Mapping grid showing how the AQA A2 Level Biology specification (for first teaching in 2008) is covered by Boardworks A2 Biology

Unit 4. Populations and environment

Topic	Boardworks A2 Biology presentation title
3.4.1 The dynamic equilibrium of populations is affected by a number of factors.	• Ecosystems and Populations
3.4.2 ATP provides the immediate source of energy for biological processes.	• Respiration • Photosynthesis: The Reaction
3.4.3 In photosynthesis, energy is transferred to ATP in the light-dependent reaction and the ATP is utilised in the light-independent reaction.	• Photosynthesis: The Reaction • Photosynthesis: Limiting Factors
3.4.4 In respiration, glycolysis takes place in the cytoplasm and the remaining steps in the mitochondria. ATP synthesis is associated with the electron transfer chain in the membranes of mitochondria.	• Respiration
3.4.5 Energy is transferred through ecosystems and the efficiency of transfer can be measured.	• Energy Transfer
3.4.6 Chemical elements are recycled in ecosystems. Microorganisms play a key role in recycling these elements.	• Nutrient Cycling and Global Warming
3.4.7 Ecosystems are dynamic systems, usually moving from colonisation to climax communities in the process of succession.	• Ecosystems and Populations
3.4.8 Genetic variation within a species and geographic isolation leads to the accumulation of different genetic information in populations and the potential formation of new species.	• Evolution and Natural Selection • Inheritance

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Unit 5. Control in cells and in organisms

Topic	Boardworks A2 Biology presentation title
3.5.1 Stimuli, both internal and external, are detected and lead to a response.	• The Nervous System • Homeostasis • Plant Hormones and Responses
3.5.2 Co-ordination may be chemical or electrical in nature.	• The Nervous System • Hormones • Homeostasis • Plant Hormones and Responses • Muscles
3.5.3 Skeletal muscles are stimulated to contract by nerves and act as effectors.	• Muscles
3.5.4 Homeostasis is the maintenance of a constant internal environment.	• Homeostasis • Hormones
3.5.5 Negative feedback helps maintain an optimal internal state in the context of a dynamic equilibrium. Positive feedback also occurs.	• Homeostasis • Hormones
3.5.6 The sequence of bases in DNA determines the structure of proteins, including enzymes.	• Gene Expression and Protein Synthesis
3.5.7 Gene expression is controlled by a number of features.	• Gene Expression and Protein Synthesis • Genetic Technologies
3.5.8 Gene cloning technologies allow study and alteration of gene function in order to better understand organism function and to design new industrial and medical processes.	• Genetic Technologies • Studying Genomes

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Unit 4. Communication, homeostasis and energy

Topic 4.1 Communication and Homeostasis	Boardworks A2 Biology presentation title
4.1.1 Communication	• The Nervous System • Homeostasis • Hormones
4.1.2 Nerves	• The Nervous System
4.1.3 Hormones	• Hormones • Homeostasis • Genetic Technologies
Topic 4.2 Excretion	**Boardworks A2 Biology presentation title**
4.2.1 Excretion	• Homeostasis
Topic 4.3 Photosynthesis	**Boardworks A2 Biology presentation title**
4.3.1 Photosynthesis	• Photosynthesis: The Reaction • Photosynthesis: Limiting Factors • Energy Transfer
Topic 4.4 Respiration	**Boardworks A2 Biology presentation title**
4.4.1 Respiration	• Respiration

Mapping grid showing how the OCR A2 Level Biology specification (for first teaching in 2008) is covered by Boardworks A2 Biology

Unit 5. Control, genomes and environment

Topic 5.1 Cellular Control and Variation	Boardworks A2 Biology presentation title
5.1.1 Cellular Control	• Gene Expression and Protein Synthesis
5.1.2 Meiosis and Variation	• Inheritance • Evolution and Natural Selection
Topic 5.2 Biotechnology and Gene Technologies	**Boardworks A2 Biology presentation title**
5.2.1 Cloning in Plants and Animals	• Genetic Technologies
5.2.2 Biotechnology	
5.2.3 Genomes and Gene Technologies	• Studying Genomes • Gene Technologies
Topic 5.3 Ecosystems and Sustainability	**Boardworks A2 Biology presentation title**
5.3.1 Ecosystems	• Ecosystems and Populations • Energy Transfer • Nutrient Cycling and Global Warming
5.3.2 Populations and Sustainability	• Ecosystems and Populations
Topic 5.4 Responding to the Environment	**Boardworks A2 Biology presentation title**
5.4.1 Plant Responses	• Plant Hormones and Responses
5.4.2 Animal Responses	• The Nervous System • Muscles • Homeostasis
5.4.3 Animal Behaviour	

