# Switching AQA GCSE (9-1) Biology to OCR GCSE (9-1) Twenty First Century Biology B

## Introduction

Are you currently teaching the AQA GCSE sciences? Are you thinking of switching? We are here to help.

We will provide you with all the support you could need to switch from the AQA GCSE Biology qualification to our OCR GCSE Biology B, including:

* Mapping of AQA’s specification to OCR’s specification
* An overview of the differences in assessment
* Mapping of the AQA textbook to OCR’s specification

## Our offer

* Our GCSE (9-1) Twenty First Century Biology B qualification has been developed in partnership with University of York Science Education Group (UYSEG), and working with a number of stakeholders, including OCR Science Consultative Forum, teachers and assessors. It has been created to be a qualification which engages students so they achieve their full potential.
* Our GCSE team are passionate about both science and education. With industry, teaching and assessment experience, they are fully committed to supporting centres’ delivery of our GCSE qualifications.
* We have produced a wide range of support materials, such as handbooks (including maths skills), delivery guides, practical activities and end of chapter quizzes. We have a selection of practice papers which can be used as mock papers in preparation for the exams and we have a free and user-friendly tool - ExamBuilder - that you can use to create customised papers for students.
* Within this document as well as mapping the specifications, we also provide textbook mapping – illustrating how you can use your existing AQA textbooks to teach the OCR specification; making it easier for you to use the resources you already have.
* Join our conversations on the OCR Community and @ocr\_science on Twitter to discuss and share good practice.

## Key differences

|  |  |
| --- | --- |
| **OCR GCSE (9-1) Twenty First Century Biology B** | **AQA GCSE (9-1) Biology** |
| **8 flexible practical** activities -select from our suggested activities or use your own preferred practical activities. | 8 required practical activities you have to deliver. |
| In each assessment students have 1 hour and 45 minutes to complete **90** marks worth of questions | In each assessment students have 1 hour and 45 minute to complete **100** marks worth of questions. |
| Context – linked specification | Content led specification. |
| **Two** 6 mark level of response in the depth paper and **none** in the breadth | Not a set number, but **more than one** 6 mark level of response question on all sample assessment material. |

## Content mapping

The content within the OCR GCSE (9-1) in Biology B (Twenty first century) covers the key concepts of biology and will be very familiar. We’ve laid it out in a logical progression to support teaching the GCSE in a linear way.

Below is a table to show where AQA biology content is covered in the OCR Twenty first century biology specification.

| **AQA Biology (8461)** | **OCR Biology B (Twenty First Century Science)** | **Surplus Content In AQA Biology** |
| --- | --- | --- |
| 4.1.1 cell structure | 4.1 what happens during cellular respiration  3.1 what happens during photosynthesis  4.2 how do organisms grow and develop  4.3 how do organisms grow & develop  1.1 what is the genome & what does it do  2.2 how do organisms protect themselves against pathogens  2.3 how can we prevent the spread of infection  2.4 how can we identify the cause of an infection (separate science only) |  |
| 4.1.2 cell division | 1. 1 what is the genome & what does it do  4.3 how do organisms grow & develop  4.5 should we use stem cells to treat damage and disease |  |
| 4.1.3 transport in cells | 5.1 how do substances get into out of and around our bodies  3.2 how do producers get the substances they need |  |
| 4.2.1 principles of organisation |  | Cells-tissues-organs-organisms |
| 4.2.2 animal tissues organs and organ systems | 3.1 What happens during photosynthesis  4.1(prac)  5.1 how do substances get into out of and around our bodies  2.5 how can lifestyle genes and the environment affect my health  2.6 how can we treat disease  2.1 what are the causes of disease |  |
| 4.2.3 plant tissues organs and systems | 3.2 how do producers get the substances they need |  |
| 4.3.1 communicable diseases | 2.1 what are the causes of disease  2.3 how can we prevent the spread of infection  2.2 how do organisms protect themselves against pathogens  2.6 how can we treat disease |  |
| 4.3.2 monoclonal antibodies biology only HT only | 2.4 how can we identify the cause of an infection (separate science only) |  |
| 4.3.3 plant disease biology only | 2.4 how can we identify the cause of an infection (separate science only)  2.2 how do organisms protect themselves against pathogens |  |
| 4.4.1 photosynthesis | 3.1 what happens during photosynthesis  3.3 how are organisms in an ecosystem interdependent  4.1 what happens during cellular respiration |  |
| 4.4.2 respiration | 4.1 what happens during cellular respiration |  |
| 4.5.1 homeostasis | 5.4 why do we need to maintain a constant internal environment  5.2 how does the nervous system help us to respond to changes |  |
| 4.5.2 the human nervous system | 5.2 how does the nervous system help us to respond to changes  5.6 what can happen when organs and control systems stop working  5.4 why do we need to maintain a constant internal environment |  |
| 4.5.3 hormonal control in humans | 5.6 what can happen when organs and control systems stop working  5.4 why do we need to maintain a constant internal environment  5.3 how do hormones control responses in the human body  5.5 what role do hormones play in human reproduction |  |
| 4.5.4 plant hormones biology only | 4.4 how is plant growth controlled (separate science only) |  |
| 4.6.1 reproduction | 6.2 how do sexual and asexual reproduction affect evolution (separate science only)  4.3 how do organisms grow & develop  1.1 what is the genome & what does it do  1.2 how is genetic information inherited |  |
| 4.6.2 variation and evolution | 6.1 how was the theory of evolution developed  1.3 how can and should gene technology be used |  |
| 4.6.3 the development of understanding of genetics and evolution | 6.1 how was the theory of evolution developed  1.2 how is genetic information inherited |  |
| 4.6.4 classification of living organisms | 6.3 how does our understanding of biology help us classify the diversity of organisms on earth |  |
| 4.7.1 Adaptations interdependence and competition | 3.3 how are organisms in an ecosystem interdependent  3.4 how are populations affected by conditions in an ecosystem | 4.7.1.4 Adaptations structural behavioural or functional adaptations. Adaptations to extreme environments |
| 4.7.2 organisation of an ecosystem | 3.3 how are organisms in an ecosystem interdependent  6.4 how is biodiversity threatened and how can we protect it  3.4 how are populations affected by conditions in an ecosystem |  |
| 4.7.3 bio-diversity and the effect of human interaction on ecosystems | 6.4 how is biodiversity threatened and how can we protect it  3.3 how are organisms in an ecosystem interdependent |  |
| 4.7.4 trophic levels of an ecosystem biology only | 3.3 how are organisms in an ecosystem interdependent |  |
| 4.7.5 food production biology only | 6.4 how is biodiversity threatened and how can we protect it  6.1 how was the theory of evolution developed |  |

## Assessment

A comparison of the differences in assessment models is below:

| **OCR GCSE (9-1) Twenty First Century Biology B** | **AQA GCSE (9-1) Biology** |
| --- | --- |
| **Paper 1** **(Breadth)**  Assessed: All Chapters  Time allowed: 1 hour 45 minutes  Foundation and Higher tier available  Marks 90 marks  Weighting 50% of GCSE  Question types:  Short answer only (maximum 4 marks per question), some multiple choice and objective style questions | **Paper 1**  Assessed: Topics 1-4  Time allowed: 1 hour 45 minutes  Foundation and Higher tier available  Marks: 100 marks  Weighting: 50% of GCSE  Question types: Multiple choice, structured, closed short answer and open response |
| **Paper 2** **(Depth)**  Assessed: All chapters  Foundation and Higher tier available  Marks 90 marks  Weighting 50% of GCSE  Question types: Multiple choice, structured, closed short answer and open response, 2 x 6 mark Level of response questions | **Paper 2**  Assessed: Topics 5-7 (may draw on knowledge from topics 1-4)  Time allowed: 1 hour 45 minutes  Foundation and Higher tier available  Marks: 100 marks  Weighting: 50% of GCSE  Question types: Multiple choice, structured, closed short answer and open response. |

## Using the AQA textbook

## Below you will find all the information you need to start teaching OCR GCSE (9-1) Twenty First Century Biology B while still using the new AQA textbooks. We have mapped our specification to the AQA OUP, Hodder and Collins textbooks to save you having to buy another set of textbooks. We also have endorsed textbooks for use with our specification and details of these textbooks can be found on the qualification page on the OCR website.

