

GCSE to A-level progression

Choose AQA for GCSE and A-level Biology

AQA A-level Biology has been designed to naturally progress from GCSE and take recognisable topics a stage further. Some, such as reflex actions and geotropisms, are studied in greater detail, while others broaden the GCSE experience and use mathematics so that the qualitative understanding becomes more quantitative. The A-level specification has been designed to not duplicate content from GCSE but to expand on the principles and increase overall knowledge while keeping context to a minimum. Scientific terminology has been standardised and GCSE examiners have played key roles in developing the new specification, meaning centres should find the progression from GCSE to A-level both seamless and natural.

Content

Keeping healthy

GCSE specification reference: 1.1

A-level specification reference: 3.2.4 Cell recognition and the immune system.

Vaccination is introduced at GCSE.

At A-level the types of cells are covered along with immunity, the structure of HIV, its role in AIDS, and monoclonal antibodies.

Diet and exercise

GCSE specification reference: 1.1.1

A-level specification reference: 3.3.4 Mass transport

The GCSE specification mainly covers the components of a healthy diet and the effects of inherited factors. Cholesterol is included.

The A-level specification expands on this to include the structure of the heart and reasons for heart disease. Section 3.6.4.2 also includes further detail on type I and II diabetes, their causes and control by insulin.

How our bodies defend themselves against infectious diseases

GCSE specification reference: 1.1.2

A-level specification reference: 3.2.4 Cell recognition and the immune system

GCSE covers pathogens and the various ways that their effects can be reduced. It includes vaccines and the immune system (including white blood cells) as well as resistance to antibiotics and cultures of microorganisms.

Antibodies, vaccines and immunity are also covered at A-level (active and passive is not included at GCSE level) along with much more detail on certain types of cells and how they can help identify and fight against pathogens. Antigen, T and B lymphocytes are covered.

The nervous system

GCSE specification reference: 1.2.1

A-level specification reference: 3.6.1 Stimuli, both internal and external, are detected and lead to a response, 3.6.2 Nervous coordination (Nerve impulses, Synaptic transmission), 3.6.3 Skeletal muscles are stimulated to contract by nerves and act as effectors

The roles of receptors, their structure and location are covered in the GCSE specification. The role of neurones and reflex actions, including synapses and effectors is covered but the structure and function of the sense organs is not required.

At A-level the reflex action is covered again in the concept of survival and response of plants. Knowledge of the retina and the Pacinian Corpuscle are also required and the concept of a generator potential is introduced. Muscles acting as effectors is also covered, as is their structure and how the contractions happen.

Control in the human body

GCSE specification reference: 1.2.2

A-level specification reference: 3.6.4 Homeostasis is the maintenance of a stable internal environment

At GCSE level hormones are introduced and their roles in controlling various conditions in the body are described.

The role of the kidney, control of blood sugar and negative feedback are not required. These are all introduced at A-level.

Control in plants

GCSE specification reference: 1.2.3

A-level specification reference: 3.6.1.1 Survival and response (Tropisms, role of IAA)

Geotropism is covered at GCSE along with auxin and how shoots and roots move according to hormones and gravity.

A-level expands on this to include the role of indoleacetic acid (IAA) and its effects on shoots and roots and examples of geotropisms.

Drugs

GCSE specification reference: 1.3.1

A-level specification reference: No equivalent topic at A-level

This does not appear as a topic at A-level. Statins, which appear at GCSE, may be included as part of the work on the heart but are not on the specification.

Adaptations

GCSE specification reference: 1.4.1

A-level specification reference: 3.4.4 Genetic diversity and adaptation

The knowledge from GCSE that some organisms have adaptations to suit their environments is expanded at A-level to include how genetic diversity and evolution can lead to an advantageous adaptation becoming more common over time.

Environmental change

GCSE specification reference: 1.4.2

A-level specification reference: No equivalent topic at A-level

This does not appear as a topic at A-level. Some topics, however, do appear in other areas, for example environmental factors affecting organisms.

Energy in biomass

GCSE specification reference: 1.5.1

A-level specification reference: 3.5.3 Energy and ecosystems

The concept of biomass is introduced at GCSE along with the reason for its reduction at each step in a food chain.

A-level introduces formulas for GPP and NPP, as well as the net production of consumers. This links to farming, and the aim of increasing efficiency by reducing losses.

Decay processes

GCSE specification reference: 1.6.1

A-level specification reference: 3.5.4 Nutrient cycles

The concept of living things removing material from the environment to grow and returning them when they die or decay is learnt at GCSE.