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Unit 4. The natural environment and species survival

Topic 5: On the wild side	Boardworks A2 Biology presentation title
2. Describe the structure of chloroplasts in relation to their role in photosynthesis.	• Photosynthesis: The Reaction
3. Describe the overall reaction of photosynthesis as requiring energy from light to split apart the strong bonds in water molecules, storing the hydrogen in a fuel (glucose) by combining it with carbon dioxide and releasing oxygen into the atmosphere.	• Photosynthesis: The Reaction
4. Describe the light-dependent reactions of photosynthesis including how light energy is trapped by exciting electrons in chlorophyll and the role of these electrons in generating ATP, and reducing NADP in photophosphorylation and producing oxygen through photolysis of water.	• Photosynthesis: The Reaction
5. Describe how phosphorylation of ADP requires energy and how hydrolysis of ATP provides an immediate supply of energy for biological processes.	• Photosynthesis: The Reaction • Respiration
6. Describe the light-independent reactions as reduction of carbon dioxide using the products of the light-dependent reactions (carbon fixation in the Calvin cycle, the role of GP, GALP, RuBP and RUBISCO) and describe the products as simple sugars which are used by plants, animals and other organisms in respiration and the synthesis of new biological molecules (including polysaccharides, amino acids, lipids and nucleic acids).	• Photosynthesis: The Reaction
7. Carry out calculations of net primary productivity and explain the relationship between gross primary productivity, net primary productivity and plant respiration.	• Energy Transfer
8. Carry out calculations to determine the efficiency of energy transfers between trophic levels.	• Energy Transfer
9. Discuss how understanding of the carbon cycle can lead to methods that can help to reduce atmospheric levels of carbon dioxide (including the use of biofuels and reforestation).	• Nutrient Cycling and Global Warming

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10. Explain that the numbers and distribution of organisms in a habitat are controlled by biotic and abiotic factors.	• Ecosystems and Populations
11. Describe how to carry out a study on the ecology of a habitat to produce valid and reliable data (including the use of quadrats and transects to assess abundance and distribution of organisms and the measurement of abiotic factors e.g. solar energy input, climate, topography, oxygen availability and edaphic factors).	• Ecosystems and Populations
12. Explain how the concept of niche accounts for distribution and abundance of organisms in a habitat.	• Ecosystems and Populations
13. Describe the concept of succession to a climax community.	• Ecosystems and Populations?
14. Outline the causes of global warming — including the role of green house gases (carbon dioxide and methane, CH4) in the greenhouse effect.	• Nutrient Cycling and Global Warming
15. Describe the effects of global warming (rising temperature, changing rainfall patterns and changes in seasonal cycles) on plants and animals (distribution of species, development and life cycles).	• Nutrient Cycling and Global Warming
16. Explain the effect of increasing temperature on the rate of enzyme activity in plants, animals and micro-organisms.	• Photosynthesis: Limiting Factors
17. Describe how to investigate the effects of temperature on the development of organisms (e.g. seedling growth rate, brine shrimp hatch rates).	
18. Analyse and interpret different types of evidence for global warming and its causes (including records of carbon dioxide levels, temperature records, pollen in peat bogs and dendrochronology) recognizing correlations and causal relationships.	• Nutrient Cycling and Global Warming
19. Describe that data can be extrapolated to make predictions, that these are used in models of future global warming, and that these models have limitations.	• Nutrient Cycling and Global Warming
20. Discuss the way in which scientific conclusions about controversial issues such as what actions should be taken to reduce global warming, or the degree to which humans are affecting global warming, can sometimes depend on who is reaching the conclusions.	
21. Describe how evolution (a change in the allele frequency) can come about through gene mutation and natural selection.	• Evolution and Natural Selection

22. Explain how reproductive isolation can lead to speciation.	• Evolution and Natural Selection
23. Describe the role of the scientific community in validating new evidence (including molecular biology e.g. DNA, proteomics) supporting the accepted scientific theory of evolution (scientific journals, the peer review process, scientific conferences).	• Evolution and Natural Selection
2. Describe the structure of chloroplasts in relation to their role in photosynthesis.	• Photosynthesis: The Reaction