## AQA OUP textbook mapping

| **Specification statement** | **Chapter covering specification statement** | **Page number** | **Comments** |
| --- | --- | --- | --- |
| **Chapter B1 You and your genes** | | | |
| **B1.1 What is the genome and what does it do?** | | | |
| B1.1.1 a) explain how the nucleus and genetic material of eukaryotic cells (plants and animals) and the genetic material, including plasmids, of prokaryotic cells are related to cell functions b) describe how to use a light microscope to observe a variety of plant and animal cells PAG1 | B1.1 the world of the microscope | 4 |  |
| B1.1.2 describe the genome as the entire genetic material of an organism | B13.4 DNA and the genome | 202,203 |  |
| B1.1.3 describe DNA as a polymer made up of nucleotides, forming two strands in a double helix | B13.5 DNA structure & protein synthesis | 204 |  |
| B1.1.4 describe simply how the genome and its interaction with the environment influence the development of the phenotype of an organism, including the idea that most characteristics depend on instructions in the genome and are modified by interaction of the organism with its environment  *i Learners are not expected to describe epigenetic effects* | B13.4 DNA and the genome B14.1 variation | 202, 203, 218, 219 | continuous and discontinuous variation not mentioned |
| B1.1.5 explain the terms chromosome, gene, allele, variant, genotype and phenotype | B13.7 inheritance in action  B13.2 cell division in sexual reproduction | 208, 209, 198, 199 |  |
| B1.1.6 explain the importance of amino acids in the synthesis of proteins, including the genome as instructions for the polymerisation of amino acids to make proteins | B13.5 DNA structure & protein synthesis | 204, 205 |  |
| B1.1.7 describe DNA as a polymer made from four different nucleotides, each nucleotide consisting of a common sugar and phosphate group with one of four different bases attached to the sugar (separate science only) | B13.5 DNA structure & protein synthesis | 204 |  |
| **B1.1.8 explain simply how the sequence of bases in DNA codes for the proteins made in protein synthesis, including the idea that each set of three nucleotides is the code for an amino acid (separate science only)** | B13.5 DNA structure & protein synthesis | 205 |  |
| **B1.1.9 recall a simple description of protein synthesis, in which: • a copy of a gene is made from messenger RNA (mRNA) • the mRNA travels to a ribosome in the cytoplasm • the ribosome joins amino acids together in an order determined by the mRNA i Learners are not expected to recall details of transcription and translation (separate science only)** | B13.5 DNA structure & protein synthesis | 204, 205 |  |
| **B1.1.10 recall that all genetic variants arise from mutations (separate science only)** | B13.6 gene expression and mutation | 206, 207 | (in higher tier) |
| **B1.1.11 describe how genetic variants in coding DNA may influence phenotype by altering the activity of a protein (separate science only)** | B13.6 gene expression and mutation | 206, 207 |  |
| **B1.1.12 describe how genetic variants in non-coding DNA may influence phenotype by altering how genes are expressed (separate science only)** | B13.6 gene expression and mutation | 206, 207 |  |
| **B1.2 How is genetic information inherited?** | | | |
| B1.2.1 explain the terms gamete, homozygous, heterozygous, dominant and recessive | B13.7 inheritance in action  B13.2 cell division in sexual reproduction | 208, 209, 198, 199 |  |
| B1.2.2 explain single gene inheritance, including dominant and recessive alleles and use of genetic diagrams | B13.7 inheritance in action | 208, 209 |  |
| B1.2.3 predict the results of single gene crosses | B13.8 more about genetics | 210, 211 |  |
| B1.2.4 use direct proportions and simple ratios in genetic crosses | B13.8 more about genetics | 210 |  |
| B1.2.5 use the concept of probability in predicting the outcome of genetic crosses | MS2 handling data | 328 |  |
| B1.2.6 recall that most phenotypic features are the result of multiple genes rather than single gene inheritance   *i Learners are not expected to describe epistasis and its effects* | B13.7 inheritance in action | 209 |  |
| B1.2.7 describe the development of our understanding of genetics including the work of Mendel **and the modern-day use of genome sequencing** (separate science only) | B15.1 the history of genetics B13.4 DNA and the Genome | 234, 235, 202, 203 |  |
| B1.2.8 describe sex determination in humans | B13.8 more about genetics | 211 |  |
| **B1.3 How can and should gene technology be used?** | | | |
| B1.3.1 discuss the potential importance for medicine of our increasing understanding of the human genome, including the discovery of alleles associated with diseases and the genetic testing of individuals to inform family planning and healthcare | B14.7 ethics of genetic technologies | 230, 231 |  |
| B1.3.2 describe genetic engineering as a process which involves modifying the genome of an organism to introduce desirable characteristics | B18.12 sustainable food production | 308, 309 |  |
| **B1.3.3 describe the main steps in the process of genetic engineering including: • isolating and replicating the required gene(s) • putting the gene(s) into a vector (e.g. a plasmid) • using the vector to insert the gene(s) into cells • selecting modified cells** | B14.4 genetic engineering | 224 |  |
| B1.3.4 explain some of the possible benefits and risks, including practical and ethical considerations, of using gene technology in modern agriculture and medicine | B14.4 genetic engineering B14.6 adult cell cloning B14.7 ethics of genetic technologies | 224, 229, 230, 231 |  |
| **Chapter B2 Keeping healthy** | | | |
| **B2.1 What are the causes of disease?** | | | |
| B2.1.1 describe the relationship between health and disease | B5.1 health and disease | 74, 75 |  |
| B2.1.2 describe different types of diseases (including communicable and non- communicable diseases) | B5.1 health and disease | 74, 75 |  |
| B2.1.3 explain how communicable diseases (caused by viruses, bacteria, protists and fungi) are spread in animals and plants | B5.2 pathogens and disease | 76, 77 |  |
| B2.1.4 describe common human infections including influenza (viral), Salmonella (bacterial), Athlete’s foot (fungal) and malaria (protist) and sexually transmitted infections in humans including HIV/AIDS (viral) | B5.6 viral diseases B5.7 bacterial diseases B5.8 diseases caused by fungi and protists | 84, 85, 86, 87, 88, 89 |  |
| B2.1.5 describe plant diseases including tobacco mosaic virus (viral), ash dieback (fungal) and crown gall disease (bacterial) | B5.6 viral diseases B5.7 bacterial diseases B5.8 diseases caused by fungi and protists | 84, 85, 86, 87, 88, 89 |  |
| **B2.2 How do organisms protect themselves against pathogens?** | | | |
| B2.2.1 describe non-specific defence systems of the human body against pathogens, including examples of physical, chemical and microbial defences | B5.5 preventing infections | 82, 83 |  |
| B2.2.2 explain how platelets are adapted to their function in the blood | B4.1 the blood | 52, 53 |  |
| B2.2.3 describe physical plant defences, including leaf cuticle and cell wall (separate science only) | B5.11 plant defence responses | 94, 95 |  |
| B2.2.4 explain the role of the immune system of the human body in defence against disease | B5.9 human defence responses  B6.1 vaccination | 90, 91, 98, 99 |  |
| B2.2.5 explain how white blood cells are adapted to their functions in the blood, including what they do and how it helps protect against disease | B4.1 the blood | 52, 53 |  |
| B2.2.6 describe chemical plant defence responses, including antimicrobial substances (separate science only) | B5.11 plant defence responses | 94, 95 |  |
| **B2.3 How can we prevent the spread of infection?** | | | |
| B2.3.1 explain how the spread of communicable diseases may be reduced or prevented in animals and plants, to include a minimum of one common human infection, one plant disease and sexually transmitted infections in humans including HIV/AIDS | B5.5 preventing infections  B5.6 viral diseases B5.7 bacterial diseases B5.8 diseases caused by fungi and protists | 82, 83, 84, 85, 86, 87, 88, 89 |  |
| B2.3.2 explain the use of vaccines in the prevention of disease, including the use of safe forms of pathogens and the need to vaccinate a large proportion of the population | B6.1 vaccination B6.2 antibiotics and painkillers | 98, 99, 100, 101 |  |
| **B2.4 How can we identify the cause of an infection? (separate science only)** | | | |
| B2.4.1 a) describe ways in which diseases, including plant diseases, can be detected and identified, in the lab and in the field b) describe how to use a light microscope to observe microorganisms PAG1 | B5.10 more about plant diseases | 93 |  |
| B2.4.2 describe and explain the aseptic techniques used in culturing organisms PAG7 | B5.3 growing bacteria in the lab | 78, 79 |  |
| B2.4.3 calculate cross-sectional areas of bacterial cultures and of clear zones around antibiotic discs on agar jelly using πr2 PAG7 | B5.4 preventing bacterial growth | 81 |  |
| **B2.4.4 describe how monoclonal antibodies are produced including the following steps: • antigen injected into an animal • antibody-producing cells taken from animal • cells producing the correct antibody selected then cultured** | B6.5 making monoclonal antibodies | 106, 107 |  |
| **B2.4.5 describe some of the ways in which monoclonal antibodies can be used in diagnostic tests** | B6.6 uses of monoclonal antibodies | 108, 109 |  |
| **B2.5 How can lifestyle, genes and the environment affect health?** | | | |
| B2.5.1 a) describe how the interaction of genetic and lifestyle factors can increase or decrease the risk of developing non-communicable human diseases, including cardiovascular diseases, many forms of cancer, some lung and liver diseases and diseases influenced by nutrition, including type 2 diabetes b) describe how to practically investigate the effect of exercise on pulse rate and recovery rate PAG6 | B7.1 non communicable diseases | 112, 113 |  |
| B2.5.2 use given data to explain the incidence of non-communicable diseases at local, national and global levels with reference to lifestyle factors, including exercise, diet, alcohol and smoking | B7.3 smoking and the risk of disease  B7.4 diet exercise and disease | 116, 117, 118, 119 |  |
| B2.5.3 in the context of data related to the causes, spread, effects and treatment of disease: a) translate information between graphical and numerical forms b) construct and interpret frequency tables and diagrams, bar charts and histograms c) understand the principles of sampling as applied to scientific data d) use a scatter diagram to identify a correlation between two variables | MS4 data and graphs MS2 handling data | 333, 334, 328, 330 |  |
| B2.5.4 describe interactions between different types of disease | B5.1 health and disease | 74, 75 |  |
| **B2.6 How can we treat disease?** | | | |
| B2.6.1 explain the use of medicines, including antibiotics, in the treatment of disease | B6.1 vaccination B6.2 antibiotics and painkillers | 98, 99, 100, 101 |  |
| B2.6.2 calculate cross-sectional areas of bacterial cultures and of clear zones around antibiotic discs on agar jelly using πr2 PAG7 | B5.4 preventing bacterial growth | 81 |  |
| B2.6.3 evaluate some different treatments for cardiovascular disease, including lifestyle changes, medicines and surgery | B4.4 helping the heart B7.3 smoking and the risk of disease | 58, 59, 117 |  |
| B2.6.4 describe the process of discovery and development of potential new medicines including preclinical and clinical testing | B6.3 discovering drugs B6.4 developing drugs | 102, 103, 104, 105 |  |
| **B2.6.5 describe how monoclonal antibodies can be used to treat cancer including: • produce monoclonal antibodies specific to a cancer cell antigen • inject the antibodies into the blood • the antibodies bind to cancer cells, tagging them for attack by white blood cells • the antibodies can also be attached to a radioactive or toxic substance to deliver it to cancer cells (separate science only)** | B6.6 uses of monoclonal antibodies | 108, 109 |  |
| **Chapter B3 Living together - food and ecosystems** | | | |
| **B3.1 What happens during photosynthesis?** | | | |
| B3.1.1 a) describe the process of photosynthesis, including the inputs and outputs of the two mains stages and the requirement of light in the first stage, and describe photosynthesis as an endothermic process b) describe practical investigations into the requirements and products of photosynthesis PAG5 | B8.1 photosynthesis B8.3 how plants use glucose | 124, 128, 129 |  |
| B3.1.2 explain how chloroplasts in plant cells are related to photosynthesis | B8.1 photosynthesis | 124 |  |
| B3.1.3 a) explain the mechanism of enzyme action including the active site, enzyme specificity and factors affecting the rate of enzyme-catalysed reactions, including substrate concentration, temperature and pH b) describe practical investigations into the effect of substrate concentration, temperature and pH on the rate of enzyme controlled reactions PAG4 | B3.4 catalysts and enzymes  B3.5 factors affecting enzyme action B3.6 how the digestive system works | 42, 43, 44, 45, 46, 47 |  |
| B3.1.4 a) explain the effect of temperature, light intensity and carbon dioxide concentration on the rate of photosynthesis b) describe practical investigations into the effect of environmental factors on the rate of photosynthesis PAG5 | B8.2 the rate of photosynthesis | 126, 127 |  |
| **B3.1.5 use the inverse square law to explain changes in the rate of photosynthesis with distance from a light source** | B8.2 the rate of photosynthesis | 127 |  |
| **B3.1.6 explain the interaction of temperature, light intensity and carbon dioxide concentration in limiting the rate of photosynthesis, and use graphs depicting the effects** | B8.4 making the most of photosynthesis | 130, 131 |  |
| B3.1.7 in the context of the rate of photosynthesis: a) understand and use simple compound measures such as the rate of a reaction b) translate information between graphical and numerical form c) plot and draw appropriate graphs selecting appropriate scales for axes d) extract and interpret information from graphs, charts and tables | MS4 data and graphs | 333, 334 |  |
| **B3.2 How do producers get the substances they need?** | | | |
| B3.2.1 describe some of the substances transported into and out of photosynthetic organisms in terms of the requirements of those organisms, including oxygen, carbon dioxide, water and mineral ions | B1. diffusion B1.7 osmosis B1.9 active transport | 14, 15, 16, 17, 20, 21 |  |
| B3.2.2 a) explain how substances are transported into and out of cells through diffusion, osmosis and active transport b) describe practical investigations into the processes of diffusion and osmosis PAG8 *i Learners are not expected to explain osmosis in terms of water potential* | B1. diffusion B1.7 osmosis B1.9 active transport | 14, 15, 16, 17, 20, 21 |  |
| B3.2.3 explain how the partially-permeable cell membranes of plant cells and prokaryotic cells are related to diffusion, osmosis and active transport | B1. diffusion B1.7 osmosis B1.9 active transport | 14, 15, 16, 17, 20, 21 |  |
| B3.2.4 explain how water and mineral ions are taken up by plants, relating the structure of the root hair cells to their function | B1.9 active transport | 20, 21 |  |
| B3.2.5 a) explain how the structure of the xylem and phloem are adapted to their functions in the plant b) describe how to use a light microscope to observe the structure of the xylem and phloem PAG1 | B4.6 tissues and organs in plants  B4.7 transport systems in plants | 62, 63, 64, 65 |  |
| B3.2.6 a) describe the processes of transpiration and translocation, including the structure and function of the stomata b) describe how to use a light microscope to observe the structure of stomata PAG1 c) describe how to use a simple potometer PAG6  *i Learners are not expected to describe transpiration in terms of tension or pressure, and are not expected to describe translocation in terms of water potential or hydrostatic pressure* | B4.7 transport systems in plants B4.8 evaporation and transpiration B4.9 factors affecting transpiration | 64, 65, 66, 67, 69 |  |
| B3.2.7 a) explain the effect of a variety of environmental factors on the rate of water uptake by a plant, to include light intensity, air movement, and temperature b) describe practical investigations into the effect of environmental factors on the rate of water uptake by a plant PAG6 | B4.9 factors affecting transpiration | 68, 69 |  |
| B3.2.8 in the context of water uptake by plants: a) use simple compound measures such as rate b) carry out rate calculations c) plot, draw and interpret appropriate graphs d) calculate percentage gain and loss of mass | MS4 data and graphs | 333, 334 | percentiles not found |
| **B3.3 How are organisms in an ecosystem interdependent?** | | | |
| B3.3.1 a) explain the importance of sugars, fatty acids and glycerol, and amino acids in the synthesis and breakdown of carbohydrates, lipids and proteins b) describe the use of qualitative tests for biological molecules PAG2 | B3.3 the chemistry of food | 40, 41 | monomer and polymer not used |
| B3.3.2 describe photosynthetic organisms as the main producers of food and therefore biomass for life on Earth | B8.1 photosynthesis | 124 |  |
| B3.3.3 describe some of the substances transported into organisms in terms of the requirements of those organisms, including dissolved food molecules | B1.10 exchanging material | 22, 23 |  |
| B3.3.4 describe different levels of organisation in an ecosystem from individual organisms to the whole ecosystem | B16.1 the importance of communities | 258, 259 |  |