A-level covers in more detail the role of bacteria in various processes including ammonification and nitrification. The nitrogen and phosphorus cycles are included at A-level, which again covers some issues concerning the use of fertilisers in farming.

The carbon cycle

GCSE specification reference: 1.6.2

A-level specification reference: 3.5.4 Nutrient cycles

The nitrogen cycle and phosphorus cycle are covered at A-level, but the carbon cycle is not.

Why organisms are different

GCSE specification reference: 1.7.1

A-level specification reference: 3.4.1 DNA, genes and chromosomes

GCSE introduces the concept of similarity due to genes, how they are passed on, and why differences may arise due to genetic, environmental factors or a combination of the two.

A-level uses the context of eukaryotes and prokaryotes. It also covers DNA, which is not covered in this topic at GCSE. The differences between DNA molecules in eukaryotic and prokaryotic cells is covered.

Reproduction

GCSE specification reference: 1.7.2

A-level specification reference: 3.8.4 Gene technologies allow the study and alteration of gene function allowing a better understanding of organism function and the design of new industrial and medical processes

Sexual and asexual reproduction are introduced, along with cloning techniques and genetic engineering predominantly in the context of GM crops.

Ethical problems are raised and continued at A-level where the focus is more on recombinant DNA, mRNA, cDNA and amplification of DNA fragments.

Evolution

GCSE specification reference: 1.8.1

A-level specification reference: 3.8.1 Alteration of the sequence of bases in DNA can alter the structure of proteins

Evolution and its history, including natural selection and gene mutation are covered at GCSE including the timescales involved in evolution.

At A-level evolution is covered throughout the course, and gene mutations is a topic in its own right. This separate topic covers DNA replication, the mutation rate being affected by mutagenic agents and the fact that gene mutations occur spontaneously.

Cells and cell structure

GCSE specification reference: 2.1.1

A-level specification reference: 3.2.1 Cell structure

GCSE covers some of the parts of plant, animal, human and algal cells, as well as the yeast cell, a bacterial cell and the concept that cells may be specialised to perform specific functions.

A-level splits cells up into eukaryotes and prokaryotes, covers the differences between them and the various adaptations to each type of cell.

Dissolved substances

GCSE specification reference: 2.1.2

A-level specification reference: 3.2.3 Transport across cell membranes

The concept of diffusion is introduced at GCSE.

A-level covers more material including how to affect the rate of movement across a membrane, and how adaptations in specialised cells affect the rate of transport across their membranes. The phospholipid bilayer is not covered at GCSE.

Animal organs

GCSE specification reference: 2.2.1

A-level specification reference: 3.3.3 Digestion and absorption

At GCSE students require knowledge of what organs are, what they are made from and what they do within the body, as well as recognising the organs within the digestive system.

At A-level the processes of digestion and absorption are discussed. Digestion of carbohydrates, lipids and proteins and how they are digested are covered, as well as the mechanism for absorption of the products of digestion by cells lining the ileum.

Plant organs

GCSE specification reference: 2.2.2

A-level specification reference: 3.3.4 Mass transport

Some examples of plant organs are required at GCSE along with a brief description of what they do and the internal structure of a leaf.

A-level covers the cohesion-tension theory, mass flow hypothesis as well as the use of tracers and ringing experiments.

Photosynthesis

GCSE specification reference: 2.3.1

A-level specification reference: 3.5.1 Photosynthesis

The fact that chlorophyll absorbs light, as well as the limiting factors are covered at both levels.

A-level also covers the light-independent reaction as well as the production of ATP and reduced NDAP.

Distribution of organisms

GCSE specification reference: 2.4.1

A-level specification reference: 3.4.7 Investigating diversity

The collection of data regarding the distribution and reasons for distributions of organisms are covered at GCSE, as are the mean, median and mode, and sample size validity.

A-level covers the distribution of organisms in relation to base sequence of DNA and mRNA, and includes standard deviation in the practical assignments but not in the written tests.

Proteins

GCSE specification reference: 2.5.1

A-level specification reference: 3.1.4 Proteins

The uses of proteins are introduced at GCSE, along with a description of their composition and the knowledge that enzymes are proteins.

A-level includes a diagrammatic representation of a protein and peptide bonds. More information on the structure, functions and properties of proteins is included.

Enzymes

GCSE specification reference: 2.5.2

A-level specification reference: 3.1.4.2 Many proteins are enzymes, 3.3.3 Digestion and absorption

At GCSE level the enzymes topic is based around digestion, with much of the content in the context of eg salivary glands. Temperature and pH affecting enzymes are also included along with some applications of enzymes outside the body, in the home and industry.

