

Inorganic ions and water

Can you state the roles of the key inorganic ions Mg^{2+} , Fe^{2+} , Ca^{2+} and PO_4^{3-} in living organisms?



Can you explain how the polarity of water and hydrogen bonding give it its properties?



Can you explain the importance of water's surface tension, role as a solvent, thermal properties and role as a metabolite?

**Carbohydrates**

Can you describe the structure, properties and functions of monosaccharides (triose, pentose and hexose sugars)?



Can you describe the structure, properties and functions of the disaccharides sucrose, lactose and maltose?



Can you describe the structure, properties and functions of the polysaccharides starch, glycogen, cellulose and chitin?



Can you explain alpha and beta isomerism in glucose?



Can you explain how alpha and beta glucose polymerise to form storage and structural carbohydrates (starch, cellulose and chitin)?



Can you explain how the chemical and physical properties of starch and glycogen suit them for storage?



Can you explain how the chemical and physical properties of cellulose and chitin suit them for a structural role?



Can you show how condensation and hydrolysis reactions form and break glycosidic bonds?

**Lipids**

Can you describe the structure, properties and functions of triglycerides?



Can you describe the structure, properties and functions of phospholipids?



Can you show how condensation and hydrolysis reactions form and break ester bonds?



Can you discuss the implications of saturated and unsaturated fats for human health?

**Proteins**

Can you describe the general structure of an amino acid and its role in forming proteins?



Can you show how condensation and hydrolysis reactions form and break peptide bonds?



Can you describe the primary, secondary, tertiary and quaternary structure of proteins and the bonds involved?



Can you relate the fibrous and globular structures of proteins to their functions?



1.2 Cell structure and organisation

Cell structure and organisation

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



Can you describe the structure and function of the Golgi body, lysosomes, centrioles, chloroplasts and vacuoles?



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



Can you describe the structure of prokaryotic cells?



Can you describe the structure of viruses?



Can you outline the cell theory?



Can you compare eukaryotic (animal and plant), prokaryotic and viral cells, including identifying them in electron micrographs?



Can you explain the levels of organisation from cells to tissues, tissues to organs and organs to organ systems?



Can you identify epithelial, muscle and connective tissue on prepared slides?



1.3 Cell membranes and transport

Cell membranes and transport

Can you describe the main components of the plasma membrane and the fluid mosaic model?



Can you explain the factors that affect membrane permeability?



Can you explain diffusion and the factors that affect its rate?



Can you explain facilitated diffusion, including the role of channel and carrier proteins?



Can you explain osmosis in terms of water potential?



Can you explain active transport, including the effect of cyanide on it?



Can you describe pinocytosis, phagocytosis and exocytosis?



1.4 Enzymes

Enzymes

Can you explain that metabolism is a series of enzyme-controlled reactions?



Can you explain the protein nature of enzymes?



Can you distinguish between intracellular and extracellular enzymes?



Can you explain the importance of the three-dimensional structure of the active site?



Can you explain the induced fit theory of enzyme action, using lysozyme as an example?



Can you explain how enzymes act as catalysts by lowering activation energy?



Can you explain the effects of temperature and pH on the rate of enzyme-controlled reactions, including inactivation and denaturation?



Can you explain the effects of substrate and enzyme concentration on the rate of enzyme-controlled reactions?



Can you explain the role of buffers in enzyme reactions?



Can you explain competitive and non-competitive inhibition of enzymes?



Can you describe the industrial use of immobilised enzymes and explain their advantages, including reuse and increased stability?



1.5 Nucleic acids

Nucleotides and ATP

Can you describe the structure of a nucleotide (pentose sugar, phosphate and organic base)?



Can you explain the importance of chemical energy in biological processes?



Can you explain the role of ATP as the universal energy carrier and how it releases energy for cellular activities?



Can you describe the structure of ATP?



DNA, RNA and replication

Can you describe the structure of DNA, including purine and pyrimidine bases, complementary base pairing, hydrogen bonding, the double helix and antiparallel strands?



Can you compare the structure of RNA and DNA?



Can you state the two main functions of DNA (replication and protein synthesis)?



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



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

**Protein synthesis**

Can you describe the features of the genetic code?



Can you explain the triplet code for amino acids?



Can you distinguish between exons (coding regions) and introns (non-coding regions) of DNA?



Can you describe the transcription of DNA to messenger RNA?