| B3.3.5 explain the importance of interdependence and competition in a community | B16.1 the importance of communities B16.4 competition in animals  B16.5 competition in plants | 259, 264, 265, 266, 267 | interdependence |
| B3.3.6 describe the differences between the trophic levels of organisms within an ecosystem (separate science only) | B18.8 trophic levels and biomass | 300 |  |
| B3.3.7 describe pyramids of biomass and explain, with examples, how biomass is lost between the different trophic levels (separate science only) | B18.8 trophic levels and biomass  B18.9 biomass transfers | 300, 301, 302, 303 |  |
| B3.3.8 calculate the efficiency of biomass transfers between trophic levels and explain how this affects the number of organisms at each trophic level (separate science only) | B18.9 biomass transfers | 302, 303 |  |
| B3.3.9 recall that many different substances cycle through the abiotic and biotic components of an ecosystem, including carbon and water | B16.1 the importance of communities | 258 |  |
| B3.3.10 explain the importance of the carbon cycle and the water cycle to living organisms | B17.2 materials cycling B17.3 the carbon cycle | 279, 280, 281 | water cycle carbon cycle |
| B3.3.11 explain the role of microorganisms in the cycling of substances through an ecosystem | B17.2 materials cycling | 278, 279 |  |
| B3.3.12 calculate the percentage of mass, in the context of the use and cycling of substances in ecosystems | MS1 arithmetic and numerical computations | 322, 323 |  |
| B3.3.13 explain the effect of factors such as temperature and water content on rate of decomposition in aerobic and anaerobic environments (separate science only) | B17.4 rates of decomposition | 282, 283 |  |
| B3.3.14 calculate rate changes in the decay of biological material (separate science only) | MS1 arithmetic and numerical computations | 322, 323 |  |
| **B3.4 How are populations affected by conditions in an ecosystem?** | | | |
| B3.4.1 explain how some abiotic and biotic factors affect communities, including environmental conditions, toxic chemicals, availability of food and other resources, and the presence of predators and pathogens | B16.2 organisms and their environment | 260, 261 |  |
| B3.4.2 describe how to carry out a field investigation into the distribution and abundance of organisms in an ecosystem and explain how to determine their numbers in a given area PAG3 | B16.3 distribution and abundance | 262, 263 |  |
| B3.4.3 in the context of data related to organisms within a population: a) calculate arithmetic means b) use fractions and percentages c) plot and draw appropriate graphs selecting appropriate scales for the axes d) extract and interpret information from charts, graphs and tables | B16.3 distribution and abundance MS1 arithmetic and numerical computations MS4 data and graphs | 262, 263, 322, 323, 333, 334 |  |
| **Chapter B4 Using food and controlling growth** | | | |
| **B4.1 What happens during cellular respiration?** | | | |
| B4.1.1 compare the processes of aerobic and anaerobic respiration, including conditions under which they occur, the inputs and outputs, and comparative yields of ATP | B9.1 aerobic respiration B9.3 anaerobic respiration | 134, 138, 139 |  |
| B4.1.2 explain why cellular respiration occurs continuously in all living cells | B9.1 aerobic respiration | 134, 135 | ATP not mentioned specifically |
| B4.1.3 explain how mitochondria in eukaryotic cells (plants and animals) are related to cellular respiration | B1.2 animal and plant cells | 6& 7 |  |
| B4.1.4 describe cellular respiration as an exothermic process | B9.1 aerobic respiration | 134 |  |
| B4.1.5 a) describe practical investigations into the effect of different substrates on the rate of respiration in yeast PAG5 b) carry out rate calculations for chemical reactions in the context of cellular respiration | B9.1 aerobic respiration B9.3 anaerobic respiration | 134, 138, 139 |  |
| **B4.2 How do we know about mitochondria and other cell structures?** | | | |
| B4.2.1 explain how electron microscopy has increased our understanding of sub-cellular structures | B1.1 the world of the microscope | 4 |  |
| B4.2.2 in the context of cells and sub-cellular structures: a) demonstrate an understanding of number, size and scale and the quantitative relationship between units b) use estimations and explain when they should be used **c) calculate with numbers written in standard form** | B1.1 the world of the microscope MS1 arithmetic and numerical computation | 4, 320, 324 |  |
| **B4.3 How do organisms grow and develop?** | | | |
| B4.3.1 a) describe the role of the cell cycle in growth, including interphase and mitosis b) describe how to use a light microscope to observe stages of mitosis PAG1  *i Learners are not expected to recall intermediate phases* | B2.1 cell division | 26, 27 |  |
| B4.3.2 describe cancer as the result of changes in cells that lead to uncontrolled growth and division | B7.2 cancer | 114, 115 |  |
| B4.3.3 explain the role of meiotic cell division in halving the chromosome number to form gametes, including the stages of interphase and two meiotic divisions  *i Learners are not expected to recall intermediate phases* | B13.2 cell division in sexual reproduction | 198 |  |
| B4.3.4 describe the function of stem cells in embryonic and adult animals and meristems in plants | B2.3 stem cells B2.2 cell differentiation | 30, 31, 28, 29 |  |
| B4.3.5 explain the importance of cell differentiation, in which cells become specialised by switching genes off and on to form tissues with particular functions | B2.2 cell differentiation | 28, 29 |  |
| **B4.4 How is plant growth controlled? (separate science only)** | | | |
| B4.4.1 a) explain how plant hormones are important in the control and coordination of plant growth and development, with reference to the role of auxins in phototropisms and gravitropisms b) describe practical investigations into the role of auxin in phototropism PAG6 | B11.9 plant hormones and responses | 176, 177 |  |
| **B4.4.2 describe some of the variety of effects of plant hormones, relating to gibberellins and ethene** | B11.10 using plant hormones | 178, 179 |  |
| **B4.4.3 describe some of the different ways in which people use plant hormones to control plant growth** | B11.10 using plant hormones | 178, 179 |  |
| **B4.5 Should we use stem cells to treat damage and disease?** | | | |
| B4.5.1 discuss potential benefits, risks and ethical issues associated with the use of stem cells in medicine | B2.3 stem cells B14.6 adult cell cloning | 30, 31, 229 |  |
| **Chapter B5 The human body - staying alive** | | | |
| **B5.1 How do substances get into, out of and around our bodies?** | | | |
| B5.1.1 describe some of the substances transported into and out of the human body in terms of the requirements of cells, including oxygen, carbon dioxide, water, dissolved food molecules and urea | B1.10 exchanging material | 22, 23 |  |
| B5.1.2 explain how the partially-permeable cell membranes of animal cells are related to diffusion, osmosis and active transport | B1. diffusion B1.7 osmosis B1.9 active transport | 14, 15, 16, 17, 20, 21 |  |
| B5.1.3 describe the human circulatory system, including its relationships with the gaseous exchange system, the digestive system and the excretory system | B4.1 the blood | 52, 53 |  |
| B5.1.4 explain how the structure of the heart is adapted to its function, including cardiac muscle, chambers and valves | B4.2 blood vessels B4.3 the heart | 54, 55, 56, 57 |  |
| B5.1.5 explain how the structures of arteries, veins and capillaries are adapted to their functions, including differences in the vessel walls and the presence of valves | B4.2 blood vessels B4.3 the heart | 54, 55, 56, 57 |  |
| B5.1.6 explain how red blood cells and plasma are adapted to their functions in the blood | B4.1 the blood | 52, 53 |  |
| B5.1.7 explain the need for exchange surfaces and a transport system in multicellular organisms in terms of surface area : volume ratio | B1.10 exchanging material | 22, 23 |  |
| B5.1.8 calculate surface area : volume ratios | MS5 geometry and trigonometry | 335 |  |
| **B5.2 How does the nervous system help us respond to changes?** | | | |
| B5.2.1 explain how the components of the nervous system work together to enable it to function, including sensory receptors, sensory neurons, the CNS, motor neurons and effectors | B10.2 the structure and function of the human nervous system | 148, 149 |  |
| B5.2.2 explain how the structures of nerve cells and synapses relate to their functions   *i Learners are not expected to explain nerve impulse transmission in terms of membrane potentials* | B10.2 the structure and function of the human nervous system | 148, 149 |  |
| B5.2.3 a) explain how the structure of a reflex arc, including the relay neuron, is related to its function b) describe practical investigations into reflex actions PAG6 | B10.3 reflex actions | 0 |  |
| B5.2.4 describe the structure and function of the brain and roles of the cerebral cortex (intelligence, memory, language and consciousness), cerebellum (conscious movement) and brain stem (regulation of heart and breathing rate) (separate science only) | B10.4 the brain | 152, 153 |  |
| **B5.2.5 explain some of the difficulties of investigating brain function (separate science only)** | B10.4 the brain | 152, 153 | (not specifically higher tier) |
| **B5.3 How do hormones control responses in the human body?** | | | |
| B5.3.1 describe the principles of hormonal coordination and control by the human endocrine system | B11.1 principles of hormonal control | 160, 161 |  |
| **B5.3.2 explain the roles of thyroxine and adrenaline in the body, including thyroxine as an example of a negative feedback system** | B11.4 the role of negative feedback | 166, 167 |  |
| **B5.4 Why do we need to maintain a constant internal environment?** | | | |
| B5.4.1 explain the importance of maintaining a constant internal environment in response to internal and external change | B12.1 controlling body temperature | 182, 183 |  |
| B5.4.2 a) describe the function of the skin in the control of body temperature, including changes to sweating, hair erection and blood flow b) describe practical investigations into temperature control of the body PAG6 (separate science only) | B12.1 controlling body temperature | 182, 183 |  |
| **B5.4.3 explain the response of the body to different temperature challenges, including receptors, processing, responses and negative feedback (separate science only)** | B12.1 controlling body temperature B12.3 the human kidney | 182, 183, 186, 187 | only vaguely |
| B5.4.4 explain the effect on cells of osmotic changes in body fluids  *i Learners are not expected to discuss water potential (separate science only)* | B12.2 removing waste products | 184, 185 |  |
| B5.4.5 describe the function of the kidneys in maintaining the water balance of the body, including filtering water and urea from the blood into kidney tubules then reabsorbing as much water as required (separate science only) | B12.3 the human kidney | 186 |  |
| **B5.4.6 describe the effect of ADH on the permeability of the kidney tubules (separate science only)** | B12.3 the human kidney | 187 | no detailed structure |
| **B5.4.7 explain the response of the body to different osmotic challenges, including receptors, processing, response, and negative feedback (separate science only)** | B12.1 controlling body temperature B12.3 the human kidney | 182, 183, 186, 187 | only vaguely |
| B5.4.8 in the context of maintaining a constant internal environment: a) extract and interpret data from graphs, charts and tables b) translate information between numerical and graphical forms | MS4 data and graphs | 333, 334 |  |
| **B5.5 What role do hormones play in human reproduction?** | | | |
| B5.5.1 describe the role of hormones in human reproduction, including the control of the menstrual cycle | B11.1 principles of hormonal control  B11.5 human reproduction | 160, 168, 169 | (mention of FSH, oestrogen) |
| **B5.5.2 explain the interactions of FSH, LH, oestrogen and progesterone in the control of the menstrual cycle** | B11.6 hormones and the menstrual cycle | 170, 171 |  |
| B5.5.3 explain the use of hormones in contraception and evaluate hormonal and non-hormonal methods of contraception | B11.7 the artificial control of fertility | 172, 173 |  |
| **B5.5.4 explain the use of hormones in modern reproductive technologies to treat infertility** | B11.8 infertility treatments | 174, 175 |  |
| **B5.6 What can happen when organs and control systems stop working?** | | | |
| B5.6.1 explain how insulin controls the blood sugar level in the body | B11.2 the control of blood glucose levels | 162, 163 |  |
| **B5.6.2 explain how glucagon and insulin work together to control the blood sugar level in the body** | B11.2 the control of blood glucose levels | 162 |  |
| B5.6.3 compare type 1 and type 2 diabetes and explain how they can be treated | B11.3 treating diabetes | 164, 165 |  |
| B5.6.4 a) explain how the main structures of the eye are related to their functions, including the cornea, iris, lens, ciliary muscle and retina and to include the use of ray diagrams b) describe practical investigations into the response of the pupil in different light conditions PAG6 (separate science only) | 10.5 the eye | 154, 155 |  |
| B5.6.5 describe common defects of the eye, including short-sightedness, long-sightedness and cataracts, and explain how these problems may be overcome, including using ray diagrams to illustrate the effect of lenses (separate science only) | B10.6 common problems of the eye | 156, 157 |  |
| **B5.6.6 explain some of the limitations in treating damage and disease in the brain and other parts of the nervous system (separate science only)** | B10.4 the brain | 152, 153 | (not specifically higher tier) |
| **Chapter B6 Life on Earth - past, present and future** | | | |
| **B6.1 How was the theory of evolution developed?** | | | |
| B6.1.1 state that there is usually extensive genetic variation within a population of a species | B14.1 variation | 218, 219 |  |
| B6.1.2 recall that genetic variants arise from mutations, and that most have no effect on the phenotype, some influence phenotype and a very few determine phenotype | B13.6 gene expression and mutation | 206, 207 | (in higher tier) |
| B6.1.3 explain how evolution occurs through natural selection of variants that give rise to phenotypes better suited to their environment | B14.2 evolution by natural selection | 220, 221 |  |
| B6.1.4 explain the importance of competition in a community, with regard to natural selection | B16.4 competition in animals | 264 |  |
| B6.1.5 describe evolution as a change in the inherited characteristics of a population over a number of generations through a process of natural selection which may result in the formation of new species | B14.2 evolution by natural selection | 220, 221 |  |
| B6.1.6 explain the impact of the selective breeding of food plants and domesticated animals | B14.3 selective breeding | 222, 223 |  |
| B6.1.7 describe how fossils provide evidence for evolution | B15.5 evidence for evolution  B15.6 fossils and extinction B15.8 antibiotic resistant bacteria | 242, 243, 244, 245, 248, 249 |  |
| B6.1.8 describe the work of Darwin and Wallace in the development of the theory of evolution by natural selection (separate science only) | B15.2 theories of evolution  B15.3 accepting Darwin’s ideas  B15.4 evolution and speciation | 236, 237, 238, 239, 240, 241 |  |
| B6.1.9 describe modern examples of evidence for evolution including antibiotic resistance in bacteria | B15.5 evidence for evolution  B15.6 fossils and extinction B15.8 antibiotic resistant bacteria | 242, 243, 244, 245, 248, 249 |  |
| B6.1.10 explain the impact of these ideas on modern biology and society (separate science only) | B15.2 theories of evolution  B15.3 accepting Darwin’s ideas  B15.4 evolution and speciation | 236, 237, 238, 239, 240, 241 |  |
| **B6.2 How do sexual and asexual reproduction affect evolution? (separate science only)** | | | |
| B6.2.1 explain some of the advantages and disadvantages of asexual and sexual reproduction in a range of organisms | B13.1 types of reproduction | 196, 197 |  |
| **B6.3 How does our understanding of biology help us classify the diversity of organisms on Earth?** | | | |
| B6.3.1 describe the impact of developments in biology on classification systems, including the use of DNA analysis to classify organisms | B15.9 classification B15.10 new systems of classification | 250, 251, 252, 253 |  |
| **B6.4 How is biodiversity threatened and how can we protect it?** | | | |
| B6.4.1 describe both positive and negative human interactions within ecosystems and explain their impact on biodiversity | B18.1 the human population explosion B18.2 land and water pollution | 286, 287, 288, 289 |  |
| **B6.4.2 evaluate evidence for the impact of environmental changes on the distribution of organisms, with reference to water and atmospheric gases (separate science only)** | B18.6 the impact of change | 296, 297 |  |
| B6.4.3 describe some of the biological factors affecting levels of food security including increasing human population, changing diets in wealthier populations, new pests and pathogens, environmental change, sustainability and cost of agricultural inputs (separate science only) | B18.10 factors affecting food security | 304, 305 |  |
| B6.4.4 explain some of the benefits and challenges of maintaining local and global biodiversity | B18.7 maintaining biodiversity | 298, 299 |  |
| B6.4.5 extract and interpret information related to biodiversity from charts, graphs and tables | MS4 data and graphs | 333, 334 |  |
| B6.4.6 describe and explain some possible biotechnological and agricultural solutions, including genetic modification, to the demands of the growing human population (separate science only) | B14.4 genetic engineering B14.7 ethics of genetic technology | 225, 230, 231 |  |

