

Water and inorganic ions

Can you explain the importance of water as a solvent in biological systems?



Can you describe the roles of potassium, calcium, magnesium, iron, hydrogencarbonate, nitrate and phosphate ions as components of biological compounds?



Can you explain the roles of inorganic ions in osmotic and buffering systems?

**Carbohydrates**

Can you describe the structure of monosaccharides, including alpha and beta glucose and the pentoses ribose and deoxyribose?



Can you explain how glycosidic bonds form by condensation and are broken by hydrolysis?



Can you describe the formation of the disaccharides maltose, sucrose and lactose?



Can you relate the structure of starch (amylose and amylopectin) and glycogen to their function as storage molecules?



Can you relate the structure of cellulose, including beta glucose, microfibrils and hydrogen bonding, to its structural role?

**Lipids**

Can you describe the structure of a triglyceride and the formation of ester bonds by condensation?



Can you distinguish between saturated and unsaturated fatty acids and relate this to fats and oils?



Can you describe the structure of phospholipids and explain their arrangement in membranes?

**Proteins**

Can you draw the general structure of an amino acid and explain how a peptide bond forms by condensation?



Can you describe the primary, secondary (alpha helix and beta pleated sheet), tertiary and quaternary structure of proteins and the bonds involved?



Can you distinguish between fibrous and globular proteins with examples?



Can you explain what is meant by a conjugated protein?



Can you explain what prions are and how they cause disease such as scrapie, BSE and CJD?



Nucleic acids and DNA replication

Can you describe the structure of a nucleotide and how nucleotides join by condensation into polynucleotides?



Can you describe the antiparallel double helix of DNA with complementary base pairing?



Can you compare the structure of DNA and RNA?



Can you describe semi-conservative DNA replication, including the roles of helicase and DNA polymerase?



Can you explain how the Meselson-Stahl experiment provided evidence for semi-conservative replication?



Practical work

Can you carry out biochemical tests for reducing and non-reducing sugars, starch and protein?



Can you separate amino acids by paper chromatography and calculate R_f values?



1.2 Enzymes

Enzyme structure and action

Can you describe enzymes as globular proteins with an active site and explain enzyme specificity?



Can you explain the roles of cofactors and coenzymes?



Can you explain how enzymes lower activation energy?



Can you compare the lock-and-key and induced-fit models of enzyme action?



Can you explain the effects of temperature, pH, substrate concentration and enzyme concentration on enzyme activity?



Can you explain the action of competitive and non-competitive inhibitors?



Applications of enzymes

Can you explain how enzymes in clinical samples can be detected and used as biomarkers of disease?



Can you explain how active site-directed inhibitors can be used as drugs against disease-related enzymes?



Can you describe methods of immobilising enzymes and evaluate the benefits and limitations of immobilisation?



Can you explain how immobilised enzymes are used in biosensors?



Practical work

Can you investigate the factors affecting enzyme activity?



Can you illustrate enzyme immobilisation in a practical procedure?



Can you use a colorimeter to follow the course of an enzyme-catalysed reaction?



1.3 Viruses

1.3 Viruses

Can you describe the structure of a bacteriophage?



Can you describe the structure of HIV, including the role of reverse transcriptase?



Can you describe how bacteriophages replicate and destroy their host cells?



Can you describe how HIV replicates and explain how it damages helper T-cells?



1.4 Cells

Cell structure

Can you describe and compare the ultrastructure of prokaryotic and eukaryotic cells?



Can you describe the fluid mosaic model of membrane structure?



Can you explain the functions of the components of membranes, including phospholipids, proteins, glycoproteins and cholesterol?



Can you describe the structure and function of mitochondria and chloroplasts?



Can you describe the structure and function of rough and smooth endoplasmic reticulum, ribosomes and the Golgi apparatus?



Can you describe the structure and function of lysosomes, microtubules and plasmodesmata?



Can you describe the structure and function of the nucleus, including the nuclear envelope, nucleolus and chromatin?



Can you compare the structure of plant, fungal and animal cells?