Topic 3.1.4.2 covers content on enzymes lowering activation energy, properties of enzymes, and specificity of enzymes. What affects the rate of reaction is also considered. Topic 3.3.3 covers digestion and absorption using the examples of amylase, protease, lipase and bile. Both include practical work focusing on investigating different variables on the rate of enzyme reactions.

Aerobic respiration

GCSE specification reference: 2.6.1

A-level specification reference: 3.5.2 Respiration

Aerobic respiration using oxygen is introduced at GCSE level along with its equation. Other content is included in the context of exercise: effects on the body and muscles storing glucose as glycogen.

A-level covers glycolysis, phosphates and aerobic respiration in more detail for example the Krebs cycle, phosphorylation, ATP and NAD (which are not considered at GCSE). There is also a link to topic 6.3 that refers to muscle action.

Anaerobic respiration

GCSE specification reference: 2.6.2

A-level specification reference: 3.5.2 Respiration

Respiration with insufficient oxygen to break down glucose, and the lower amount of energy produced are included at GCSE - along with the context of exercise and an oxygen debt - and lactic acid.

A-level expands on this to cover glycolysis and its stages, and the conversion of pyruvate to ethanol or reduced lactate. The context of exercise is not considered in the A-level topic.

Cell division and inheritance

GCSE specification reference: 2.7

A-level specification reference: 3.7.1 Inheritance, 3.8.2 Gene expression is controlled by a number of features

Mendel's work on inheritance is covered at GCSE along with the results from monohybrid crosses, genetic diagrams and ethical considerations of treating genetic disorders.

Dihybrid crosses and the chi-squared test are included at A-level along with epistasis, autosomal linkage and sex linkage. A-level also expands on stem cells to include those that appear in embryos and mature mammals.

Cell division

GCSE specification reference: 2.7.1

A-level specification reference: 3.2.2 All cells arise from other cells, 3.4.3 Genetic diversity can arise as a result of mutation or during meiosis

GCSE level covers the theories of mitosis and meiosis, the division of cells to form gametes and an introduction to stem cells.

A-level continues the concept that not all cells retain the ability to divide, and certain dividing cells being identical to the parent cell, but also includes far more content on the stages of division that do not appear at GCSE. Cancer being a result of division appears at A-level. Topic 3.4.3 expands on what is already known about meiosis to include mutations and the difference between mitosis and meiosis, and how genetic variation occurs.

Genetic variation

GCSE specification reference: 2.7.2

A-level specification reference: 3.1.5 Nucleic acids are important information-carrying molecules, 3.4.3 Genetic diversity can arise as a result of mutation or during meiosis, 3.4.4 Genetic diversity and adaptation, 3.4.1 DNA, genes and chromosomes, 3.8.4.3 Genetic fingerprinting

At GCSE students are expected to know the differences between XX/XY chromosomes, the link between genes, DNA and chromosomes, and the meanings of dominant and recessive alleles.

The various A-level topics expand significantly on these concepts to include the structure of many things not in GCSE (DNA, RNA) and how differences in alleles can result in genetic difference leading to natural selection. How the link between DNA and proteins varies by cell type, and coding variation between cell types, are also covered. The uniqueness of DNA is also considered in terms of variable-number tandem repeats (VNTRs). The applications of DNA (forensics, medicine, animal and plant breeding) are also covered.

Genetic disorders

GCSE specification reference: 2.7.3

A-level specification reference: 3.7.1 Inheritance

The terms homozygous, heterozygous, recessive and dominant are common to both specifications.

A-level requires the use of fully labelled genetic diagrams to interpret or predict the results of monohybrid cross and dihybrid crosses, as well as other crosses. The term codominant is also used only at A-level and the use of the chi-squared test to compare observed phenotypic ratio to expected ones is required.

Old and new species

GCSE specification reference: 2.8.1

A-level specification reference: 3.7.3 Evolution may lead to speciation

The material covered at GCSE covered both old species and introduced how new ones come about. Fossils, what they are, why they form and why we might not have them are covered as well as the reasons for extinction.

At A-level the material covered focusses solely on speciation and how new species can arise from existing ones due to evolution.

Dissolved substances

GCSE specification reference: 3.1.1

A-level specification reference: 3.2.3 Transport across cell membranes, 3.3.1 Surface area to volume ration, 3.3.2 Gas exchange

At GCSE, the ideas of diffusion, osmosis and active transport are covered. The effectiveness and adaptation of exchange surfaces is also included. Examples of villi and alveoli are given as well as the context of a soft drink to explain water, sugar and ion concentration in the body.