## AQA Collins textbook mapping

| **Specification statement** | **Chapter covering specification statement** | **Page number** | **Comments** |
| --- | --- | --- | --- |
| **Chapter B1 You and your genes** | | | |
| **B1.1 What is the genome and what does it do?** | | | |
| B1.1.1 a) explain how the nucleus and genetic material of eukaryotic cells (plants and animals) and the genetic material, including plasmids, of prokaryotic cells are related to cell functions b) describe how to use a light microscope to observe a variety of plant and animal cells PAG1 | 1.2 the light microscope | 16, 17 | staining not mentioned |
| B1.1.2 describe the genome as the entire genetic material of an organism | 6.1 DNA and genes | 238, 239 |  |
| B1.1.3 describe DNA as a polymer made up of nucleotides, forming two strands in a double helix | 6.1 DNA and genes 6.4 structure of DNA | 238, 244, 245 |  |
| B1.1.4 describe simply how the genome and its interaction with the environment influence the development of the phenotype of an organism, including the idea that most characteristics depend on instructions in the genome and are modified by interaction of the organism with its environment  *i Learners are not expected to describe epigenetic effects* | 6.1 DNA and genes 6.9 genetics | 238, 239, 254, 255 |  |
| B1.1.5 explain the terms chromosome, gene, allele, variant, genotype and phenotype | 6.1 DNA and genes 6.7 meiosis 6.9 genetics | 238, 239, 250, 251, 254, 255 |  |
| B1.1.6 explain the importance of amino acids in the synthesis of proteins, including the genome as instructions for the polymerisation of amino acids to make proteins | 6.5 proteins | 246, 247 |  |
| B1.1.7 describe DNA as a polymer made from four different nucleotides, each nucleotide consisting of a common sugar and phosphate group with one of four different bases attached to the sugar (separate science only) | 6.4 structure of DNA | 244, 245 |  |
| **B1.1.8 explain simply how the sequence of bases in DNA codes for the proteins made in protein synthesis, including the idea that each set of three nucleotides is the code for an amino acid (separate science only)** | 6.5 proteins | 246, 247 |  |
| **B1.1.9 recall a simple description of protein synthesis, in which: • a copy of a gene is made from messenger RNA (mRNA) • the mRNA travels to a ribosome in the cytoplasm • the ribosome joins amino acids together in an order determined by the mRNA i Learners are not expected to recall details of transcription and translation (separate science only)** | 6.5 proteins | 246, 247 |  |
| **B1.1.10 recall that all genetic variants arise from mutations (separate science only)** | 6.6 mutations | 248, 249 |  |
| **B1.1.11 describe how genetic variants in coding DNA may influence phenotype by altering the activity of a protein (separate science only)** | 6.6 mutations | 248, 249 |  |
| **B1.1.12 describe how genetic variants in non-coding DNA may influence phenotype by altering how genes are expressed (separate science only)** | 6.6 mutations | 248, 249 |  |
| **B1.2 How is genetic information inherited?** | | | |
| B1.2.1 explain the terms gamete, homozygous, heterozygous, dominant and recessive | 6.1 DNA and genes 6.7 meiosis 6.9 genetics | 238, 239, 250, 251, 254, 255 |  |
| B1.2.2 explain single gene inheritance, including dominant and recessive alleles and use of genetic diagrams | 6.10 genetic crosses | 256, 257 |  |
| B1.2.3 predict the results of single gene crosses | 6.10 genetic crosses | 256, 257 |  |
| B1.2.4 use direct proportions and simple ratios in genetic crosses | 6.14 maths skills - fractions ratio proportion and probability | 264, 265 |  |
| B1.2.5 use the concept of probability in predicting the outcome of genetic crosses | 6.14 maths skills - fractions ratio proportion and probability | 264, 265 |  |
| B1.2.6 recall that most phenotypic features are the result of multiple genes rather than single gene inheritance   *i Learners are not expected to describe epistasis and its effects* | 6.13 key concept genetics is simple - or is it? | 262, 263 |  |
| B1.2.7 describe the development of our understanding of genetics including the work of Mendel **and the modern-day use of genome sequencing** (separate science only) | 6.12 Gregor Mendel 6.2 the human genome 6.3 tracing human migration | 260, 261, 240, 241, 242, 243 |  |
| B1.2.8 describe sex determination in humans | 6.7 meiosis | 251 |  |
| **B1.3 How can and should gene technology be used?** | | | |
| B1.3.1 discuss the potential importance for medicine of our increasing understanding of the human genome, including the discovery of alleles associated with diseases and the genetic testing of individuals to inform family planning and healthcare | 1.10 stem cell banks | 32, 33 |  |
| B1.3.2 describe genetic engineering as a process which involves modifying the genome of an organism to introduce desirable characteristics | 7.14 genetic engineering | 300, 301 |  |
| **B1.3.3 describe the main steps in the process of genetic engineering including: • isolating and replicating the required gene(s) • putting the gene(s) into a vector (e.g. a plasmid) • using the vector to insert the gene(s) into cells • selecting modified cells** | 7.14 genetic engineering | 301 |  |
| B1.3.4 explain some of the possible benefits and risks, including practical and ethical considerations, of using gene technology in modern agriculture and medicine | 7.15 genetically modified crops: the science 7.16 is genetic modification safe  7.17 Ethically wrong, or essential? | 302, 303, 304, 305, 306, 307 |  |
| **Chapter B2 Keeping healthy** | | | |
| **B2.1 What are the causes of disease?** | | | |
| B2.1.1 describe the relationship between health and disease | 4.1 learning about health | 130, 131 |  |
| B2.1.2 describe different types of diseases (including communicable and non-communicable diseases) | 4.1 learning about health | 130, 131 |  |
| B2.1.3 explain how communicable diseases (caused by viruses, bacteria, protists and fungi) are spread in animals and plants | 4.6 learning about viral diseases  4.7 studying bacterial diseases  4.8 looking at fungal diseases | 140, 141, 142, 143, 144, 145 |  |
| B2.1.4 describe common human infections including influenza (viral), Salmonella (bacterial), Athlete’s foot (fungal) and malaria (protist) and sexually transmitted infections in humans including HIV/AIDS (viral) | 4.6 learning about viral diseases  4.7 studying bacterial diseases  4.8 looking at fungal diseases  4.16 looking at plant diseases | 140, 141, 142, 143, 144, 145, 160, 161 |  |
| B2.1.5 describe plant diseases including tobacco mosaic virus (viral), ash dieback (fungal) and crown gall disease (bacterial) | 4.6 learning about viral diseases  4.7 studying bacterial diseases  4.8 looking at fungal diseases  4.16 looking at plant diseases | 140, 141, 142, 143, 144, 145, 160, 161 |  |
| **B2.2 How do organisms protect themselves against pathogens?** | | | |
| B2.2.1 describe non-specific defence systems of the human body against pathogens, including examples of physical, chemical and microbial defences | 4.13 building immunity | 154, 155 |  |
| B2.2.2 explain how platelets are adapted to their function in the blood | 4.10 protecting the body 4.11 exploring white blood cells | 148, 149, 150, 151 |  |
| B2.2.3 describe physical plant defences, including leaf cuticle and cell wall (separate science only) | 4.17 learning about plant defences | 162, 163 |  |
| B2.2.4 explain the role of the immune system of the human body in defence against disease | 4.13 building immunity | 154, 155 |  |
| B2.2.5 explain how white blood cells are adapted to their functions in the blood, including what they do and how it helps protect against disease | 4.10 protecting the body 4.11 exploring white blood cells | 148, 149, 150, 151 |  |
| B2.2.6 describe chemical plant defence responses, including antimicrobial substances (separate science only) | 4.17 learning about plant defences | 162, 163 |  |
| **B2.3 How can we prevent the spread of infection?** | | | |
| B2.3.1 explain how the spread of communicable diseases may be reduced or prevented in animals and plants, to include a minimum of one common human infection, one plant disease and sexually transmitted infections in humans including HIV/AIDS | 4.13 building immunity 4.6 learning about viral diseases  4.7 studying bacterial diseases  4.8 looking at fungal diseases  4.16 looking at plant diseases | 154, 155, 140-145, 160, 161 |  |
| B2.3.2 explain the use of vaccines in the prevention of disease, including the use of safe forms of pathogens and the need to vaccinate a large proportion of the population | 4.13 building immunity | 154, 155 |  |
| **B2.4 How can we identify the cause of an infection? (separate science only)** | | | |
| B2.4.1 a) describe ways in which diseases, including plant diseases, can be detected and identified, in the lab and in the field b) describe how to use a light microscope to observe microorganisms PAG1 | 4.16 looking at plant diseases | 161 |  |
| B2.4.2 describe and explain the aseptic techniques used in culturing organisms PAG7 | 1.14 growing microorganisms | 40, 41 |  |
| B2.4.3 calculate cross-sectional areas of bacterial cultures and of clear zones around antibiotic discs on agar jelly using πr2 PAG7 | 0 | 0 | not found |
| **B2.4.4 describe how monoclonal antibodies are produced including the following steps: • antigen injected into an animal • antibody-producing cells taken from animal • cells producing the correct antibody selected then cultured** | 4.15 investigating monoclonal antibodies | 158, 159 |  |
| **B2.4.5 describe some of the ways in which monoclonal antibodies can be used in diagnostic tests** | 4.15 investigating monoclonal antibodies | 158, 159 |  |
| **B2.5 How can lifestyle, genes and the environment affect health?** | | | |
| B2.5.1 a) describe how the interaction of genetic and lifestyle factors can increase or decrease the risk of developing non-communicable human diseases, including cardiovascular diseases, many forms of cancer, some lung and liver diseases and diseases influenced by nutrition, including type 2 diabetes b) describe how to practically investigate the effect of exercise on pulse rate and recovery rate PAG6 | 4.3 exploring non communicable diseases | 134 135 |  |
| B2.5.2 use given data to explain the incidence of non-communicable diseases at local, national and global levels with reference to lifestyle factors, including exercise, diet, alcohol and smoking | 4.2 key concept looking at risk factors | 132 133 |  |
| B2.5.3 in the context of data related to the causes, spread, effects and treatment of disease: a) translate information between graphical and numerical forms b) construct and interpret frequency tables and diagrams, bar charts and histograms c) understand the principles of sampling as applied to scientific data d) use a scatter diagram to identify a correlation between two variables | 3.18 maths skills extracting and interpreting information  7.21 maths skills - using charts and graphs to display data  4.18 maths skills - sampling & scientific data 4.4 analysing and evaluating data | 122, 123, 314, 315, 164, 165, 136, 137 |  |
| B2.5.4 describe interactions between different types of disease | 4.1 learning about health | 130, 131 | HPV & cervical cancer |
| **B2.6 How can we treat disease?** | | | |
| B2.6.1 explain the use of medicines, including antibiotics, in the treatment of disease | 4.13 building immunity | 154, 155 |  |
| B2.6.2 calculate cross-sectional areas of bacterial cultures and of clear zones around antibiotic discs on agar jelly using πr2 PAG7 | 0 | 0 | not found |
| B2.6.3 evaluate some different treatments for cardiovascular disease, including lifestyle changes, medicines and surgery | 4.2 key concept looking at risk factors | 132, 133 |  |
| B2.6.4 describe the process of discovery and development of potential new medicines including preclinical and clinical testing | 4.14 making new drugs | 156, 157 |  |
