reagents to test for carbohydrates, lipids and proteins	4.2.2.1	B3 Organisation and the Digestive System (Y9)
5	Investigate the effect of pH on the rate of reaction of amylase	4.2.2.1	B3 (Y9); catch-up in Y10 after B11
6	Investigate the effect of light intensity on the rate of photosynthesis	4.4.1.2	B8 Photosynthesis (Y10)
7	Plan and carry out an investigation into the effect of a factor on human reaction time	4.5.2.1	B10 The Human Nervous System (Y10)
8	Triple only Investigate the effect of light or gravity on the growth of newly germinated seedlings	4.5.4.1	B11 Hormonal Coordination (Y10)
9	Measure the population size of a common species and investigate the effect of a factor on its distribution	4.7.2.1	B16 Adaptations (Y11)
10	Triple only Investigate the effect of temperature on the rate of decay of fresh milk by measuring pH change	4.7.2.3	B17 Organising an Ecosystem (Y11)

Specification coverage map

Every subsection of the AQA 8461 subject content, with the unit that teaches it. All 24 subsections are covered.

Spec	Title	Unit	Year	Paper
4.1.1	Cell structure (4.1.1.4 differentiation in B2; 4.1.1.6 culturing microorganisms Triple only in B5)	B1	9	1
4.1.2	Cell division	B2	9	1
4.1.3	Transport in cells	B1	9	1
4.2.1	Principles of organisation	B3	9	1
4.2.2	Animal tissues, organs and organ systems	B3, B4, B5, B7	9–10	1
4.2.3	Plant tissues, organs and systems	B4	10	1
4.3.1	Communicable diseases	B5, B6	10	1
4.3.2	Monoclonal antibodies Triple only HT only	B6	10	1
4.3.3	Plant disease Triple only	B5	10	1
4.4.1	Photosynthesis	B8	10	1
4.4.2	Respiration	B9	10	1
4.5.1	Homeostasis	B10	10	2
4.5.2	The human nervous system (4.5.2.4 body temperature Triple only in B12)	B10, B12	10	2
4.5.3	Hormonal coordination in humans (4.5.3.3 water and nitrogen balance Triple only in B12)	B11, B12	10	2
4.5.4	Plant hormones Triple only	B11	10	2
4.6.1	Reproduction	B13	11	2
4.6.2	Variation and evolution	B14	11	2
4.6.3	The development of understanding of genetics and evolution	B15	11	2
4.6.4	Classification of living organisms	B15	11	2
4.7.1	Adaptations, interdependence and competition	B16	11	2
4.7.2	Organisation of an ecosystem (4.7.2.4 Triple only HT only in B18)	B16, B17, B18	11	2
4.7.3	Biodiversity and the effect of human interaction on ecosystems	B18	11	2
4.7.4	Trophic levels in an ecosystem Triple only	B18	11	2
4.7.5	Food production Triple only	B18	11	2

Textbook, revision guides and websites

Textbook used in class

- AQA GCSE Biology Student Book (AQA GCSE Science 3rd Edition), Ann Fullick; series editor Lawrie Ryan (Oxford University Press)

Recommended revision guide

- Collins AQA GCSE 9-1 Biology Complete Revision & Practice

Useful websites

- **Physics & Maths Tutor:** past paper questions with mark schemes; some have video solutions. https://www.physicsandmathstutor.com/biology-revision/gcse-aqa/
- **AQA:** all past papers and mark schemes. https://www.aqa.org.uk/subjects/biology/gcse/biology-8461/assessment-resources
- **Revisely:** Free Science Lessons revision videos. https://www.revisely.com/gcse/biology/aqa
- **Malmesbury Education (YouTube):** videos of the required practicals. https://www.youtube.com/@MalmesburyEducation

Source: specification content summarised from AQA GCSE Biology (8461) specification (aqa.org.uk/8461). Check the AQA website for any later updates.