Can you describe the translation of mRNA by ribosomes?



Can you describe the structure and function of transfer RNA?



Can you explain the 'one gene, one polypeptide' hypothesis?



Can you explain that some polypeptides are modified and combined after synthesis?

**1.6****Cell division****Mitosis and meiosis**

Can you describe interphase and the main stages of mitosis?



Can you explain the significance of mitosis in giving daughter cells identical copies of genes, and describe cytokinesis?



Can you explain the role of mitosis in cell renewal, repair and healing?



Can you explain how unrestricted cell division can lead to cancer?



Can you describe the main stages of meiosis and cytokinesis (without sub-stages of prophase 1)?



Can you compare mitosis (genetically identical daughter cells) with meiosis (genetically different daughter cells)?



2.1

Classification and biodiversity

Classification

Can you explain that organisms are grouped by evolutionary relationships into discrete, nested groups?



Can you explain why classification is necessary but provisional and subject to change?



Can you compare the three-domain system with the five-kingdom system of classification?



Can you describe the characteristic features of the kingdoms Prokaryotae, Protoctista, Plantae, Fungi and Animalia?



Can you explain how physical features and biochemical methods (DNA genetic fingerprinting and enzyme studies) are used to assess relatedness?



Can you explain why biochemical methods avoid the misleading results that convergent evolution can give with physical features?



Can you explain the concept of a species?



Can you use the binomial system to name organisms?



Biodiversity and adaptation

Can you define biodiversity as the number and variety of organisms in a specified geographic region?



Can you explain how biodiversity varies spatially and over time and the factors that affect it?



Can you calculate and interpret Simpson's Diversity Index for a habitat?



Can you explain how genetic biodiversity within a species is measured, including the proportion of polymorphic loci?



Can you explain how DNA fingerprinting and sequencing are used to assess molecular biodiversity?



Can you explain how biodiversity has been generated through natural selection?



Can you give examples of anatomical, physiological and behavioural adaptations?



2.2

Adaptations for gas exchange

Gas exchange in animals

Can you explain how gas exchange adaptations allow increases in body size and metabolic rate?



Can you explain gas exchange across the general body surface in small animals?



Can you compare gas exchange in Amoeba, flatworms and earthworms?



Can you explain why larger animals have specialised respiratory surfaces, such as gills in fish and lungs in mammals?



Can you explain why large, active animals with high metabolic rates need ventilation to maintain diffusion gradients?



Can you describe ventilation in bony fish and compare counter-current and parallel flow?



Can you describe the structure and function of the human breathing system, including T.S. lung and trachea slides?



Can you describe ventilation in humans and explain how gases are exchanged in the alveoli?



Can you explain how the insect tracheal system is adapted to terrestrial life?



Gas exchange in plants

Can you describe the structure of the angiosperm leaf?



Can you explain how the structures of the leaf allow it to photosynthesise effectively?



Can you explain how the leaf acts as a gas exchange organ, including the opening and closing of stomata?



2.3 Adaptations for transport

Transport in animals

Can you compare the vascular systems of the earthworm (closed circulation) and the insect (open circulation, dorsal heart)?



Can you compare single circulation in fish with double circulation in mammals?



Can you describe the structure and function of the mammalian heart and blood vessels, and name the main vessels connected to the heart?



Can you analyse graphs of pressure changes during the cardiac cycle?



Can you explain the roles of the sino-atrial node and Purkyne fibres in coordinating the heartbeat?



Can you analyse and interpret ECG traces?



Can you explain the roles of red blood cells and plasma in transporting respiratory gases?



Can you interpret oxygen dissociation curves for adult and foetal haemoglobin?



Can you explain the dissociation curves of animals adapted to low-oxygen habitats, such as the llama and lugworm?



Can you explain the Bohr effect and the chloride shift?



Can you describe how blood transports nutrients, hormones, excretory products and heat?



Can you explain how tissue fluid is formed and its role as a link between blood and cells?



Transport in plants

Can you describe the structure of the dicotyledon root, including T.S. dicot root slides?



Can you explain how water is absorbed by the root?



Can you describe the movement of water through the root by the apoplast, symplast and vacuolar pathways?



Can you describe the structure and role of the endodermis?



Can you describe the structure of xylem as seen with light and electron microscopes, including T.S. dicot stem slides?