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Topic 6. Infection, immunity and forensics	Boardworks A2 Biology presentation title
2. Explain the nature of the genetic code (triplet code, non-overlapping and degenerate).	• Gene Expression and Protein Synthesis
3. Explain the process of protein synthesis (transcription, translation messenger RNA, transfer RNA, ribosomes and the role of start and stop codons) and explain the roles of the template (antisense) DNA strand in transcription, codons on messenger RNA, anticodons on transfer RNA.	• Gene Expression and Protein Synthesis
4. Explain how one gene can give rise to more than one protein through post-transcriptional changes to messenger RNA.	
5. Describe how DNA profiling is used for identification and determining genetic relationships between organisms (plants and animals).	• Studying the Genome
6. Describe how DNA can be amplified using the polymerase chain reaction (PCR).	• Studying the Genome
7. Describe how gel electrophoresis can be used to separate DNA fragments of different length.	• Studying the Genome
8. Distinguish between the structure of bacteria and viruses.	
9. Describe the role of micro-organisms in the decomposition of organic matter and the recycling of carbon.	• Nutrient Cycling and Global Warming
10. Describe the major routes pathogens may take when entering the body and explain the role of barriers in protecting the body from infection, including the roles of skin, stomach acid, gut and skin flora.	
11. Explain how bacterial and viral infectious diseases have a sequence of symptoms which may result in death, including the diseases caused by Mycobacterium tuberculosis (TB) and Human Immunodeficiency Virus (HIV).	
12. Describe the non-specific responses of the body to infection, including inflammation, lysozyme action, interferon, phagocytosis.	
13. Explain the roles of antigens and antibodies in the body's immune response including the involvement of plasma cells, macrophages and antigen-presenting cells.	

14. Distinguish between the roles of B cells (including B memory and B effector cells) and T cells (T helper, T killer and T memory cells) in the body's immune response.	
15. Explain how individuals may develop immunity (natural, artificial, active, passive).	
16. Discuss how the theory of an 'evolutionary race' between pathogens and their hosts is supported by the evasion mechanisms as shown by Human Immunodeficiency Virus (HIV) and Mycobacterium tuberculosis (TB) contraction.	
17. Distinguish between bacteriostatic and bactericidal antibiotics.	
18. Describe how to investigate the effect of different antibiotics on bacteria.	
19. Describe how an understanding of the contributory causes of hospital acquired infections have led to codes of practice relating to antibiotic prescription and hospital practice relating to infection prevention and control.	
20. Describe how to determine the time of death of a mammal by examining the extent of decomposition, stage of succession, forensic entomology, body temperature and degree of muscle.	

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Unit 5. Energy, exercise and coordination

Topic 7: Run for your life	Boardworks A2 Biology presentation title
2. Describe the structure of a muscle fibre and explain the structural and physiological differences between fast and slow twitch muscle fibres.	• Muscles
3. Explain the contraction of skeletal muscle in terms of the sliding filament theory, including the role of actin, myosin, troponin, tropomyosin, calcium ions (Ca2+), ATP and ATPase.	• Muscles
4. Recall the way in which muscles, tendons, the skeleton and ligaments interact to enable movement, including antagonistic muscle pairs, extensors and flexors.	• Muscles
5. Describe the overall reaction of aerobic respiration as splitting of the respiratory substrate (e.g. glucose) to release carbon dioxide as a waste product and reuniting of hydrogen with atmospheric oxygen with the release of a large amount of energy.	• Respiration
6. Describe how to investigate rate of respiration practically.	• Respiration
7. Recall how phosphorylation of ADP requires energy and how hydrolysis of ATP provides an accessible supply of energy for biological processes.	• Respiration • Photosynthesis: The Reaction
8. Describe the roles of glycolysis in aerobic and anaerobic respiration, including the phosphorylation of hexoses, the production of ATP, reduced coenzyme and pyruvate acid (details of intermediate stages and compounds are not required).	• Respiration
9. Describe the role of the Krebs cycle in the complete oxidation of glucose and formation of carbon dioxide (CO2), ATP, reduced NAD and reduced FAD (names of other compounds are not required) and that respiration is a many-stepped process with each step controlled and catalysed by a specific intracellular enzyme.	• Respiration
10. Describe the synthesis of ATP by oxidative phosphorylation associated with the electron transport chain in mitochondria, including the role of chemiosmosis and ATPase.	• Respiration
11. Explain the fate of lactate after a period of anaerobic respiration in animals.	