| **B2.6.5 describe how monoclonal antibodies can be used to treat cancer including: • produce monoclonal antibodies specific to a cancer cell antigen • inject the antibodies into the blood • the antibodies bind to cancer cells, tagging them for attack by white blood cells • the antibodies can also be attached to a radioactive or toxic substance to deliver it to cancer cells (separate science only)** | 4.15 investigating monoclonal antibodies | 158, 159 |  |
| **Chapter B3 Living together - food and ecosystems** | | | |
| **B3.1 What happens during photosynthesis?** | | | |
| B3.1.1 a) describe the process of photosynthesis, including the inputs and outputs of the two mains stages and the requirement of light in the first stage, and describe photosynthesis as an endothermic process b) describe practical investigations into the requirements and products of photosynthesis PAG5 | 2.1 explaining photosynthesis | 56, 57 |  |
| B3.1.2 explain how chloroplasts in plant cells are related to photosynthesis | 2.1 explaining photosynthesis | 56 |  |
| B3.1.3 a) explain the mechanism of enzyme action including the active site, enzyme specificity and factors affecting the rate of enzyme-catalysed reactions, including substrate concentration, temperature and pH b) describe practical investigations into the effect of substrate concentration, temperature and pH on the rate of enzyme controlled reactions PAG4 | 3.5 explaining enzymes  3.6 required practical | 96, 97, 98 |  |
| B3.1.4 a) explain the effect of temperature, light intensity and carbon dioxide concentration on the rate of photosynthesis b) describe practical investigations into the effect of environmental factors on the rate of photosynthesis PAG5 | 2.5 increasing photosynthesis 2.4 required practical | 64, 65, 62, 63 |  |
| **B3.1.5 use the inverse square law to explain changes in the rate of photosynthesis with distance from a light source** | 0 | 0 | not found |
| **B3.1.6 explain the interaction of temperature, light intensity and carbon dioxide concentration in limiting the rate of photosynthesis, and use graphs depicting the effects** | 2.5 increasing photosynthesis | 64, 65 | not specified as higher |
| B3.1.7 in the context of the rate of photosynthesis: a) understand and use simple compound measures such as the rate of a reaction b) translate information between graphical and numerical form c) plot and draw appropriate graphs selecting appropriate scales for axes d) extract and interpret information from graphs, charts and tables | 2.5 increasing photosynthesis 3.18 maths skills extracting and interpreting information 7.21 maths skills - using charts and graphs to display data | 64, 122, 123, 314, 315 |  |
| **B3.2 How do producers get the substances they need?** | | | |
| B3.2.1 describe some of the substances transported into and out of photosynthetic organisms in terms of the requirements of those organisms, including oxygen, carbon dioxide, water and mineral ions | 3.1 explaining water movement 3.3 learning about active transport | 88 89 92 93 | also 3.2 required practical p90 91 |
| B3.2.2 a) explain how substances are transported into and out of cells through diffusion, osmosis and active transport b) describe practical investigations into the processes of diffusion and osmosis PAG8 *i Learners are not expected to explain osmosis in terms of water potential* | 3.1 explaining water movement 3.3 learning about active transport | 88, 89, 92, 93 | also 3.2 required practical p90 91 |
| B3.2.3 explain how the partially-permeable cell membranes of plant cells and prokaryotic cells are related to diffusion, osmosis and active transport | 3.1 explaining water movement 3.3 learning about active transport | 88, 89, 92, 93 | also 3.2 required practical p90 91 |
| B3.2.4 explain how water and mineral ions are taken up by plants, relating the structure of the root hair cells to their function | 3.11 learning about plants and minerals | 108, 109 |  |
| B3.2.5 a) explain how the structure of the xylem and phloem are adapted to their functions in the plant b) describe how to use a light microscope to observe the structure of the xylem and phloem PAG1 | 2.9 moving water | 72, 73 |  |
| B3.2.6 a) describe the processes of transpiration and translocation, including the structure and function of the stomata b) describe how to use a light microscope to observe the structure of stomata PAG1 c) describe how to use a simple potometer PAG6  *i Learners are not expected to describe transpiration in terms of tension or pressure, and are not expected to describe translocation in terms of water potential or hydrostatic pressure* | 2.8 looking at stomata 2.9 moving water 2.10 investigating transpiration | 70, 71, 72, 73, 75 |  |
| B3.2.7 a) explain the effect of a variety of environmental factors on the rate of water uptake by a plant, to include light intensity, air movement, and temperature b) describe practical investigations into the effect of environmental factors on the rate of water uptake by a plant PAG6 | 2.10 investigating transpiration | 74, 75 |  |
| B3.2.8 in the context of water uptake by plants: a) use simple compound measures such as rate b) carry out rate calculations c) plot, draw and interpret appropriate graphs d) calculate percentage gain and loss of mass | 2.5 increasing photosynthesis  3.18 maths skills extracting and interpreting information 7.21 maths skills - using charts and graphs to display data | 64, 122, 123, 314, 315 | percentiles not found |
| **B3.3 How are organisms in an ecosystem interdependent?** | | | |
| B3.3.1 a) explain the importance of sugars, fatty acids and glycerol, and amino acids in the synthesis and breakdown of carbohydrates, lipids and proteins b) describe the use of qualitative tests for biological molecules PAG2 | 3.8 explaining digestion | 103 |  |
| B3.3.2 describe photosynthetic organisms as the main producers of food and therefore biomass for life on Earth | 2.1 explaining photosynthesis | 56 |  |
| B3.3.3 describe some of the substances transported into organisms in terms of the requirements of those organisms, including dissolved food molecules | 3.10 looking more at exchange surfaces | 106, 107 |  |
| B3.3.4 describe different levels of organisation in an ecosystem from individual organisms to the whole ecosystem | 8.1 key concept learning about ecosystems | 324, 325 |  |
| B3.3.5 explain the importance of interdependence and competition in a community | 8.3 investigating predator-prey relationships | 328, 329 | mutualism not mentioned |
| B3.3.6 describe the differences between the trophic levels of organisms within an ecosystem (separate science only) | 8.4 looking at trophic levels | 330, 331 |  |
| B3.3.7 describe pyramids of biomass and explain, with examples, how biomass is lost between the different trophic levels (separate science only) | 8.4 looking at trophic levels  8.5 transferring biomass | 330, 331, 332, 333 |  |
| B3.3.8 calculate the efficiency of biomass transfers between trophic levels and explain how this affects the number of organisms at each trophic level (separate science only) | 8.5 transferring biomass | 333 |  |
| B3.3.9 recall that many different substances cycle through the abiotic and biotic components of an ecosystem, including carbon and water | 8.2 changing abiotic factors 8.10 cycling materials | 326, 327, 342, 343 |  |
| B3.3.10 explain the importance of the carbon cycle and the water cycle to living organisms | 8.10 cycling materials 8.11 carbon cycling | 342, 343, 344, 345 |  |
| B3.3.11 explain the role of microorganisms in the cycling of substances through an ecosystem | 8.10 cycling materials | 343 |  |
| B3.3.12 calculate the percentage of mass, in the context of the use and cycling of substances in ecosystems | 6.14 maths skills - fractions ratio proportion and probability | 264, 265 |  |
| B3.3.13 explain the effect of factors such as temperature and water content on rate of decomposition in aerobic and anaerobic environments (separate science only) | 8.12 investigating decay | 346, 347 | terms aerobic and anaerobic not used |
| B3.3.14 calculate rate changes in the decay of biological material (separate science only) | 6.14 maths skills - fractions ratio proportion and probability | 264, 265 |  |
| **B3.4 How are populations affected by conditions in an ecosystem?** | | | |
| B3.4.1 explain how some abiotic and biotic factors affect communities, including environmental conditions, toxic chemicals, availability of food and other resources, and the presence of predators and pathogens | 8.2 changing abiotic factors | 326, 327 |  |
| B3.4.2 describe how to carry out a field investigation into the distribution and abundance of organisms in an ecosystem and explain how to determine their numbers in a given area PAG3 | 8.7 required practical - measure the population size of a common species in a habitat | 336, 337 | Transect, capture-recapture not mentioned |
| B3.4.3 in the context of data related to organisms within a population: a) calculate arithmetic means b) use fractions and percentages c) plot and draw appropriate graphs selecting appropriate scales for the axes d) extract and interpret information from charts, graphs and tables | 5.29 maths skills the spread of scientific data 6.14 maths skills - fractions ratio proportion and probability 7.21 maths skills - using charts and graphs to display data | 228, 264, 265, 314, 315 |  |
| **Chapter B4 Using food and controlling growth** | | | |
| **B4.1 What happens during cellular respiration?** | | | |
| B4.1.1 compare the processes of aerobic and anaerobic respiration, including conditions under which they occur, the inputs and outputs, and comparative yields of ATP | 1.12 cells at work 1.13 living without oxygen | 36, 37, 38, 39 |  |
| B4.1.2 explain why cellular respiration occurs continuously in all living cells | 1.12 cells at work | 36, 37 |  |
| B4.1.3 explain how mitochondria in eukaryotic cells (plants and animals) are related to cellular respiration | 1.3 looking at cells in more detail  1.5 primitive cells | 18, 19, 22, 23 |  |
| B4.1.4 describe cellular respiration as an exothermic process | 1.12 cells at work | 37 |  |
| B4.1.5 a) describe practical investigations into the effect of different substrates on the rate of respiration in yeast PAG5 b) carry out rate calculations for chemical reactions in the context of cellular respiration | 1.12 cells at work 1.13 living without oxygen | 36, 37, 38, 39 |  |
| **B4.2 How do we know about mitochondria and other cell structures?** | | | |
| B4.2.1 explain how electron microscopy has increased our understanding of sub-cellular structures | 1.3 looking at cells in more detail | 18, 19 |  |
| B4.2.2 in the context of cells and sub-cellular structures: a) demonstrate an understanding of number, size and scale and the quantitative relationship between units b) use estimations and explain when they should be used **c) calculate with numbers written in standard form** | 1.1 looking at cells 1.17 maths skills size and number | 14, 15, 46, 47 |  |
| **B4.3 How do organisms grow and develop?** | | | |
| B4.3.1 a) describe the role of the cell cycle in growth, including interphase and mitosis b) describe how to use a light microscope to observe stages of mitosis PAG1  *i Learners are not expected to recall intermediate phases* | 1.6 cell division | 24, 25 |  |
| B4.3.2 describe cancer as the result of changes in cells that lead to uncontrolled growth and division | 4.3 exploring non communicable diseases | 134, 135 |  |
| B4.3.3 explain the role of meiotic cell division in halving the chromosome number to form gametes, including the stages of interphase and two meiotic divisions  *i Learners are not expected to recall intermediate phases* | 6.7 meiosis | 250, 251 |  |
| B4.3.4 describe the function of stem cells in embryonic and adult animals and meristems in plants | 1.9 stem cells | 30, 31 |  |
| B4.3.5 explain the importance of cell differentiation, in which cells become specialised by switching genes off and on to form tissues with particular functions | 1.7 cell differentiation | 26, 27 |  |