Topic 3.2.3 expands to include co-transport and separates the types of diffusion. Protein channels and carrier molecules are also covered. Exchange in the context of surface to volume ratio appears in Topic 3.3.1, and in Topic 3.3.2 human gas exchange is included, following on from the introduction of alveoli at GCSE level.

Gaseous exchange

GCSE specification reference: 3.1.2

A-level specification reference: 3.3.2 Gas exchange

The GCSE topic is limited to the function of the lungs and ventilation.

This is included at A-level also, but is expanded to include alveoli, bronchi, bronchioles, and the trachea. Gas exchange in single-celled organisms, fish, plants and insects is included. The function of the alveolar epithelium -and the compromise between gas exchange and water loss prevention in insects and plants - is also covered.

Exchange systems in plants

GCSE specification reference: 3.1.3

A-level specification reference: 3.3.2 Gas exchange, 3.3.4 Mass transport

At GCSE level the content focuses on the leaves, the roots, their surface areas, water vapour and guard cells surrounding the stomata.

The A-level topic covers insects, gills and single-celled organisms. The human gas exchange system is included, as are some aspects of the xylem and phloem, and the capillaries as exchange surfaces.

The blood system

GCSE specification reference: 3.2.1

AS/A-level specification reference: 3.3.4 Mass transport

The structure of the heart is covered at GCSE along with several of the arteries and veins, the structures of arteries

and veins and the role of capillaries.

A-level expands on the role and structure of arteries, veins and arterioles and touches on cardiovascular disease.

The blood

GCSE specification reference: 3.2.2

A-level specification reference: 3.3.4 Mass transport

The role of red blood cells in transporting oxygen is common to both A-level and GCSE.

Oxygen binding is introduced at A-level as well as different haemoglobin types for different animals and the Bohr effect.

Transport systems in plants

GCSE specification reference: 3.2.3

A-level specification reference: 3.3.4 Mass transport

The purpose of the xylem- and phloem as well as the term transpiration are covered at both levels.

At A-level, the cohesion-tension theory of water transport is included in the knowledge of the xylem, the mass-flow hypothesis, tracers and ringing experiments are also required.

Homeostasis

GCSE specification reference: 3.3

A-level specification reference: 3.6.4 Homeostasis is the maintenance of a stable internal environment

The GCSE overarching topic of homeostasis covers kidney failure and diabetes, water and iron content, body temperature and blood glucose levels.

Blood pH in relation to enzyme activity, negative and positive feedback are introduced at A-level as is more detail on blood glucose concentration in relation to availability of substrate levels and water potential of blood.

Removal of waste and water control

GCSE specification reference: 3.3.1

A-level specification reference: 3.6.4 Homeostasis is the maintenance of a stable internal environment, 3.2.4 Cell recognition and the immune system

GCSE covers the removal of CO₂ and urea from the body. Much of the content refers to dialysis and kidney transplants.

Dialysis and transplants are not covered at A-level although antigens are included. More detail is included on topics such as T cells, B cells and phagocytosis. A-level also covers more on blood glucose concentration, positive and negative feedback.

Temperature control

GCSE specification reference: 3.3.2

A-level specification reference: No equivalent topic at A-level

Temperature control, how this is achieved and references to sweating and shivering are included at GCSE.

A-level only refers to stable temperature in relation to enzyme activity in section 3.6.4.1 Principles of homeostasis and negative feedback.

Sugar control

GCSE specification reference: 3.3.3

A-level specification reference: 3.6.4 Homeostasis is the maintenance of a stable internal environment

Insulin, glucagon and what they do in relation to glucose and blood are covered at GCSE as is why type I diabetes happens, and what can be done to control it.

A-level expands to include the actions of insulin and glucagon, the role of adrenaline, the role of the liver and the second messenger model of adrenaline and glucagon action. Type II diabetes is also included, along with how to control it through insulin and exercise.

Waste from human activity

GCSE specification reference: 3.4.1

▸ A-level specification reference: No equivalent topic at A-level

Other than a reference to the trade-off between land available for human activity and conservation, this topic is not covered at A-level.

Deforestation and the destruction of areas of peat

GCSE specification reference: 3.4.2

A-level specification reference: No equivalent topic at A-level

Due to the context, this is not covered at A-level.

Biofuels

GCSE specification reference: 3.4.3

A-level specification reference: No equivalent topic at A-level

Biofuels does not appear as a topic in its own right at A-level.

Food production

GCSE specification reference: 3.4.4

A-level specification reference: 3.5.3 Energy and ecosystems

Biomass and the efficiency of food production is covered at both levels.

A-level introduces equations for NPP and net production of consumers, N. Farming is included as a general term but the context of fishing stocks is not included.

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