12. Understand that cardiac muscle is myogenic and describe the normal electrical activity of the heart, including the roles of the sinoatrial node (SAN), the atrioventricular node (AVN) and the bundle of His, and how the use of the electrocardiograms (ECGs) can aid the diagnosis of cardiovascular disease (CVD) and other heart conditions.	
13. Explain how variations in ventilation and cardiac output enable rapid delivery of oxygen to tissues and the removal of carbon dioxide from them, including how the heart rate and ventilation rate are controlled and the roles of the cardiovascular control centre and the ventilation centre.	
14. Describe how to investigate the effects of exercise on tidal volume and breathing rate using data from spirometer traces.	
15. Explain the principle of negative feedback in maintaining systems within narrow limits.	• Homeostasis
16. Discuss the concept of homeostasis and its importance in maintaining the body in a state of dynamic equilibrium during exercise, including the role of the hypothalamus and the mechanisms of thermoregulation.	• Homeostasis • Hormones
17. Explain how genes can be switched on and off by DNA transcription factors including hormones.	• Gene Expression and Protein Synthesis
18. Analyse and interpret data on possible disadvantages of exercising too much (wear and tear on joints, suppression of the immune system) and exercising too little (increased risk of obesity, coronary heart disease (CHD) and diabetes), recognising correlation and causal relationships.	
19. Explain how medical technology, including the use of keyhole surgery and prostheses, is enabling those with injuries and disabilities to participate in sports e.g. cruciate ligaments repair using keyhole surgery and knee joint replacement using prosthetics.	
20. Outline two ethical positions relating to whether the use of performance-enhancing substances by athletes is acceptable.	

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Topic 8: Grey matter	Boardworks A2 Biology presentation title
2. Describe how plants detect light using photoreceptors and how they respond to environmental cues.	• Plant Hormones and Responses
3. Describe the structure and function of sensory, relay and motor neurones including the role of Schwann cells and myelination.	• The Nervous System
4. Describe how a nerve impulse (action potential) is conducted along an axon including changes in membrane permeability to sodium and potassium ions and the role of the nodes of Ranvier.	• The Nervous System
5. Describe the structure and function of synapses including the role of neurotransmitters, including acetylcholine.	• The Nervous System
6. Describe how the nervous systems of organisms can detect stimuli with reference to rods in the retina of mammals, the roles of rhodopsin, opsin, retinal, sodium ions, cation channels and hyperpolarisation of rod cells in forming action potentials in the optic neurones.	• The Nervous System
7. Explain how the nervous systems of organisms can cause effectors to respond as exemplified by pupil dilation and contraction.	• The Nervous System
8. Compare mechanisms of coordination in plants and animals i.e. nervous and hormonal, including the role of IAA in phototropism (details of individual mammalian hormones are not required).	• Plant Hormones and Responses • Homeostasis • Hormones • The Nervous System
9. Locate and state the functions of the regions of the human brain's cerebral hemispheres (ability to see, think, learn and feel emotions), hypothalamus (thermoregulate), cerebellum (co-ordinate movement) and medulla oblongata (control the heartbeat).	
10. Describe the use of magnetic resonance imaging (MRI), functional magnetic resonance imaging (fMRI) and computed tomography (CT) scans in medical diagnosis and investigating brain structure and function.	
11. Discuss whether there exists a critical 'window' within which humans must be exposed to particular stimuli if they are to develop their visual capacities to the full.	

12. Describe the role animal models have played in developing explanations of human brain development and function, including Hubel and Wiesel's experiments with monkeys and kittens.	
13. Consider the methods used to compare the contributions of nature and nurture to brain development, including evidence from the abilities of new born babies, animal experiments, studies of individuals with damaged brain areas, twin studies and cross-cultural studies.	
14. Describe how animals, including humans, can learn by habituation.	
15. Describe how to investigate habituation to a stimulus.	
16. Discuss the moral and ethical issues relating to the use of animals in medical research from two ethical standpoints.	
17. Explain how imbalances in certain, naturally occurring, brain chemicals can contribute to ill health (e.g. dopamine in Parkinson's disease and serotonin in depression) and to the development of new drugs.	
18. Explain the effects of drugs on synaptic transmissions, including the use of L-Dopa in the treatment of Parkinson's disease and the action of MDMA in ecstasy.	
19. Discuss how the outcomes of the Human Genome Project are being used in the development of new drugs and the social, moral and ethical issues this raises.	• Studying Genomes
20. Describe how drugs can be produced using genetically modified organisms (plants and animals and micro-organisms).	• Genetic Technologies
21. Discuss the risks and benefits associated with the use of genetically modified organisms.	• Genetic Technologies