| **B4.4 How is plant growth controlled? (separate science only)** | | | |
| B4.4.1 a) explain how plant hormones are important in the control and coordination of plant growth and development, with reference to the role of auxins in phototropisms and gravitropisms b) describe practical investigations into the role of auxin in phototropism PAG6 | 5.25 auxins | 220, 221 |  |
| **B4.4.2 describe some of the variety of effects of plant hormones, relating to gibberellins and ethene** | 5.25 auxins 5.26 applications of auxins  5.28 other plant hormones | 220, 221, 222, 223, 226, 227 |  |
| **B4.4.3 describe some of the different ways in which people use plant hormones to control plant growth** | 5.26 applications of auxins  5.28 other plant hormones | 222, 223, 226, 227 |  |
| **B4.5 Should we use stem cells to treat damage and disease?** | | | |
| B4.5.1 discuss potential benefits, risks and ethical issues associated with the use of stem cells in medicine | 1.9 stem cells | 30, 31 |  |
| **Chapter B5 The human body - staying alive** | | | |
| **B5.1 How do substances get into, out of and around our bodies?** | | | |
| B5.1.1 describe some of the substances transported into and out of the human body in terms of the requirements of cells, including oxygen, carbon dioxide, water, dissolved food molecules and urea | 3.10 looking more at exchange surfaces | 106, 107 |  |
| B5.1.2 explain how the partially-permeable cell membranes of animal cells are related to diffusion, osmosis and active transport | 3.1 explaining water movement 3.3 learning about active transport | 88, 89, 92, 93 | also 3.2 required practical p90 91 |
| B5.1.3 describe the human circulatory system, including its relationships with the gaseous exchange system, the digestive system and the excretory system | 3.13 learning about the circulatory system | 112, 113 |  |
| B5.1.4 explain how the structure of the heart is adapted to its function, including cardiac muscle, chambers and valves | 3.14 exploring the heart | 114, 115 |  |
| B5.1.5 explain how the structures of arteries, veins and capillaries are adapted to their functions, including differences in the vessel walls and the presence of valves | 3.14 exploring the heart | 114, 115 |  |
| B5.1.6 explain how red blood cells and plasma are adapted to their functions in the blood | 3.15 studying blood | 116, 117 |  |
| B5.1.7 explain the need for exchange surfaces and a transport system in multicellular organisms in terms of surface area : volume ratio | 3.4 key concept 2.12 maths skills | 94, 95, 78, 79 |  |
| B5.1.8 calculate surface area : volume ratios | 2.12 maths skills | 78, 79 |  |
| **B5.2 How does the nervous system help us respond to changes?** | | | |
| B5.2.1 explain how the components of the nervous system work together to enable it to function, including sensory receptors, sensory neurons, the CNS, motor neurons and effectors | 5.2 the nervous system | 174, 175 |  |
| B5.2.2 explain how the structures of nerve cells and synapses relate to their functions   *i Learners are not expected to explain nerve impulse transmission in terms of membrane potentials* | 5.2 the nervous system | 174, 175 |  |
| B5.2.3 a) explain how the structure of a reflex arc, including the relay neuron, is related to its function b) describe practical investigations into reflex actions PAG6 | 5.3 reflex actions | 176, 177 |  |
| B5.2.4 describe the structure and function of the brain and roles of the cerebral cortex (intelligence, memory, language and consciousness), cerebellum (conscious movement) and brain stem (regulation of heart and breathing rate) (separate science only) | 5.4 the brain | 178, 179 |  |
| **B5.2.5 explain some of the difficulties of investigating brain function (separate science only)** | 5.4 the brain | 178, 179 |  |
| **B5.3 How do hormones control responses in the human body?** | | | |
| B5.3.1 describe the principles of hormonal coordination and control by the human endocrine system | 5.10 the endocrine system | 190, 191 |  |
| **B5.3.2 explain the roles of thyroxine and adrenaline in the body, including thyroxine as an example of a negative feedback system** | 5.16 negative feedback | 202, 203 |  |
| **B5.4 Why do we need to maintain a constant internal environment?** | | | |
| B5.4.1 explain the importance of maintaining a constant internal environment in response to internal and external change | 5.1 homeostasis | 172, 173 |  |
| B5.4.2 a) describe the function of the skin in the control of body temperature, including changes to sweating, hair erection and blood flow b) describe practical investigations into temperature control of the body PAG6 (separate science only) | 5.9 controlling body temperature | 188, 189 |  |
| **B5.4.3 explain the response of the body to different temperature challenges, including receptors, processing, responses and negative feedback (separate science only)** | 5.14 water balance | 198, 199 |  |
| B5.4.4 explain the effect on cells of osmotic changes in body fluids  *i Learners are not expected to discuss water potential (separate science only)* | 5.14 water balance | 198, 199 |  |
| B5.4.5 describe the function of the kidneys in maintaining the water balance of the body, including filtering water and urea from the blood into kidney tubules then reabsorbing as much water as required (separate science only) | 5.15 the kidneys | 200, 201 |  |
| **B5.4.6 describe the effect of ADH on the permeability of the kidney tubules (separate science only)** | 5.15 the kidneys | 201 |  |
| **B5.4.7 explain the response of the body to different osmotic challenges, including receptors, processing, response, and negative feedback (separate science only)** | 5.14 water balance | 198, 199 |  |
| B5.4.8 in the context of maintaining a constant internal environment: a) extract and interpret data from graphs, charts and tables b) translate information between numerical and graphical forms | 3.18 maths skills extracting and interpreting information | 122, 123 |  |
| **B5.5 What role do hormones play in human reproduction?** | | | |
| B5.5.1 describe the role of hormones in human reproduction, including the control of the menstrual cycle | 5.19 human reproduction | 208 |  |
| **B5.5.2 explain the interactions of FSH, LH, oestrogen and progesterone in the control of the menstrual cycle** | 5.19 human reproduction | 209 |  |
| B5.5.3 explain the use of hormones in contraception and evaluate hormonal and non-hormonal methods of contraception | 5.23 contraception 5.24 which contraceptive? | 216, 217, 218, 219 |  |
| **B5.5.4 explain the use of hormones in modern reproductive technologies to treat infertility** | 5.20 IVF | 211 |  |
| **B5.6 What can happen when organs and control systems stop working?** | | | |
| B5.6.1 explain how insulin controls the blood sugar level in the body | 5.11 controlling blood glucose | 192, 193 |  |
| **B5.6.2 explain how glucagon and insulin work together to control the blood sugar level in the body** | 5.11 controlling blood glucose | 193 |  |
| B5.6.3 compare type 1 and type 2 diabetes and explain how they can be treated | 5.12 diabetes 5.13 diabetes recommendations | 194, 195, 196, 197 |  |
| B5.6.4 a) explain how the main structures of the eye are related to their functions, including the cornea, iris, lens, ciliary muscle and retina and to include the use of ray diagrams b) describe practical investigations into the response of the pupil in different light conditions PAG6 (separate science only) | 5.6 the eye | 182, 183 |  |
| B5.6.5 describe common defects of the eye, including short-sightedness, long-sightedness and cataracts, and explain how these problems may be overcome, including using ray diagrams to illustrate the effect of lenses (separate science only) | 5.8 eye defects | 186, 187 |  |
| **B5.6.6 explain some of the limitations in treating damage and disease in the brain and other parts of the nervous system (separate science only)** | 5.4 the brain | 178, 179 |  |
| **Chapter B6 Life on Earth - past, present and future** | | | |
| **B6.1 How was the theory of evolution developed?** | | | |
| B6.1.1 state that there is usually extensive genetic variation within a population of a species | 7.1 variation | 274, 275 |  |
| B6.1.2 recall that genetic variants arise from mutations, and that most have no effect on the phenotype, some influence phenotype and a very few determine phenotype | 6.6 mutations | 248, 249 |  |
| B6.1.3 explain how evolution occurs through natural selection of variants that give rise to phenotypes better suited to their environment | 7.1 variation 7.2 the theory of evolution | 274, 275, 276, 277 |  |
| B6.1.4 explain the importance of competition in a community, with regard to natural selection | 7.2 the theory of evolution (environmental change) | 277 | figure 7.6 |
| B6.1.5 describe evolution as a change in the inherited characteristics of a population over a number of generations through a process of natural selection which may result in the formation of new species | 7.2 the theory of evolution 7.7 a new species | 276, 277, 286, 287 |  |
| B6.1.6 explain the impact of the selective breeding of food plants and domesticated animals | 7.12 selective breeding 7.13 producing new plant varieties | 296, 297, 298, 299 |  |
| B6.1.7 describe how fossils provide evidence for evolution | 7.4 fossil evidence 7.5 how much have organisms changed 7.10 antimicrobial resistance | 280, 281, 282, 283, 292, 293 |  |
| B6.1.8 describe the work of Darwin and Wallace in the development of the theory of evolution by natural selection (separate science only) | 7.6 Darwin and Wallace | 284, 285 |  |
| B6.1.9 describe modern examples of evidence for evolution including antibiotic resistance in bacteria | 7.4 fossil evidence 7.5 how much have organisms changed 7.10 antimicrobial resistance | 280, 281, 282, 283, 292, 293 |  |
| B6.1.10 explain the impact of these ideas on modern biology and society (separate science only) | 7.6 Darwin and Wallace | 284, 285 |  |
| **B6.2 How do sexual and asexual reproduction affect evolution? (separate science only)** | | | |
| B6.2.1 explain some of the advantages and disadvantages of asexual and sexual reproduction in a range of organisms | 6.8 asexual and sexual reproduction | 252, 253 |  |
| **B6.3 How does our understanding of biology help us classify the diversity of organisms on Earth?** | | | |
| B6.3.1 describe the impact of developments in biology on classification systems, including the use of DNA analysis to classify organisms | 7.19 the tree of life | 310, 311 |  |
| **B6.4 How is biodiversity threatened and how can we protect it?** | | | |
| B6.4.1 describe both positive and negative human interactions within ecosystems and explain their impact on biodiversity | 8.15 learning about land use 8.16 changing the landscape  8.19 investigating pollution  8.20 maintaining biodiversity | 352, 353, 354, 355, 360, 361, 362, 363 |  |
| **B6.4.2 evaluate evidence for the impact of environmental changes on the distribution of organisms, with reference to water and atmospheric gases (separate science only)** | 8.14 changing the environment | 350, 351 | not higher tier |
| B6.4.3 describe some of the biological factors affecting levels of food security including increasing human population, changing diets in wealthier populations, new pests and pathogens, environmental change, sustainability and cost of agricultural inputs (separate science only) | 8.21 learning about food security | 364, 365 |  |
| B6.4.4 explain some of the benefits and challenges of maintaining local and global biodiversity | 8.20 maintaining biodiversity | 362, 363 |  |
| B6.4.5 extract and interpret information related to biodiversity from charts, graphs and tables | 7.21 maths skills - using charts and graphs to display data | 314, 315 |  |
| B6.4.6 describe and explain some possible biotechnological and agricultural solutions, including genetic modification, to the demands of the growing human population (separate science only) | 7.14 genetic engineering | 301 |  |