Microscopy and cell fractionation

Can you compare light and electron (transmission and scanning) microscopes?	☐	☐	☐
Can you distinguish between magnification and resolution?	☐	☐	☐
Can you explain how homogenisation and differential centrifugation are used in cell fractionation?	☐	☐	☐

Practical work

Can you interpret electron micrographs and identify organelles?	☐	☐	☐
Can you make accurate drawings of cells from a light microscope?	☐	☐	☐
Can you prepare and stain temporary mounts of cells?	☐	☐	☐
Can you calculate the actual size of cells and organelles and the magnification of images?	☐	☐	☐
Can you calibrate an eyepiece graticule using a stage micrometer and use it to measure cells at low and high power?	☐	☐	☐

1.5**Cell Physiology****1.5 Cell Physiology**

Can you explain diffusion and the factors that affect its rate?	☐	☐	☐
Can you explain osmosis in terms of water potential?	☐	☐	☐
Can you explain facilitated diffusion using channel and carrier proteins?	☐	☐	☐
Can you explain active transport and its dependence on ATP?	☐	☐	☐
Can you describe endocytosis and exocytosis?	☐	☐	☐
Can you explain the permeability of membranes to fat-soluble and water-soluble substances?	☐	☐	☐
Can you calculate water potential using the equation $\Psi = \Psi_s + \Psi_p$?	☐	☐	☐
Can you explain incipient plasmolysis, turgor and flaccidity in plant cells?	☐	☐	☐
Can you determine the water potential of plant tissue by a weighing method?	☐	☐	☐
Can you determine the solute potential of plant cells by the incipient plasmolysis method?	☐	☐	☐

1.6 Continuity of Cells

Cell cycle and mitosis

Can you describe the cell cycle, including interphase (G1, S, G2), G0, mitosis and cytokinesis?



Can you explain the role of control points in the cell cycle and how loss of control can lead to cancer?



Can you describe the structure of a eukaryotic chromosome, including DNA and histones?



Can you describe and identify the stages of mitosis?



Can you explain the significance of mitosis in growth, repair and asexual reproduction?



Can you explain how anticancer drugs such as mitotic poisons and S-phase inhibitors act on the cell cycle?



Meiosis and variation

Can you explain the terms haploid and diploid and interpret a karyotype?



Can you describe and identify the stages of meiosis?



Can you explain the significance of meiosis in sexual reproduction?



Can you explain how crossing over generates genetic variation?



Can you explain how independent assortment generates genetic variation?



Practical work

Can you prepare and stain a root tip squash to observe mitosis?



Can you identify the stages of mitosis and meiosis from slides and photographs?



1.7 Tissues and Organs

1.7 Tissues and Organs

Can you explain how specialised cells are organised into tissues and organs?



Can you describe the tissue layers of the ileum wall?



Can you describe the structure of the ileum mucosa, including villi, microvilli and crypts?



Can you explain how the ileum is adapted for absorption?



Can you describe the tissue layers of a mesophytic leaf?



Can you explain how a mesophytic leaf is adapted for photosynthesis and water conservation?



Can you examine and make accurate block diagrams of sections of the ileum and a leaf?



2.1a

Exchange and gas exchange

Principles of exchange and transport

Can you explain how surface area to volume ratio affects exchange and the supply of metabolites as organisms increase in size?



Can you describe how exchange surfaces are adapted by large surface area, thin barriers and maintained concentration gradients, using examples such as mesophyll, root hairs, capillaries, red blood cells and alveoli?



Can you explain why flowering plants and mammals need mass transport systems?



Gaseous exchange

Can you explain the factors affecting the rate of gas exchange and relate them to Fick's law?



Can you explain gas exchange in plants in relation to respiration and photosynthesis, including net exchange over day and night and the compensation point?



Can you explain how leaves are adapted for gas exchange, including thinness, air spaces and stomatal opening?



Can you explain how the mammalian gas exchange surface is adapted, including alveoli, squamous epithelium, surfactant and blood supply?



Can you describe the structure of the respiratory tree and the roles of the intercostal muscles, ribcage and diaphragm?



Can you describe the mechanism of inspiration and expiration?