Can you explain the movement of water from root to leaf by the transpiration stream and cohesion-tension theory?



Can you explain how environmental factors affect the rate of transpiration?



Can you describe the adaptations of hydrophytes and xerophytes, including marram grass and water lily?



Can you describe the structure of phloem as seen with light and electron microscopes?



Can you explain translocation from source to sink, comparing diffusion, cytoplasmic streaming and mass flow models?



Can you evaluate evidence that sucrose is transported in the phloem, including aphid and autoradiograph studies?



2.4

Adaptations for nutrition

Types of nutrition

Can you distinguish between autotrophic (photoautotrophic and chemoautotrophic) and heterotrophic nutrition?



Can you describe saprotrophic, holozoic and parasitic nutrition as types of heterotrophy?



Can you describe saprotrophic nutrition in fungi (secretion of enzymes, external digestion and absorption)?



Can you explain holozoic nutrition as the internal digestion of food?



Can you describe intracellular digestion in unicellular organisms such as Amoeba?



Digestive systems

Can you describe the increasing complexity of guts, from the sac-like gut of Hydra to a tube gut with specialised regions?



Can you explain how the human gut is adapted to an omnivorous diet, including duodenum and ileum slides?



Can you explain why efficient digestion requires different enzymes and conditions for different foods?



Can you explain how the gut and dentition of ruminant herbivores are adapted to a high-cellulose diet?



Can you explain how the gut and dentition of carnivores are adapted to a high-protein diet?



Can you describe the adaptations of parasites such as Taenia (tapeworm) and Pediculus (louse)?



3.1 Importance of ATP**A-LEVEL ONLY****Chemiosmosis**

Can you explain how ATP is synthesised as protons flow through ATP synthase down an electrochemical gradient (chemiosmosis)?



Can you compare how mitochondrial and chloroplast membranes generate proton gradients?



Can you explain how proton pumps, driven by energy from excited electrons, maintain the proton gradient?



Can you describe the electron transport chain as alternating proton pumps and electron carriers?

**3.2 Photosynthesis****A-LEVEL ONLY****Light-dependent stage**

Can you explain how the distribution of chloroplasts helps to trap light?



Can you explain how chloroplasts convert light energy into chemical energy in ATP?



Can you explain how chlorophyll and accessory pigments absorb different wavelengths and pass energy to reaction centres?



Can you describe the basic features of Photosystems I and II?



Can you compare cyclic and non-cyclic photophosphorylation?



Can you explain how photolysis of water supplies electrons to Photosystem II?



Can you explain how the reduction of NADP in the stroma helps maintain the proton gradient?

**Light-independent stage and limiting factors**

Can you explain how RuBisCO fixes CO_2 with ribulose bisphosphate to form glycerate-3-phosphate?



Can you explain how ATP and reduced NADP are used to reduce glycerate-3-phosphate to triose phosphate and regenerate RuBP?



Can you outline how triose phosphate is converted into carbohydrates, lipids and amino acids?



Can you explain how limiting factors affect the rate of photosynthesis?



Can you explain the roles of nitrogen and magnesium in plant metabolism?



3.3 Respiration**A-LEVEL ONLY****Respiration**

- | | |
|---|---|
| Can you explain that all living organisms respire to release energy in cells? | ☐ ☐ ☐ |
| Can you describe glycolysis, producing triose phosphate, pyruvate, ATP and reduced NAD? | ☐ ☐ ☐ |
| Can you describe the link reaction forming acetyl coenzyme A? | ☐ ☐ ☐ |
| Can you describe how the Krebs cycle produces ATP, reduced NAD and reduced FAD and releases CO ₂ ? | ☐ ☐ ☐ |
| Can you explain how reduced NAD and FAD supply electrons and protons to the electron transport system? | ☐ ☐ ☐ |
| Can you compare the energy budget of glucose breakdown in aerobic and anaerobic conditions? | ☐ ☐ ☐ |
| Can you explain how lipids and amino acids can be used as respiratory substrates? | ☐ ☐ ☐ |

3.4 Microbiology**A-LEVEL ONLY****Microbiology**

- | | |
|---|---|
| Can you classify bacteria by shape and Gram stain reaction and relate the reaction to cell wall structure? | ☐ ☐ ☐ |
| Can you describe how to prepare and examine Gram-stained bacteria? | ☐ ☐ ☐ |
| Can you describe how microorganisms are cultured in the laboratory? | ☐ ☐ ☐ |
| Can you describe the conditions needed for bacterial growth? | ☐ ☐ ☐ |
| Can you explain the principles of aseptic technique? | ☐ ☐ ☐ |
| Can you monitor microbial population growth using viable counts, serial dilutions, plating and colony counting? | ☐ ☐ ☐ |