## AQA Hodder textbook mapping

| **Specification statement** | **Chapter covering specification statement** | **Page number** | **Comments** |
| --- | --- | --- | --- |
| **Chapter B1 You and your genes** | | | |
| **B1.1 What is the genome and what does it do?** | | | |
| B1.1.1 a) explain how the nucleus and genetic material of eukaryotic cells (plants and animals) and the genetic material, including plasmids, of prokaryotic cells are related to cell functions b) describe how to use a light microscope to observe a variety of plant and animal cells PAG1 | 1: cell structure | 11,6 | p6 is drawing specimen using light microscope. No mention of staining |
| B1.1.2 describe the genome as the entire genetic material of an organism | 14: reproduction (DNA and the genome) | 183 |  |
| B1.1.3 describe DNA as a polymer made up of nucleotides, forming two strands in a double helix | 14: reproduction | 185 | not specifically called a polymer |
| B1.1.4 describe simply how the genome and its interaction with the environment influence the development of the phenotype of an organism, including the idea that most characteristics depend on instructions in the genome and are modified by interaction of the organism with its environment  *i Learners are not expected to describe epigenetic effects* | 15: variation (causes of variation, types of variation) | 198, 199 |  |
| B1.1.5 explain the terms chromosome, gene, allele, variant, genotype and phenotype | 2: cell division (chromosomes)  14: reproduction (genetic inheritance) | 19, 188, 189 |  |
| B1.1.6 explain the importance of amino acids in the synthesis of proteins, including the genome as instructions for the polymerisation of amino acids to make proteins | 14: reproduction | 186-187 |  |
| B1.1.7 describe DNA as a polymer made from four different nucleotides, each nucleotide consisting of a common sugar and phosphate group with one of four different bases attached to the sugar (separate science only) | 14: reproduction | 185 |  |
| **B1.1.8 explain simply how the sequence of bases in DNA codes for the proteins made in protein synthesis, including the idea that each set of three nucleotides is the code for an amino acid (separate science only)** | 14: reproduction | 187 |  |
| **B1.1.9 recall a simple description of protein synthesis, in which: • a copy of a gene is made from messenger RNA (mRNA) • the mRNA travels to a ribosome in the cytoplasm • the ribosome joins amino acids together in an order determined by the mRNA i Learners are not expected to recall details of transcription and translation (separate science only)** | 14: reproduction | 186-187 |  |
| **B1.1.10 recall that all genetic variants arise from mutations (separate science only)** | 15: variation (mutations) | 200 |  |
| **B1.1.11 describe how genetic variants in coding DNA may influence phenotype by altering the activity of a protein (separate science only)** | 14: reproduction (protein synthesis, mutations) | 186, 187 |  |
| **B1.1.12 describe how genetic variants in non-coding DNA may influence phenotype by altering how genes are expressed (separate science only)** | 14: reproduction (protein synthesis, mutations) | 186, 187 |  |
| **B1.2 How is genetic information inherited?** | | | |
| B1.2.1 explain the terms gamete, homozygous, heterozygous, dominant and recessive | 2: cell division (chromosomes)  14: reproduction (genetic inheritance) | 19, 188, 189 |  |
| B1.2.2 explain single gene inheritance, including dominant and recessive alleles and use of genetic diagrams | 14:reproduction (genetic inheritance) | 188-191 |  |
| B1.2.3 predict the results of single gene crosses | 14:reproduction (genetic inheritance) | 189, 190 |  |
| B1.2.4 use direct proportions and simple ratios in genetic crosses | 14 reproduction | 190 | fig 14.18 not very satisfactory |
| B1.2.5 use the concept of probability in predicting the outcome of genetic crosses | 14 reproduction | 189, 190 | not very satisfactory |
| B1.2.6 recall that most phenotypic features are the result of multiple genes rather than single gene inheritance   *i Learners are not expected to describe epistasis and its effects* | 14: reproduction (genetic inheritance, eye colour) | 190 | in 'tips' |
| B1.2.7 describe the development of our understanding of genetics including the work of Mendel **and the modern-day use of genome sequencing** (separate science only) | 16: the development of understanding of genetics and evolution (understanding of genetics) 14: reproduction (the human genome project) | 217, 218 186 |  |
| B1.2.8 describe sex determination in humans | 14:reproduction (sex determination) | 192-193 |  |
| **B1.3 How can and should gene technology be used?** | | | |
| B1.3.1 discuss the potential importance for medicine of our increasing understanding of the human genome, including the discovery of alleles associated with diseases and the genetic testing of individuals to inform family planning and healthcare | 14: reproduction (the human genome project) | 186 | in 'tips' |
| B1.3.2 describe genetic engineering as a process which involves modifying the genome of an organism to introduce desirable characteristics | 15: variation (genetic engineering) | 201 |  |
| **B1.3.3 describe the main steps in the process of genetic engineering including: • isolating and replicating the required gene(s) • putting the gene(s) into a vector (e.g. a plasmid) • using the vector to insert the gene(s) into cells • selecting modified cells** | 15: variation (genetically engineering insulin) | 203 |  |
| B1.3.4 explain some of the possible benefits and risks, including practical and ethical considerations, of using gene technology in modern agriculture and medicine | 15: variation (genetically engineered crops, genetically modified animals) 14: reproduction (the human genome project) | 202-203, 186 |  |
| **Chapter B2 Keeping healthy** | | | |
| **B2.1 What are the causes of disease?** | | | |
| B2.1.1 describe the relationship between health and disease | 4: animal tissues, organs and organ systems (health issues) | 58 | relationship to disease not made |
| B2.1.2 describe different types of diseases (including communicable and non- communicable diseases) | 4: animal tissues, organs and organ systems (health issues) 6: infection and response (communicable diseases) | 59-62, 79-85 |  |
| B2.1.3 explain how communicable diseases (caused by viruses, bacteria, protists and fungi) are spread in animals and plants | 6: infection and response (spread of pathogens) | 80, 81 |  |
| B2.1.4 describe common human infections including influenza (viral), Salmonella (bacterial), Athlete’s foot (fungal) and malaria (protist) and sexually transmitted infections in humans including HIV/AIDS (viral) | 6: infection and response (Measles; HIV/AIDS) 8: plant diseases (detection and identification of plant diseases) | 81, 82, 103, 104 |  |
| B2.1.5 describe plant diseases including tobacco mosaic virus (viral), ash dieback (fungal) and crown gall disease (bacterial) | 6: infection and response (Measles; HIV/AIDS) 8: plant diseases (detection and identification of plant diseases) | 81, 82, 103, 104 |  |
| **B2.2 How do organisms protect themselves against pathogens?** | | | |
| B2.2.1 describe non-specific defence systems of the human body against pathogens, including examples of physical, chemical and microbial defences | 6: infection and response (human defence systems) | 85-88 |  |
| B2.2.2 explain how platelets are adapted to their function in the blood | 4: animal tissues, organs and organ systems (components of blood) | 55, 56 |  |
| B2.2.3 describe physical plant defences, including leaf cuticle and cell wall (separate science only) | 8: plant diseases (plant defence responses) | 106 |  |
| B2.2.4 explain the role of the immune system of the human body in defence against disease | 6: infection and response (human defence systems) | 87, 88 |  |
| B2.2.5 explain how white blood cells are adapted to their functions in the blood, including what they do and how it helps protect against disease | 4: animal tissues, organs and organ systems (components of blood) | 55, 56 |  |
| B2.2.6 describe chemical plant defence responses, including antimicrobial substances (separate science only) | 8: plant diseases (plant defence responses) | 106 |  |
| **B2.3 How can we prevent the spread of infection?** | | | |
| B2.3.1 explain how the spread of communicable diseases may be reduced or prevented in animals and plants, to include a minimum of one common human infection, one plant disease and sexually transmitted infections in humans including HIV/AIDS | 6: infection and response (human defence systems) 6: infection and response (Measles; HIV/AIDS) 8: plant diseases (detection and identification of plant diseases) | 85-88, 81, 82, 103, 104 |  |
| B2.3.2 explain the use of vaccines in the prevention of disease, including the use of safe forms of pathogens and the need to vaccinate a large proportion of the population | 6: infection and response (vaccination) | 89, 90 |  |
| **B2.4 How can we identify the cause of an infection? (separate science only)** | | | |
| B2.4.1 a) describe ways in which diseases, including plant diseases, can be detected and identified, in the lab and in the field b) describe how to use a light microscope to observe microorganisms PAG1 | 8: plant diseases (other diseases) | 105 |  |
| B2.4.2 describe and explain the aseptic techniques used in culturing organisms PAG7 | 6: infection and response (higher practical culturing microorganisms) | 80 | no explanation of aseptic technique, just practical description |
| B2.4.3 calculate cross-sectional areas of bacterial cultures and of clear zones around antibiotic discs on agar jelly using πr2 PAG7 | 6: infection and response (higher practical culturing microorganisms) | 0 | in 'tips' but no explanation of how to do it |
| **B2.4.4 describe how monoclonal antibodies are produced including the following steps: • antigen injected into an animal • antibody-producing cells taken from animal • cells producing the correct antibody selected then cultured** | 7: monoclonal antibodies (producing monoclonal antibodies) | 97-99 |  |
| **B2.4.5 describe some of the ways in which monoclonal antibodies can be used in diagnostic tests** | 7: monoclonal antibodies (using monoclonal antibodies) | 99, 100 |  |
| **B2.5 How can lifestyle, genes and the environment affect health?** | | | |
| B2.5.1 a) describe how the interaction of genetic and lifestyle factors can increase or decrease the risk of developing non-communicable human diseases, including cardiovascular diseases, many forms of cancer, some lung and liver diseases and diseases influenced by nutrition, including type 2 diabetes b) describe how to practically investigate the effect of exercise on pulse rate and recovery rate PAG6 | 4: animal tissues, organs and organ systems (the effect of lifestyle on some non-communicable diseases) | 62 | paragraph under table 4.5 |
| B2.5.2 use given data to explain the incidence of non-communicable diseases at local, national and global levels with reference to lifestyle factors, including exercise, diet, alcohol and smoking | 4: animal tissues, organs and organ systems (the effect of lifestyle on some non-communicable diseases) | 61, 62 | global levels not found |
| B2.5.3 in the context of data related to the causes, spread, effects and treatment of disease: a) translate information between graphical and numerical forms b) construct and interpret frequency tables and diagrams, bar charts and histograms c) understand the principles of sampling as applied to scientific data d) use a scatter diagram to identify a correlation between two variables | working scientifically: dealing with data (data types and graphs) working scientifically: experimental skills (sampling and bias) working scientifically: dealing with data(correlation and causation) | 209, 210, 267, 268, 285, 286 | not satisfactory |
| B2.5.4 describe interactions between different types of disease | 0 | 0 | not found |
| **B2.6 How can we treat disease?** | | | |
| B2.6.1 explain the use of medicines, including antibiotics, in the treatment of disease | 6: infection and response (vaccination) | 89, 90 |  |
| B2.6.2 calculate cross-sectional areas of bacterial cultures and of clear zones around antibiotic discs on agar jelly using πr2 PAG7 | 6: infection and response (higher practical culturing microorganisms) | 0 | in 'tips' but no explanation of how to do it |
| B2.6.3 evaluate some different treatments for cardiovascular disease, including lifestyle changes, medicines and surgery | 4: animal tissues, organs and organ systems (coronary heart disease: a non-communicable disease) | 56, 57 |  |