Can you describe the effects of smoking, including damage to cilia, bronchitis, emphysema and lung cancer?



Can you use a simple respirometer to measure oxygen consumption (with KOH) and net carbon dioxide production (without KOH)?



2.1b

Transport in plants

2.1b Transport in plants

Can you describe the structure of the epidermis, endodermis, xylem (protoxylem and metaxylem with lignification patterns) and phloem (sieve-tube elements and companion cells)?



Can you explain the uptake of water by osmosis and ions by active transport at root hairs?



Can you describe the apoplast and symplast pathways through roots and leaves?



Can you explain the role of the endodermis and Casparian strip in forcing water into the symplast pathway?



Can you explain transpiration through stomata and the cuticle?



Can you explain how internal factors (leaf area, stomatal density, cuticle thickness) affect transpiration?



Can you explain how external factors (light, air currents, temperature, humidity, soil water) affect transpiration?



Can you explain the cohesion-tension theory of water movement in xylem, including transpiration pull, cohesion and adhesion?



Can you explain the root pressure hypothesis?



Can you describe the evidence that phloem translocation requires energy and is two-way?



Can you describe the xerophytic adaptations of plants, such as leaf rolling, thick cuticle, hairs, sunken stomata, succulence, deep roots and spines?



Can you describe the hydrophytic adaptations of plants, such as stomata on the upper surface and aerenchyma?



2.1c

Circulation and blood

Circulatory system

Can you describe the double circulation of mammals and identify the major thoracic and abdominal blood vessels?



Can you relate the structure of arteries, veins and capillaries to their functions, including elastic and muscle tissue and vein valves?



Can you explain vasoconstriction and vasodilation?



Can you describe atheroma and atherosclerosis?



Can you describe the structure of the heart, including chambers, septum, atrioventricular and semilunar valves, chordae tendinae and papillary muscles?



Can you describe the cardiac cycle and explain blood flow in terms of pressure gradients and valve action?



Can you explain myogenic excitation of the heart via the SA node, AV node, bundle of His and Purkinje fibres?



Can you interpret pressure and volume changes during the cardiac cycle?



Can you explain how heart sounds, ECGs and angiography are used in diagnosis?



Can you examine sections of arteries, veins and capillaries and dissect a mammalian heart?



Blood and body fluids

Can you explain how red blood cells are adapted for oxygen transport?	☐	☐	☐
Can you describe the roles of polymorphs, monocytes and lymphocytes (B-cells and T-cells)?	☐	☐	☐
Can you describe the functions of plasma and the formation and role of tissue fluid?	☐	☐	☐
Can you identify red cells, polymorphs, monocytes, lymphocytes and platelets in stained blood films?	☐	☐	☐
Can you describe blood clotting, including platelets, thromboplastin, prothrombin, clotting factors, calcium, vitamin K, fibrinogen and fibrin?	☐	☐	☐

Haemoglobin and oxygen transport

Can you describe haemoglobin as a conjugated protein with four haem groups containing Fe^{2+} that each carry one O_2 ?	☐	☐	☐
Can you interpret the oxygen dissociation curve and explain cooperative binding of oxygen?	☐	☐	☐
Can you explain the Bohr effect and its benefit to respiring tissues?	☐	☐	☐
Can you compare myoglobin with haemoglobin and explain its role as an oxygen store?	☐	☐	☐
Can you explain the effects of altitude on oxygen loading and the adaptations of high-altitude dwellers and altitude-trained athletes?	☐	☐	☐

2.2 Adaptation of Organisms

2.2 Adaptation of Organisms

Can you explain adaptation as behavioural, physiological and morphological responses to environmental challenges?	☐	☐	☐
Can you explain how climatic factors (temperature, water, light intensity and quality, day length) affect distribution?	☐	☐	☐
Can you explain how edaphic factors (pH, macronutrients and micronutrients, soil aeration) affect distribution?	☐	☐	☐
Can you explain how biotic factors (competitors, predators, waste accumulation) affect distribution?	☐	☐	☐
Can you define the term ecological niche?	☐	☐	☐
Can you use random sampling, line and belt transects and quadrats (including pin frames) to sample plants?	☐	☐	☐
Can you use pitfall traps, sweep nets and pooters to sample animals?	☐	☐	☐

Can you estimate abundance as density, frequency and percentage cover?