3.5 Population size and ecosystems**A-LEVEL ONLY****Populations**

- | | |
|--|---|
| Can you carry out a simple quantitative treatment of population growth using birth, death, immigration and emigration rates? | ☐ ☐ ☐ |
| Can you interpret population growth curves and explain the effects of competition and carrying capacity? | ☐ ☐ ☐ |

Can you distinguish between density-dependent and density-independent factors regulating populations?



Can you describe sampling techniques used to assess the abundance and distribution of organisms?



Ecosystems and energy

Can you explain that ecosystems vary greatly in size?



Can you explain that the sun is the source of energy for ecosystems?



Can you define habitat and community?



Can you explain biomass transfer between trophic levels and calculate the efficiency of transfer?



Can you distinguish between gross and net production?



Can you construct and interpret pyramids of biomass?



Succession

Can you describe succession from bare rock to woodland?



Can you distinguish between primary and secondary succession and explain pioneer species, sere and climax community?



Nutrient cycles

Can you explain how decomposition of organic matter recycles nutrients?



Can you describe the carbon cycle?



Can you explain human effects on the carbon cycle, including climate change altering species distribution and causing possible extinction?



Can you describe the role of bacteria in the nitrogen cycle?



Can you explain the role of nitrates in the synthesis of proteins and nucleic acids?



Can you explain how ploughing and drainage create aerobic conditions that favour nitrification?



Can you explain the economic importance of the nitrogen cycle for food production and fertiliser use?



Can you explain eutrophication and algal blooms?



Can you explain how drainage can harm habitats?



3.6 Human impact on the environment

A-LEVEL ONLY

Human impact

- | | |
|--|---|
| Can you explain why species become endangered and the causes of extinction? | ☐ ☐ ☐ |
| Can you describe how gene pools are conserved in the wild and in captivity? | ☐ ☐ ☐ |
| Can you discuss conflicts between agricultural production and conservation, and possible resolutions, using deforestation and overfishing? | ☐ ☐ ☐ |
| Can you explain the need for sustainability given increasing human pressures, through changing attitudes and informed choices? | ☐ ☐ ☐ |
| Can you explain why political decisions should be based on sound scientific principles? | ☐ ☐ ☐ |
| Can you explain the concept of planetary boundaries? | ☐ ☐ ☐ |

3.7 Homeostasis and the kidney

A-LEVEL ONLY

Homeostasis and the kidney

- | | |
|---|---|
| Can you explain homeostasis as maintaining a dynamic equilibrium? | ☐ ☐ ☐ |
| Can you compare negative feedback and positive feedback? | ☐ ☐ ☐ |
| Can you describe the structure of the mammalian kidney and nephron, including slides and electron micrographs? | ☐ ☐ ☐ |
| Can you explain the functions of the kidney in nitrogenous excretion and water regulation (ultrafiltration and selective reabsorption)? | ☐ ☐ ☐ |
| Can you explain how proximal convoluted tubule cells are adapted for reabsorption? | ☐ ☐ ☐ |
| Can you explain how the posterior pituitary secretes ADH as part of endocrine control? | ☐ ☐ ☐ |
| Can you explain the role of ADH in osmoregulation? | ☐ ☐ ☐ |
| Can you describe the effects of kidney failure and its treatments, such as dialysis and transplant? | ☐ ☐ ☐ |
| Can you explain how excretory products differ between environments and how the loop of Henle is adapted accordingly? | ☐ ☐ ☐ |

3.8 The nervous system

A-LEVEL ONLY

Nervous organisation

- | | |
|---|---|
| Can you describe the components of a nervous response, from receptors to effectors? | ☐ ☐ ☐ |
|---|---|

Can you identify the main areas of the spinal cord on a T.S. slide?



Can you describe the pattern of spinal nerves, including dorsal and ventral roots?



Can you explain how the simple reflex arc produces rapid, protective, involuntary actions?



Can you compare the nerve net of Cnidaria with more complex nervous systems?



Can you draw and label the structure of a motor neurone?



