

Mapping grid showing how the Edexcel AS Level Biology specification (for first teaching in 2008) is covered by Boardworks AS Biology

Unit 1. Lifestyle, transport, genes and health

Topic 1: Lifestyle, health and risk	Boardworks AS Biology presentation title
2. Explain the importance of water as a solvent in transport, including its dipole nature.	<ul style="list-style-type: none"> Biological Molecules: Water and Carbohydrates
3. Distinguish between monosaccharides, disaccharides and polysaccharides (glycogen and starch – amylose and amylopectin) and relate their structures to their roles in providing and storing energy (β -glucose and cellulose are not required in this topic).	<ul style="list-style-type: none"> Biological Molecules: Water and Carbohydrates
4. Describe how monosaccharides join to form disaccharides (sucrose, lactose and maltose) and polysaccharides (glycogen and amylose) through condensation reactions forming glycosidic bonds, and how these can be split through hydrolysis reactions.	<ul style="list-style-type: none"> Biological Molecules: Water and Carbohydrates
5. Describe the synthesis of a triglyceride by the formation of ester bonds during condensation reactions between glycerol and three fatty acids and recognise differences between saturated and unsaturated lipids.	<ul style="list-style-type: none"> Biological Molecules: Proteins and Lipids
6. Explain why many animals have a heart and circulation (mass transport to overcome limitations of diffusion in meeting the requirements of organisms).	<ul style="list-style-type: none"> The Heart Circulation and Blood
7. Describe the cardiac cycle (atrial systole, ventricular systole and diastole) and relate the structure and operation of the mammalian heart to its function, including the major blood vessels.	<ul style="list-style-type: none"> The Heart
8. Explain how the structures of blood vessels (capillaries, arteries and veins) relate to their functions.	<ul style="list-style-type: none"> Circulation and Blood
9. Describe how the effect of caffeine on heart rate in <i>Daphnia</i> can be investigated practically, and discuss whether there are ethical issues in the use of invertebrates.	
10. Describe the blood clotting process (thromboplastin release, conversion of prothrombin to thrombin and fibrinogen to fibrin) and its role in cardiovascular disease (CVD).	<ul style="list-style-type: none"> Lifestyle and Disease

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<p>11. Explain the course of events that leads to atherosclerosis (endothelial damage, inflammatory response, plaque formation, raised blood pressure).</p>	<ul style="list-style-type: none"> • Lifestyle and Disease
<p>12. Describe the factors which increase the risk of CVD (genetic, diet, age, gender, high blood pressure, smoking and inactivity).</p>	<ul style="list-style-type: none"> • Lifestyle and Disease
<p>13. Describe the benefits and risks of treatments for CVD (antihypertensives, plant statins, anticoagulants and platelet inhibitory drugs).</p>	<ul style="list-style-type: none"> • Lifestyle and Disease
<p>14. Analyse and interpret data on the possible significance for health of blood cholesterol levels and levels of high-density lipoproteins (HDLs) and low-density lipoproteins (LDLs). Describe the evidence for a causal relationship between blood cholesterol levels (total cholesterol and LDL cholesterol) and CVD.</p>	<ul style="list-style-type: none"> • Lifestyle and Disease
<p>15. Discuss how people use scientific knowledge about the effects of diet (including obesity indicators), exercise and smoking to reduce their risk of coronary heart disease.</p>	<ul style="list-style-type: none"> • Lifestyle and Disease
<p>16. Describe how to investigate the vitamin C content of food and drink.</p>	
<p>17. Analyse data on energy budgets and diet so as to be able to discuss the consequences of energy imbalance, including weight loss, weight gain, and development of obesity.</p>	
<p>18. Analyse and interpret quantitative data on illness and mortality rates to determine health risks, (including distinguishing between correlation and causation and recognising conflicting evidence).</p>	<ul style="list-style-type: none"> • Lifestyle and Disease • Immunology
<p>19. Evaluate design of studies used to determine health risk factors (including sample selection and sample size used to collect data that is both valid and reliable).</p>	<ul style="list-style-type: none"> • Lifestyle and Disease • Immunology
<p>20. Explain why people’s perceptions of risks are often different from the actual risks (including underestimating and overestimating the risks due to diet and other lifestyle factors in the development of heart disease).</p>	<ul style="list-style-type: none"> • Lifestyle and Disease