Can you measure biotic and abiotic factors in the field?



2.3

Biodiversity

Biodiversity and its measurement

Can you explain that all organisms share the same basic biochemicals?



Can you describe biodiversity at genetic, species and ecosystem levels?



Can you calculate and interpret Simpson's diversity index?



Can you explain why plant cover or frequency is used for plants and counts for animals?



Can you explain how genetic diversity can be measured?



Classification

Can you explain nomenclature using the binomial system and systematics?



Can you define a species?



Can you list the taxonomic hierarchy of genus, family, order, class, phylum and kingdom?



Can you explain how phylogenetic classification uses morphology, cell structure and biochemistry (DNA, RNA and protein comparisons)?



Can you name the five kingdoms and show awareness of the three-domain system?



Can you describe the features of Prokaryotae, using a rod-shaped bacterium as an example?



Can you describe the features of Protocista, using Paramecium and Pleurococcus as examples?



Can you describe the features of Fungi, including hyphae, chitin cell walls and extracellular digestion?



Can you describe the features of Plantae and Animalia?



2.4 Human Impact on Biodiversity

Can you evaluate agricultural practices that promote biodiversity, such as polyculture, crop rotation, hedgerow conservation, predator strips and integrated pest management?



Can you explain how intensive farming increases food production at a cost to biodiversity?



Can you describe organic pollution of waterways by slurry and silage effluent?



Can you explain eutrophication caused by fertiliser run-off?



Can you explain the effects of these pollutants on BOD and on aquatic flora and fauna?



Can you describe strategies to reduce aquatic pollution?



Can you describe conservation initiatives, including ASSIs, Special Areas of Conservation, Biodiversity Action Plans, agri-environment schemes and Northern Ireland priority habitats and species?



Can you explain the effects of global warming and climate change on flora, fauna and biodiversity, including local extinctions and range shifts?



3a Assessed practical tasks

Can you use qualitative reagents to identify biological molecules?	☐	☐	☐
Can you carry out chromatography of amino acids?	☐	☐	☐
Can you carry out enzyme experiments on temperature, pH, substrate or enzyme concentration, or illustrate enzyme immobilisation?	☐	☐	☐
Can you use a colorimeter to follow a starch-amylase reaction or membrane permeability in beetroot, including making serial dilutions?	☐	☐	☐
Can you use a graticule and stage micrometer to measure cell size at low and high power?	☐	☐	☐
Can you measure the average water potential of cells in plant tissue?	☐	☐	☐
Can you measure the average solute potential of cells at incipient plasmolysis?	☐	☐	☐
Can you prepare and stain root tip squashes to observe mitosis?	☐	☐	☐
Can you complete accurate block diagrams of sections of the ileum or a leaf?	☐	☐	☐
Can you dissect a mammalian heart?	☐	☐	☐
Can you use field sampling techniques, including measuring abiotic or biotic factors?	☐	☐	☐

3b Practical skills examination

Can you plan an investigation, identifying independent, dependent and controlled variables?	☐	☐	☐
Can you record results in suitable tables with units and appropriate precision?	☐	☐	☐
Can you present data in suitable graphs and calculate means, rates and percentage changes?	☐	☐	☐
Can you analyse results, identify limitations and sources of error, and suggest improvements?	☐	☐	☐
Can you apply practical skills to the italicised practical activities in Units AS 1 and AS 2?	☐	☐	☐