Nerve impulses and synapses

Can you explain the nature of the nerve impulse, including resting and action potentials?



Can you explain how the nerve impulse is transmitted along an axon?



Can you analyse oscilloscope traces of action potentials?



Can you explain the factors that affect the speed of conduction, including in other organisms?



Can you describe the structure and role of the synapse?



Can you describe the process of synaptic transmission?



Can you explain the effects of chemicals such as organophosphates and psychoactive drugs on synaptic transmission?



4.1 Sexual reproduction in humans**A-LEVEL ONLY****Sexual reproduction in humans**

Can you describe the structure and function of the male and female reproductive systems, including the histology of the ovary and testis?



Can you describe spermatogenesis and oogenesis?



Can you describe sexual intercourse, fertilisation and implantation?



Can you explain the roles of FSH, LH, oestrogen and progesterone in controlling the menstrual cycle?



Can you explain the roles of hCG, oxytocin and prolactin in pregnancy, birth and lactation?



Can you describe the role of the placenta, including its hormonal control?

**4.2 Sexual reproduction in plants****A-LEVEL ONLY****Sexual reproduction in plants**

Can you describe generalised flower structure and compare wind-pollinated and insect-pollinated flowers?



Can you describe the development of pollen and ovules, including prepared slides of anther and ovary?



Can you compare cross-pollination and self-pollination?



Can you describe double fertilisation?



Can you describe the formation and structure of seeds and fruits, using broad bean and maize?



Can you describe the germination of *Vicia faba* (broad bean)?



Can you explain the effect of gibberellin on germination?

**4.3 Inheritance****A-LEVEL ONLY****Inheritance**

Can you explain that alleles are different forms of the same gene?



Can you construct genetic diagrams for monohybrid inheritance, including codominance?



Can you construct genetic diagrams for dihybrid inheritance, including linkage?



Can you use the chi-squared test to analyse the results of genetic crosses?	☐	☐	☐
Can you explain sex linkage, using haemophilia and Duchenne muscular dystrophy?	☐	☐	☐
Can you explain gene mutation using sickle cell anaemia as an example?	☐	☐	☐
Can you explain chromosome mutation using Down's syndrome as an example?	☐	☐	☐
Can you explain the terms mutagen, carcinogen and oncogene?	☐	☐	☐
Can you explain epigenetics as the control of gene expression without changes to the DNA base sequence?	☐	☐	☐

4.4**Variation and evolution****A-LEVEL ONLY****Variation and selection**

Can you explain how genetic and environmental factors cause variation between individuals?	☐	☐	☐
Can you distinguish between continuous and discontinuous variation, and heritable and non-heritable variation?	☐	☐	☐
Can you explain the effects of inter- and intra-specific competition on breeding success and survival?	☐	☐	☐
Can you explain how selective agents (food supply, breeding sites, climate, human impact) affect survival?	☐	☐	☐
Can you explain the concepts of gene pool and genetic drift?	☐	☐	☐
Can you explain how selection changes allele frequencies in a population?	☐	☐	☐

Hardy-Weinberg and speciation

Can you use the Hardy-Weinberg equation to calculate allele and genotype frequencies?	☐	☐	☐
Can you state the conditions under which the Hardy-Weinberg principle applies?	☐	☐	☐
Can you explain the concepts of isolation and speciation?	☐	☐	☐
Can you describe geographical, behavioural, morphological, seasonal and hybrid sterility isolation mechanisms?	☐	☐	☐
Can you explain Darwin's theory that existing species arose from ancestral species by natural selection?	☐	☐	☐

Applications of genetics

Can you describe the Human Genome Project and its extension, the 100K Genome Project?



Can you discuss the ethics of embryo screening for cystic fibrosis, Huntington's disease and thalassaemia?



Can you explain the implications for malaria control of sequencing the genomes of *Anopheles gambiae* and *Plasmodium*?



Can you explain how PCR and electrophoresis are used in genetic fingerprinting, including forensic use?



Can you describe how recombinant DNA is produced using bacterial plasmids, using insulin as an example?



Can you discuss the issues of GM crops, such as disease-resistant GM tomatoes and GM soya?



Can you evaluate the advantages and disadvantages of gene therapy, using muscular dystrophy as an example?



Can you discuss genomics and its possible future impact on healthcare?



Can you discuss the issues of using stem cells to replace damaged tissues and organs?