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Topic 2. Genes and health	Boardworks AS Biology presentation title
2. Explain how models such as the fluid mosaic model of cell membranes are interpretations of data used to develop scientific explanations of the structure and properties of cell membranes.	<ul style="list-style-type: none"> • Cell Membranes
3. Explain what is meant by osmosis in terms of the movement of free water molecules through a partially permeable membrane (consideration of water potential is not required).	<ul style="list-style-type: none"> • Transport Across Membranes
4. Explain what is meant by passive transport (diffusion, facilitated diffusion), active transport (including the role of ATP), endocytosis and exocytosis and describe the involvement of carrier and channel proteins in membrane transport.	<ul style="list-style-type: none"> • Transport Across Membranes
5. Describe how membrane structure can be investigated practically, e.g. by the effect of alcohol concentration or temperature on membrane permeability.	<ul style="list-style-type: none"> • Cell Membranes
6. Describe the properties of gas exchange surfaces in living organisms (large surface area to volume ratio, thickness of surface, difference in concentration) and explain how the structure of the mammalian lung is adapted for rapid gaseous exchange.	<ul style="list-style-type: none"> • Gas Exchange
7. Describe the basic structure of an amino acid (structures of specific amino acids are not required) and the formation of polypeptides and proteins (as amino acid monomers linked by peptide bonds in condensation reactions) and explain the significance of a protein's primary structure in determining its three-dimensional structure and properties (globular and fibrous proteins and types of bonds involved in three-dimensional structure).	<ul style="list-style-type: none"> • Biological Molecules: Proteins and Lipids
8. Explain the mechanism of action and specificity of enzymes in terms of their three-dimensional structure and explain that enzymes are biological catalysts that reduce activation energy, catalysing a wide range of intracellular and extracellular reactions.	<ul style="list-style-type: none"> • Enzymes

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<p>9. Describe how enzyme concentrations can affect the rates of reactions and how the effect of these on reaction rate can be investigated practically by measuring the initial rate of reaction.</p>	<ul style="list-style-type: none"> • Enzymes
<p>10. Describe the basic structure of mononucleotides (as a deoxyribose or ribose linked to a phosphate and a base i.e. thymine, uracil, cytosine, adenine or guanine) and the structures of DNA and RNA (as polynucleotides composed of mononucleotides linked through condensation reactions) and describe how complementary base pairing and the hydrogen bonding between two complementary strands are involved in the formation of the DNA double helix.</p>	<ul style="list-style-type: none"> • Nucleic Acids and the Genetic Code
<p>11. Describe DNA replication (including the role of DNA polymerase), and explain how Meselson and Stahl's classic experiment provided new data that supported the accepted theory of replication of DNA and refuted competing theories.</p>	<ul style="list-style-type: none"> • Nucleic Acids and the Genetic Code
<p>12. Explain the nature of the genetic code (triplet code only; non-overlapping and degenerate not required at AS).</p>	<ul style="list-style-type: none"> • Nucleic Acids and the Genetic Code
<p>13. Describe a gene as being a sequence of bases on a DNA molecule coding for a sequence of amino acids in a polypeptide chain.</p>	<ul style="list-style-type: none"> • Nucleic Acids and the Genetic Code
<p>14. Outline the process of protein synthesis, including the role of transcription, translation, messenger RNA, transfer RNA and the template (antisense) DNA strand (details of the mechanism of protein synthesis on ribosomes are not required at AS).</p>	<ul style="list-style-type: none"> • Nucleic Acids and the Genetic Code
<p>15. Explain how errors in DNA replication can give rise to mutations and explain how cystic fibrosis (CF) results from one of a number of possible gene mutations.</p>	<ul style="list-style-type: none"> • Variation
<p>16. Explain the terms gene, allele, genotype, phenotype, recessive, dominant, homozygote and heterozygote, and explain monohybrid inheritance, including the interpretation of genetic pedigree diagrams, in the context of traits such as cystic fibrosis (CF), albinism, thalassaemia, garden pea height and seed morphology.</p>	

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17. Explain how the expression of a gene mutation in people with cystic fibrosis impairs the functioning of the gaseous exchange, digestive and reproductive systems.	
18. Describe the principles of gene therapy and distinguish between somatic and germ line therapy.	
19. Explain the uses of genetic screening: identification of carriers, preimplantation genetic diagnosis and prenatal testing (amniocentesis and chorionic villus sampling) and discuss the implications of prenatal genetic screening.	
20. Identify and discuss the social and ethical issues related to genetic screening from a range of ethical viewpoints.	