4.1 Homeostasis**A-LEVEL ONLY****Principles and the kidney**

Can you define homeostasis and explain the need for a receptor, a corrective mechanism and negative feedback?	☐ ☐ ☐
Can you explain the roles of the kidney in excreting urea and creatinine and in regulating body fluid water potential?	☐ ☐ ☐
Can you identify the cortex, medulla, pyramids, pelvis, ureters, bladder and urethra?	☐ ☐ ☐
Can you describe the structure of a nephron, including Bowman's capsule, proximal tubule, loop of Henle, distal tubule and collecting duct?	☐ ☐ ☐
Can you describe the filter formed by capillary endothelium, basement membrane and podocytes?	☐ ☐ ☐
Can you explain ultrafiltration in terms of hydrostatic pressure, osmotic gradient and back pressure, and state which components are filtered?	☐ ☐ ☐
Can you explain selective reabsorption in the proximal tubule by active transport and osmosis?	☐ ☐ ☐
Can you explain facultative water reabsorption in the distal tubule and collecting duct?	☐ ☐ ☐
Can you explain how the loop of Henle creates a salt gradient in the medulla that allows water recovery?	☐ ☐ ☐

Osmoregulation

Can you explain osmoregulation by hypothalamic osmoreceptors and ADH released from the posterior pituitary?	☐ ☐ ☐
Can you explain how ADH increases the permeability of the collecting duct to water?	☐ ☐ ☐
Can you explain negative feedback in ADH control, for example after exercise?	☐ ☐ ☐

4.2 Immunity**A-LEVEL ONLY****Defence and immune responses**

Can you describe natural barriers to infection, including skin, stomach acid, tears with lysozyme, mucus and blood clotting?	☐ ☐ ☐
Can you define antigen and antibody?	☐ ☐ ☐
Can you describe antibody-mediated immunity, including clonal selection of B-cells into plasma cells and memory cells?	☐ ☐ ☐
Can you describe cell-mediated immunity, including killer, helper, memory and suppressor T-cells?	☐ ☐ ☐

Can you explain the primary and secondary immune responses?



Can you describe how antigen-antibody reactions lead to agglutination and phagocytosis by polymorphs?



Can you distinguish active and passive immunity, natural and artificial, including vaccination and monoclonal antibodies?



Transplants and blood groups

Can you explain transplant rejection and the use of immunosuppression by irradiation or drugs?



Can you describe the ABO and rhesus blood group systems?



Can you explain the risk to a rhesus-positive baby of a rhesus-negative mother?



Can you work out transfusion compatibility from donor antigens and recipient antibodies?



Can you explain the consequences of transfusion incompatibility?



Antibiotics and biomarkers

Can you explain factors in the spread of antibiotic resistance and disease, including animal reservoirs such as bats?



Can you explain the importance of searching for new antibacterials from natural sources?



Can you describe the use of antibodies in ELISA to detect disease biomarkers?



Can you explain the use of cytokines as markers of inflammation?



Can you use aseptic techniques to investigate the effect of antibiotics on bacteria and prepare streak plates?



Can you investigate the antimicrobial properties of plants?



4.3 Co-ordination and Control

A-LEVEL ONLY

Plants

Can you explain the roles of phytochrome (P660 and P730) and critical night length in flowering of short-day and long-day plants?



Can you explain how photoperiod is manipulated for out-of-season flowering?



Can you describe the roles of auxins, cytokinins and gibberellins in plant growth?



Nerves and synapses

- | | |
|---|---|
| Can you describe the structure of a myelinated motor neurone? | ☐ ☐ ☐ |
| Can you explain the resting potential, threshold and the all-or-nothing law? | ☐ ☐ ☐ |
| Can you explain depolarisation, repolarisation, the refractory period and propagation of an action potential? | ☐ ☐ ☐ |
| Can you explain how axon diameter, myelination and saltatory conduction affect impulse speed? | ☐ ☐ ☐ |
| Can you describe synapse structure and synaptic transmission by acetylcholine, noradrenaline and GABA? | ☐ ☐ ☐ |
| Can you explain EPSPs, IPSPs and the role of acetylcholinesterase? | ☐ ☐ ☐ |

The eye

- | | |
|--|---|
| Can you describe the structures and functions of the mammalian eye? | ☐ ☐ ☐ |
| Can you explain accommodation and control of pupil size? | ☐ ☐ ☐ |
| Can you explain rod and cone distribution, convergence, sensitivity, acuity and dark adaptation? | ☐ ☐ ☐ |
| Can you explain colour vision and binocular vision? | ☐ ☐ ☐ |
| Can you identify eye structures on prepared slides or photomicrographs? | ☐ ☐ ☐ |