**Disease**

Can you define pathogenic, infectious, carrier, reservoir, endemic, epidemic, pandemic and vector?



Can you define vaccine, antibiotic, antigen, antibody, resistance, toxin and antigenic types?



Can you explain the human body as a host for pathogens?



Can you describe the causative organism, source, tissue affected, transmission, prevention, control and treatment of cholera and tuberculosis?



Can you describe the causative organism, source, tissue affected, transmission, prevention, control and treatment of smallpox and influenza?



Can you describe the causative organism, source, tissue affected, transmission, prevention, control and treatment of malaria?



Can you relate the pathogenicity of viruses to their mode of reproduction?



Antibiotics

Can you distinguish between bacteriostatic and bactericidal antibiotics, and broad and narrow spectrum antibiotics?



Can you explain the modes of action of penicillin and tetracycline?



Can you explain how the Gram-negative cell wall protects bacteria from some antibiotics?



Can you explain how overuse of antibiotics has spread antibiotic resistance?

**Immune response**

Can you describe natural barriers to infection, including skin flora, inflammation, phagocytosis, clotting, tears, mucus and ciliated epithelium?



Can you explain how specific immune responses develop after exposure to foreign antigens?



Can you describe the humoral response, including antibody production and secretion?



Can you describe cell-mediated immunity, including destruction of pathogens, infected cells and cancer cells?



Can you explain the roles of T and B lymphocytes?



Can you distinguish between active and passive immunity, naturally and artificially acquired?



Can you explain active immunisation using the rubella vaccine as an example?



Can you explain passive treatment by antibody injection using rabies as an example?



Can you explain why immunisation programmes differ in effectiveness?



Can you discuss the ethics of designing vaccination programmes?

**B****Human Musculoskeletal Anatomy****OPTION****Skeletal tissues**

Can you compare hyaline, yellow elastic and white fibrous cartilage?



Can you describe the composition of compact bone, with an organic (collagen) and inorganic (hydroxyapatite) matrix?



Can you explain the functions of the organic and inorganic components of bone?



Can you explain the roles of osteoblasts and osteoclasts?



Can you describe the structure and function of Haversian systems?



Can you explain how calcium or vitamin D deficiency causes rickets and osteomalacia?



Can you describe the causes, symptoms and treatment of osteoporosis and brittle bone disease?



Skeletal muscle

Can you describe the ultrastructure of skeletal muscle?



Can you explain the sliding filament theory, including the roles of actin, myosin, tropomyosin and troponin?



Can you compare fast-twitch and slow-twitch muscle fibres?



Can you explain the roles of creatine phosphate and the build-up of lactic acid under anaerobic conditions?



Can you explain the use of glycogen and protein as energy sources during muscle contraction?



Skeleton and joints

Can you distinguish between the appendicular and axial skeleton?



Can you describe the types and causes of fractures?



Can you compare cervical, thoracic and lumbar vertebrae and relate them to their functions?



Can you describe the causes and treatment of posture-related conditions?



Can you describe the functions of the skeleton (support, muscle attachment, protection, blood cell production, calcium storage)?



Can you describe immovable, gliding, hinge and ball and socket joints?



Can you describe the causes and treatment of osteoarthritis and rheumatoid arthritis?



Can you explain how joints act as first, second and third order levers?



Can you describe the structure of a synovial joint, including cartilage, synovial membrane, synovial fluid and ligaments?



Can you explain antagonistic muscle action in the forelimb and the role of tendons?



Neurobiology and Behaviour

OPTION

The brain

Can you locate the cerebrum, hypothalamus, hippocampus, cerebellum and medulla oblongata?



Can you describe the main functions of the cerebrum, hypothalamus, cerebellum and medulla oblongata?



Can you explain the roles of the sympathetic and parasympathetic nervous systems?



Can you explain the role of the hypothalamus as the link between nervous and endocrine control?



Can you describe the roles of the sensory and motor areas of the cortex?



Can you relate the size of cortical areas to complexity of innervation, using sensory and motor homunculi?



Can you identify the cerebral areas involved in language comprehension and speech?



Neuroscience

Can you describe non-invasive techniques for studying the brain (fMRI, CT, PET and EEG)?



Can you explain brain development and critical periods for learning and language acquisition?



Can you explain neuroplasticity and how it allows adaptation and compensation for injury or disease?