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Unit 2. Development, plants and the environment

Topic 3: The voice of the genome	Boardworks AS Biology presentation title
2. Distinguish between eukaryotic and prokaryotic cells in terms of their structure and ultrastructure.	<ul style="list-style-type: none"> • Cell Structure
3. Describe the ultrastructure of an animal (eukaryotic) cell (nucleus, nucleolus, ribosomes, rough and smooth endoplasmic reticulum, mitochondria, centrioles, lysosomes, and Golgi apparatus) and recognise these organelles from EM images.	<ul style="list-style-type: none"> • Cell Structure
4. Explain the role of the rough endoplasmic reticulum (rER) and the Golgi apparatus in protein transport within cells and including its role in formation of extracellular enzymes.	<ul style="list-style-type: none"> • Cell Structure
5. Describe how the cells of multicellular organisms can be organised into tissues, tissues into organs and organs into systems.	<ul style="list-style-type: none"> • Cell Division
6. Explain the role of mitosis and the cell cycle for growth and asexual reproduction.	<ul style="list-style-type: none"> • Cell Division
7. Describe the stages of mitosis and how to prepare and stain a root tip squash in order to observe them practically.	<ul style="list-style-type: none"> • Cell Division
8. Explain the role of meiosis in the production of gametes and genetic variation through recombination of alleles and genes including independent assortment and crossing over (details of the stages of meiosis are not required).	<ul style="list-style-type: none"> • Cell Division
9. Explain how mammalian gametes are specialised for their functions.	
10. Describe the process of fertilisation in mammals and flowering plants (starting with the acrosome reaction in mammals and pollen tube growth in plants and ending with the fusion of the nuclei) and explain the importance of fertilisation in sexual reproduction.	

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<p>11. Explain what is meant by the terms stem cell, pluripotency and totipotency and discuss the way society uses scientific knowledge to make decisions about the use of stem cells in medical therapies (e.g. regulatory authorities relating to human embryo research, ability of stem cells to develop into specialised tissues, potential sources of stem cells, who could benefit from the therapies, procedures to obtain stem cells and their risks).</p>	<ul style="list-style-type: none"> • Cell Division
<p>12. Describe how totipotency can be demonstrated practically using plant tissue culture techniques.</p>	
<p>13. Explain how cells become specialised through differential gene expression, producing active mRNA leading to synthesis of proteins which in turn control cell processes or determine cell structure in animals and plants (details of transcription factors are not required at AS).</p>	
<p>14. Explain how phenotype is the result of an interaction between genotype and the environment (e.g. animal hair colour, human height, monoamine oxidase A (MAOA) and cancers), but the data on the relative contributions of genes and environment are often difficult to interpret.</p>	<ul style="list-style-type: none"> • Variation
<p>15. Explain how some phenotypes are affected by alleles at many loci (polygenic inheritance) as well as the environment (e.g. height) and how this can give rise to phenotypes which show continuous variation.</p>	<ul style="list-style-type: none"> • Variation

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Topic 4: Biodiversity and natural resources	Boardworks AS Biology presentation title
2. Compare the ultrastructure of plant cells (cell wall, chloroplasts, amyloplasts, vacuole, tonoplast, plasmodesmata, pits and middle lamella) with that of animal cells.	<ul style="list-style-type: none"> Cell Structure
3. Compare the structure and function of the polysaccharides starch and cellulose including the role of hydrogen bonds between β -glucose molecules in the formation of cellulose microfibrils.	<ul style="list-style-type: none"> Biological Molecules: Water and Carbohydrates
4. Explain how the arrangement of cellulose microfibrils in plant cell walls and secondary thickening contribute to the physical properties of plant fibres which can be exploited by humans.	
5. Compare the structures, position in the stem and function of sclerenchyma fibres (support) and xylem vessels (support and transport of water and mineral ions).	<ul style="list-style-type: none"> Transport in Plants
6. Describe how the uses of plant fibres and starch may contribute to sustainability e.g. plant-based products to replace oil-based plastics.	
7. Identify sclerenchyma fibres and xylem vessels as seen through a light microscope.	
8. Describe how to determine the tensile strength of plant fibres practically.	
9. Explain the importance of water and inorganic ions (nitrate, calcium ions and magnesium ions) to plants.	
10. Describe how to investigate plant mineral deficiencies practically.	
11. Describe how to investigate the antimicrobial properties of plants.	
12. Compare historic drug testing with contemporary drug testing protocols e.g. William Withering's digitalis soup; double blind trials; placebo; three-phased testing.	

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<p>13. Explain the terms biodiversity and endemism and describe how biodiversity can be measured within a habitat using species richness and within a species using genetic diversity e.g. variety of alleles in a gene pool.</p>	<ul style="list-style-type: none"> • Biodiversity
<p>14. Describe the concept of niche and discuss examples of adaptation of organisms to their environment (behavioural, physiological and anatomical).</p>	
<p>15. Describe how natural selection can lead to adaptation and evolution.</p>	<ul style="list-style-type: none"> • Variation
<p>16. Discuss the process and importance of critical evaluation of new data by the scientific community, which leads to new taxonomic groupings (i.e. three domains based on molecular phylogeny).</p>	<ul style="list-style-type: none"> • Classification
<p>17. Discuss and evaluate the methods used by zoos and seedbanks in the conservation of endangered species and their genetic diversity (e.g. scientific research, captive breeding programmes, reintroduction programmes and education).</p>	<ul style="list-style-type: none"> • Conservation