Muscle

- | | |
|---|---|
| Can you describe skeletal muscle structure at the level of muscle, fibre and myofibril? | ☐ ☐ ☐ |
| Can you describe the sarcomere, including actin, myosin, A and I bands and Z lines? | ☐ ☐ ☐ |
| Can you explain the sliding filament theory, including the roles of calcium ions and ATP? | ☐ ☐ ☐ |
| Can you examine and compare skeletal, cardiac and smooth muscle? | ☐ ☐ ☐ |

4.4

Ecosystems

A-LEVEL ONLY

Populations

- | | |
|---|---|
| Can you describe the lag, exponential, stationary and decline phases of population growth and the factors affecting them? | ☐ ☐ ☐ |
| Can you explain carrying capacity and environmental resistance? | ☐ ☐ ☐ |
| Can you compare r-selected and K-selected species and their growth curves? | ☐ ☐ ☐ |

Can you explain competition, mutualism, predation, parasitism and grazing and their effects on population growth?



Can you explain biological pest control and its advantages over chemical control?



Can you explain population changes in terms of birth, death, immigration and emigration?



Can you count yeast populations using a haemocytometer?



Can you estimate population size by capture-mark-recapture?



Communities and energetics

Can you define community and ecosystem and explain their interactions?



Can you explain primary and secondary succession, pioneer species and climax communities?



Can you describe grazing and detritus food chains and webs and the roles of producers, consumers, detritivores and decomposers?



Can you explain trophic levels and calculate net primary production as GPP minus respiration?



Can you interpret pyramids of numbers, biomass and energy?



Can you calculate energy transfer efficiency and explain energy losses?



Can you explain the agricultural implications of energy flow, including intensive livestock methods?



Nutrient cycling

Can you describe the carbon cycle?



Can you describe the nitrogen cycle, including ammonification, nitrification, nitrogen fixation and denitrification?



5.1 Respiration

A-LEVEL ONLY

5.1 Respiration

Can you describe the structure of ATP and its role in synthesis, mechanical work and active transport?	☐	☐	☐
Can you describe glycolysis, including phosphorylation, triose phosphate and net yield of 2 ATP?	☐	☐	☐
Can you outline the stages of aerobic respiration and their locations?	☐	☐	☐
Can you explain anaerobic respiration producing ethanol and CO ₂ in plants and fungi and lactate in animals?	☐	☐	☐
Can you describe the link reaction and Krebs cycle and their yields of NADH, FADH and ATP?	☐	☐	☐
Can you explain the role of the Krebs cycle in linking carbohydrate, fat and protein metabolism?	☐	☐	☐
Can you describe the electron transport chain and oxidative phosphorylation with oxygen as final acceptor?	☐	☐	☐
Can you compare aerobic and anaerobic respiration and explain oxygen debt?	☐	☐	☐
Can you calculate RQ and use it to identify respiratory substrates?	☐	☐	☐
Can you use a respirometer to measure O ₂ uptake, CO ₂ production and RQ?	☐	☐	☐
Can you use redox indicators such as methylene blue to investigate respiration?	☐	☐	☐

5.2 Photosynthesis

A-LEVEL ONLY

5.2 Photosynthesis

Can you state the sites of the light-dependent and light-independent stages in the chloroplast?	☐	☐	☐
Can you describe the light-dependent stage, including PSI, PSII, the Z-scheme, photophosphorylation and photolysis?	☐	☐	☐
Can you describe the Calvin cycle, including rubisco, RuBP, GP and triose phosphate regeneration?	☐	☐	☐
Can you interpret absorption spectra and action spectra and explain the role of accessory pigments?	☐	☐	☐
Can you distinguish gross and net photosynthesis and explain the compensation point?	☐	☐	☐
Can you explain the effects of light intensity, CO ₂ concentration and temperature as limiting factors?	☐	☐	☐

Can you separate photosynthetic pigments by paper chromatography and calculate Rf values?