Can you explain how gene expression affects brain development and behaviour?



Can you explain how altered gene expression in childhood may increase the risk of mental illness in adults?



Behaviour

Can you describe innate behaviour, including escape reflexes, kinesis and taxis in woodlice?



Can you describe learned behaviour, including habituation, imprinting, and classical and operant conditioning?



Can you describe complex primate societies, including humans, and behaviours such as imitation and insight?



Can you evaluate the advantages and disadvantages of living in social groups?



Can you describe the caste-based social structure of some insects and communication by innate behaviours?



Can you explain dominance hierarchies in vertebrates, including individual recognition and learning ability?



Can you explain how territorial and courtship behaviour increase reproductive success?



Can you explain the role of sexual selection in the evolution of territorial and courtship behaviour?



Practical skills

Can you plan and carry out an experiment safely, identifying independent, dependent and controlled variables?



Can you record raw data accurately in suitable tables with correct units and appropriate precision?



Can you process data, including means, rates and appropriate statistical tests such as chi-squared and Student's t-test?



Can you plot suitable graphs and draw valid conclusions from them?



Can you identify sources of error and uncertainty and suggest improvements to an investigation?



Can you analyse and evaluate data from an unfamiliar experiment in the Practical Analysis Task?



Specified practical work

1 Can you use iodine, Benedict's, biuret and emulsion tests to identify starch, reducing and non-reducing sugars, protein and fats?	☐	☐	☐
2 Can you calibrate a light microscope at low and high power and calculate actual size and drawing magnification?	☐	☐	☐
3 Can you prepare and draw a slide of living cells (e.g. onion, rhubarb or Amoeba), calculating actual size and magnification?	☐	☐	☐
4 Can you determine water potential by measuring changes in mass or length of plant tissue?	☐	☐	☐
5 Can you determine solute potential by measuring incipient plasmolysis?	☐	☐	☐
6 Can you investigate the permeability of beetroot cell membranes?	☐	☐	☐
7 Can you investigate the effect of temperature or pH on enzyme activity?	☐	☐	☐
8 Can you investigate the effect of enzyme or substrate concentration on enzyme activity?	☐	☐	☐
9 Can you carry out a simple extraction of DNA from living material?	☐	☐	☐
10 Can you make scientific drawings of root tip cells showing the stages of mitosis?	☐	☐	☐
11 Can you make scientific drawings of prepared developing anther slides showing the stages of meiosis?	☐	☐	☐
12 Can you investigate biodiversity in a habitat?	☐	☐	☐
13 Can you investigate stomatal numbers in leaves?	☐	☐	☐
14 Can you dissect a fish head to show the gas exchange system?	☐	☐	☐
15 Can you draw a low-power plan of a prepared T.S. dicotyledon leaf (e.g. Ligustrum), calculating actual size and magnification?	☐	☐	☐
16 Can you investigate transpiration using a simple potometer?	☐	☐	☐
17 Can you draw a low-power plan of a prepared T.S. artery and vein, calculating actual size and magnification?	☐	☐	☐
18 Can you dissect a mammalian heart?	☐	☐	☐
19 Can you investigate dehydrogenase activity using an artificial hydrogen acceptor (e.g. methylene blue, DCPIP or TTC)?	☐	☐	☐
20 Can you separate chloroplast pigments by chromatography and calculate R _f values?	☐	☐	☐
21 Can you investigate factors affecting the rate of photosynthesis?	☐	☐	☐
22 Can you investigate the roles of nitrogen and magnesium in plant growth?	☐	☐	☐

23 Can you investigate factors affecting the rate of respiration in yeast?	☐	☐	☐
24 Can you compare bacterial numbers in fresh and stale milk using serial dilution, plating and colony counting?	☐	☐	☐
25 Can you investigate the abundance and distribution of organisms in a habitat?	☐	☐	☐
26 Can you dissect a kidney?	☐	☐	☐
27 Can you investigate starch agar digestion by germinating seeds?	☐	☐	☐
28 Can you dissect wind-pollinated and insect-pollinated flowers?	☐	☐	☐
29 Can you draw a low-power plan of a prepared anther slide?	☐	☐	☐
30 Can you carry out a gene segregation experiment and analyse it with a chi-squared test?	☐	☐	☐
31 Can you investigate continuous variation in a species using Student's t-test?	☐	☐	☐