Can you use DCPIP as a redox indicator to investigate the light-dependent stage?



5.3 DNA as the Genetic Code

A-LEVEL ONLY

5.3 DNA as the Genetic Code

Can you describe the genetic code as a non-overlapping, degenerate triplet code?



Can you explain the terms exon and intron?



Can you describe transcription and the role of RNA polymerase?



Can you describe translation and the roles of mRNA, tRNA and ribosomes?



Can you explain the one gene-one polypeptide hypothesis and how enzymes influence phenotype?



Can you explain epigenetics, including DNA methylation and histone modification?



5.4 Gene Technology

A-LEVEL ONLY

Techniques

Can you describe the stages of PCR and its uses?



Can you explain the use of DNA probes, including fluorescent probes?



Can you explain the use of microsatellites and SNPs as genetic markers?



Can you describe how microarrays are used to profile gene expression and sequence variation?



Can you describe genetic fingerprinting using restriction enzymes, gel electrophoresis and probes?



Can you carry out gel electrophoresis of DNA or DNA extraction?



Genetic modification

Can you describe the stages of gene transfer, including vectors, transformation and marker genes?



Can you describe the uses of genetically modified microorganisms, including GM viruses to treat disease?



Can you describe the uses of transgenic animals and plants?



Can you explain gene therapy, including somatic and germ-line approaches and the role of vectors?



Genomics and ethics

Can you explain genome sequencing and the Human Genome Project?



Can you explain the use of knockout and knockin mice?



Can you explain pharmacogenetics and personalised medicine, using codeine as an example?



Can you discuss the social, ethical, legal and ecological issues of gene technology?



Can you describe safety precautions used with GMOs?



5.5 Genes and Patterns of Inheritance

A-LEVEL ONLY

5.5 Genes and Patterns of Inheritance

Can you define genotype, phenotype, homozygous and heterozygous?



Can you define gene, allele and locus?



Can you explain monohybrid inheritance and Mendel's first law?



Can you explain dominance, codominance, lethal alleles and multiple alleles?



Can you use a test cross to find an unknown genotype?



Can you explain dihybrid inheritance and Mendel's second law and link Mendel's laws to meiosis?



Can you solve genetics problems using genetic diagrams and Punnett squares?



Can you explain sex determination and sex-linked inheritance?



Can you explain gene interaction, including epistasis?



Can you explain polygenic inheritance and the role of the environment in continuous variation?



5.6 Population Genetics

A-LEVEL ONLY

5.6 Population Genetics

Can you define a gene pool?



Can you use the Hardy-Weinberg equation to calculate allele and genotype frequencies?



Can you state the conditions for Hardy-Weinberg equilibrium?



Can you explain how mutation, non-random mating, migration and selection affect allele frequencies?



Can you explain the sources of variation, including mutation and sexual reproduction?



Can you explain fitness and natural selection, including stabilising and directional selection?



Can you explain evolutionary change as a change in allele frequency?



Can you explain allopatric speciation and reproductive isolating mechanisms?



5.7 Kingdom Plantae

A-LEVEL ONLY

5.7 Kingdom Plantae

Can you describe the features of mosses, including lack of true roots, stems and leaves, rhizoids and support by turgor?



Can you explain why mosses are restricted to moist habitats, including the lack of cuticle, stomata and vascular tissue and the dependence of spores on moisture?



Can you explain how ferns are better adapted to land than mosses, including vascular tissue, true roots, stems and leaves, a waterproof cuticle and stomatal control?



Can you explain how flowering plants are further adapted to land, including wood, xerophytic adaptations and desiccation-resistant seeds?



Can you study living and preserved plant specimens, prepared slides and photographs?



5.8 Kingdom Animalia

A-LEVEL ONLY

5.8 Kingdom Animalia

Can you describe the features of Cnidaria, including radial symmetry and support by water and a hydrostatic skeleton from the enteron?



Can you describe the features of Platyhelminthes, including bilateral symmetry, dorsoventral flattening and a gut with one opening?



Can you describe the features of Annelida, including metameric segmentation, a gut with mouth and anus and a hydrostatic skeleton?



Can you describe the features of Arthropoda, including a fixed number of segments per region and jointed limbs?



Can you explain why arthropods, especially insects, are the most successful animal group?



Can you describe the features of Chordata, including support by a spinal column and jointed calcified bones?



Can you study living and preserved animal specimens, prepared slides and photographs?



6a

Assessed practical tasks

A-LEVEL ONLY

6a Assessed practical tasks

Can you investigate microorganisms using aseptic techniques, such as the effect of antibiotics or e-strips on bacteria or the preparation of streak plates?	☐	☐	☐
Can you investigate the antimicrobial properties of plants?	☐	☐	☐
Can you use a respirometer to measure oxygen uptake, carbon dioxide production and RQ?	☐	☐	☐
Can you use a redox indicator such as methylene blue to investigate respiration in yeast?	☐	☐	☐
Can you separate photosynthetic pigments by paper chromatography and calculate R _f values?	☐	☐	☐
Can you use DCPIP to investigate the light-dependent stage of photosynthesis?	☐	☐	☐
Can you count yeast cells using a haemocytometer to follow population growth?	☐	☐	☐
Can you estimate population size by capture-mark-recapture?	☐	☐	☐
Can you carry out DNA extraction or gel electrophoresis of DNA?	☐	☐	☐

6b

Practical skills examination

A-LEVEL ONLY

6b Practical skills examination

Can you plan an investigation, including a hypothesis, variables, controls and replicates?	☐	☐	☐
Can you record and present data in suitable tables and graphs?	☐	☐	☐
Can you analyse data, including calculating means, rates and standard deviation, and select a suitable statistical test?	☐	☐	☐
Can you evaluate the reliability and validity of results and suggest improvements?	☐	☐	☐
Can you write a short bibliography with correctly referenced sources?	☐	☐	☐
Can you apply practical skills to the italicised practical activities in Units A2 1 and A2 2?	☐	☐	☐

Practical activities

AS3.1 Can you use qualitative reagents to identify biological molecules?	☐	☐	☐
AS3.2 Can you carry out paper chromatography of amino acids and calculate R _f values?	☐	☐	☐
AS3.3 Can you carry out enzyme experiments, such as the effect of temperature, pH, substrate or enzyme concentration, or illustrate enzyme immobilisation?	☐	☐	☐
AS3.4 Can you use a colorimeter to follow a starch-amylase reaction or membrane permeability in beetroot, including making serial dilutions?	☐	☐	☐
AS3.5 Can you use a graticule and stage micrometer to measure cell size at low and high power?	☐	☐	☐
AS3.6 Can you measure the average water potential of cells in plant tissue?	☐	☐	☐
AS3.7 Can you measure the average solute potential of cells at incipient plasmolysis?	☐	☐	☐
AS3.8 Can you prepare and stain root tip squashes to observe mitosis?	☐	☐	☐
AS3.9 Can you complete accurate block diagrams of sections of the ileum or a leaf?	☐	☐	☐
AS3.10 Can you dissect a mammalian heart and identify its structures?	☐	☐	☐
AS3.11 Can you use field sampling techniques, including measuring abiotic or biotic factors?	☐	☐	☐
A23.1 Can you investigate microorganisms using aseptic techniques, such as the effect of antibiotics on bacteria or preparing streak plates?	☐	☐	☐
A23.2 Can you investigate the antimicrobial properties of plants?	☐	☐	☐
A23.3 Can you count yeast cells with a haemocytometer or estimate population size by capture-mark-recapture?	☐	☐	☐
A23.4 Can you use a respirometer to determine oxygen uptake, carbon dioxide production and RQ?	☐	☐	☐
A23.5 Can you use a redox indicator such as methylene blue to investigate respiration?	☐	☐	☐
A23.6 Can you separate photosynthetic pigments by paper chromatography and calculate R _f values?	☐	☐	☐
A23.7 Can you use DCPIP as a redox indicator to investigate photosynthesis?	☐	☐	☐
A23.8 Can you carry out gel electrophoresis of DNA and/or DNA extraction?	☐	☐	☐