| B2.6.4 describe the process of discovery and development of potential new medicines including preclinical and clinical testing | 6: infection and response (discovery and development of drugs) | 92, 93 |  |
| **B2.6.5 describe how monoclonal antibodies can be used to treat cancer including: • produce monoclonal antibodies specific to a cancer cell antigen • inject the antibodies into the blood • the antibodies bind to cancer cells, tagging them for attack by white blood cells • the antibodies can also be attached to a radioactive or toxic substance to deliver it to cancer cells (separate science only)** | 7: monoclonal antibodies (using monoclonal antibodies) | 99, 100 |  |
| **Chapter B3 Living together - food and ecosystems** | | | |
| **B3.1 What happens during photosynthesis?** | | | |
| B3.1.1 a) describe the process of photosynthesis, including the inputs and outputs of the two mains stages and the requirement of light in the first stage, and describe photosynthesis as an endothermic process b) describe practical investigations into the requirements and products of photosynthesis PAG5 | 9: photosynthesis (photosynthetic reaction) 9: photosynthesis (rate of photosynthesis) | 111, 113, 114 |  |
| B3.1.2 explain how chloroplasts in plant cells are related to photosynthesis | 9: photosynthesis (photosynthetic reaction) | 111 |  |
| B3.1.3 a) explain the mechanism of enzyme action including the active site, enzyme specificity and factors affecting the rate of enzyme-catalysed reactions, including substrate concentration, temperature and pH b) describe practical investigations into the effect of substrate concentration, temperature and pH on the rate of enzyme controlled reactions PAG4 | 4: animal tissues organs and organ systems (Human digestive enzymes) | 48, 49 |  |
| B3.1.4 a) explain the effect of temperature, light intensity and carbon dioxide concentration on the rate of photosynthesis b) describe practical investigations into the effect of environmental factors on the rate of photosynthesis PAG5 | 9: photosynthesis (rate of photosynthesis) | 112, 113 |  |
| **B3.1.5 use the inverse square law to explain changes in the rate of photosynthesis with distance from a light source** | 9: photosynthesis (rate of photosynthesis) | 113 | in 'tips' |
| **B3.1.6 explain the interaction of temperature, light intensity and carbon dioxide concentration in limiting the rate of photosynthesis, and use graphs depicting the effects** | 9: photosynthesis (rate of photosynthesis) | 113 |  |
| B3.1.7 in the context of the rate of photosynthesis: a) understand and use simple compound measures such as the rate of a reaction b) translate information between graphical and numerical form c) plot and draw appropriate graphs selecting appropriate scales for axes d) extract and interpret information from graphs, charts and tables | 9: photosynthesis (rate of photosynthesis) working scientifically: dealing with data (data types and graphs) 5: plant tissues organs and organ systems - working scientifically: dealing with data | 113, 209, 210, 77 |  |
| **B3.2 How do producers get the substances they need?** | | | |
| B3.2.1 describe some of the substances transported into and out of photosynthetic organisms in terms of the requirements of those organisms, including oxygen, carbon dioxide, water and mineral ions | 3: transport in cells | 28-36 |  |
| B3.2.2 a) explain how substances are transported into and out of cells through diffusion, osmosis and active transport b) describe practical investigations into the processes of diffusion and osmosis PAG8 *i Learners are not expected to explain osmosis in terms of water potential* | 3: transport in cells | 28-36 |  |
| B3.2.3 explain how the partially-permeable cell membranes of plant cells and prokaryotic cells are related to diffusion, osmosis and active transport | 3: transport in cells | 28-36 |  |
| B3.2.4 explain how water and mineral ions are taken up by plants, relating the structure of the root hair cells to their function | 5: plant tissues organs and organ systems | 69, 70 |  |
| B3.2.5 a) explain how the structure of the xylem and phloem are adapted to their functions in the plant b) describe how to use a light microscope to observe the structure of the xylem and phloem PAG1 | 5: plant tissues organs and organ systems | 69 |  |
| B3.2.6 a) describe the processes of transpiration and translocation, including the structure and function of the stomata b) describe how to use a light microscope to observe the structure of stomata PAG1 c) describe how to use a simple potometer PAG6  *i Learners are not expected to describe transpiration in terms of tension or pressure, and are not expected to describe translocation in terms of water potential or hydrostatic pressure* | 5: plant tissues organs and organ systems 5: plant tissues organs and organ systems - working scientifically: dealing with data | 71, 72, 76, 77 |  |
| B3.2.7 a) explain the effect of a variety of environmental factors on the rate of water uptake by a plant, to include light intensity, air movement, and temperature b) describe practical investigations into the effect of environmental factors on the rate of water uptake by a plant PAG6 | 5: plant tissues organs and organ systems | 71, 72 |  |
| B3.2.8 in the context of water uptake by plants: a) use simple compound measures such as rate b) carry out rate calculations c) plot, draw and interpret appropriate graphs d) calculate percentage gain and loss of mass | 9: photosynthesis (rate of photosynthesis) working scientifically: dealing with data (data types and graphs) 5: plant tissues organs and organ systems - working scientifically: dealing with data | 113, 209, 210, 77 | percentiles not found |
| **B3.3 How are organisms in an ecosystem interdependent?** | | | |
| B3.3.1 a) explain the importance of sugars, fatty acids and glycerol, and amino acids in the synthesis and breakdown of carbohydrates, lipids and proteins b) describe the use of qualitative tests for biological molecules PAG2 | 4: animal tissues organs and organ systems (Human digestive enzymes) 10: Respiration | 46, 126 | breakdown only, (diagram). Monomer and polymer not used |
| B3.3.2 describe photosynthetic organisms as the main producers of food and therefore biomass for life on Earth | 9: phothotosynthesis | 110 |  |
| B3.3.3 describe some of the substances transported into organisms in terms of the requirements of those organisms, including dissolved food molecules | 3: Transport in cells | 29-32 |  |
| B3.3.4 describe different levels of organisation in an ecosystem from individual organisms to the whole ecosystem | 19: organisation of an ecosystem (levels of organisation) | 251 |  |
| B3.3.5 explain the importance of interdependence and competition in a community | 18: adaptations, interdependence and competition | 236-238 |  |
| B3.3.6 describe the differences between the trophic levels of organisms within an ecosystem (separate science only) | 19: organisation of an ecosystem (producers consumers and decomposers)  21: trophic levels in an ecosystem (trophic levels) | 256, 257, 288 |  |
| B3.3.7 describe pyramids of biomass and explain, with examples, how biomass is lost between the different trophic levels (separate science only) | 21: trophic levels in an ecosystem (pyramids of biomass) | 288, 289 |  |
| B3.3.8 calculate the efficiency of biomass transfers between trophic levels and explain how this affects the number of organisms at each trophic level (separate science only) | 21: trophic levels in an ecosystem (transfer of biomass) | 290 |  |
| B3.3.9 recall that many different substances cycle through the abiotic and biotic components of an ecosystem, including carbon and water | 19: organisation of an ecosystem (materials cycling) | 258-261 |  |
| B3.3.10 explain the importance of the carbon cycle and the water cycle to living organisms | 19: organisation of an ecosystem (materials cycling) | 258-260 |  |
| B3.3.11 explain the role of microorganisms in the cycling of substances through an ecosystem | 19: organisation of an ecosystem (producers consumers and decomposers), 19: organisation of an ecosystem (decomposition) | 257, 260, 261 |  |
| B3.3.12 calculate the percentage of mass, in the context of the use and cycling of substances in ecosystems | working scientifically: dealing with data (energy calculations) | 294 | percentages |
| B3.3.13 explain the effect of factors such as temperature and water content on rate of decomposition in aerobic and anaerobic environments (separate science only) | 19: organisation of an ecosystem (decomposition) | 260, 261 | terms aerobic and anaerobic not used here |
| B3.3.14 calculate rate changes in the decay of biological material (separate science only) | working scientifically: dealing with data (energy calculations) | 294 | percentages |
| **B3.4 How are populations affected by conditions in an ecosystem?** | | | |
| B3.4.1 explain how some abiotic and biotic factors affect communities, including environmental conditions, toxic chemicals, availability of food and other resources, and the presence of predators and pathogens | 18: adaptations, interdependence and competition | 239 -242 |  |
| B3.4.2 describe how to carry out a field investigation into the distribution and abundance of organisms in an ecosystem and explain how to determine their numbers in a given area PAG3 | 19: organisation of an ecosystem (levels of organisation) | 251-253 |  |
| B3.4.3 in the context of data related to organisms within a population: a) calculate arithmetic means b) use fractions and percentages c) plot and draw appropriate graphs selecting appropriate scales for the axes d) extract and interpret information from charts, graphs and tables | working scientifically: dealing with data (means and ranges) working scientifically: dealing with data (energy calculations)  working scientifically: experimental skills (drawing conclusions from data) | 129, 130, 294, 109, 110 |  |
| **Chapter B4 Using food and controlling growth** | | | |
| **B4.1 What happens during cellular respiration?** | | | |
| B4.1.1 compare the processes of aerobic and anaerobic respiration, including conditions under which they occur, the inputs and outputs, and comparative yields of ATP | 10 respiration | 120-125 |  |
| B4.1.2 explain why cellular respiration occurs continuously in all living cells | 10: respiration (aerobic respiration) | 120-121 |  |
| B4.1.3 explain how mitochondria in eukaryotic cells (plants and animals) are related to cellular respiration | 1: cell structure | 3, 5 |  |
| B4.1.4 describe cellular respiration as an exothermic process | 10: respiration (aerobic respiration) | 121 |  |
| B4.1.5 a) describe practical investigations into the effect of different substrates on the rate of respiration in yeast PAG5 b) carry out rate calculations for chemical reactions in the context of cellular respiration | 10 respiration | 120-125 |  |
| **B4.2 How do we know about mitochondria and other cell structures?** | | | |
| B4.2.1 explain how electron microscopy has increased our understanding of sub-cellular structures | 1: cell structure | 12 | no comparison images of light microscope and electron microscope |
| B4.2.2 in the context of cells and sub-cellular structures: a) demonstrate an understanding of number, size and scale and the quantitative relationship between units b) use estimations and explain when they should be used **c) calculate with numbers written in standard form** | 1: cell structure | 16 | only found in extension material estimations not found |
| **B4.3 How do organisms grow and develop?** | | | |
| B4.3.1 a) describe the role of the cell cycle in growth, including interphase and mitosis b) describe how to use a light microscope to observe stages of mitosis PAG1  *i Learners are not expected to recall intermediate phases* | 0 | 0 |  |
| B4.3.2 describe cancer as the result of changes in cells that lead to uncontrolled growth and division | 4: animal tissues, organs and organ systems (cancer) | 60 |  |
| B4.3.3 explain the role of meiotic cell division in halving the chromosome number to form gametes, including the stages of interphase and two meiotic divisions  *i Learners are not expected to recall intermediate phases* | 14: reproduction (meiosis) | 180, 181 |  |
| B4.3.4 describe the function of stem cells in embryonic and adult animals and meristems in plants | 2: cell division (stem cells) | 22-24 |  |
| B4.3.5 explain the importance of cell differentiation, in which cells become specialised by switching genes off and on to form tissues with particular functions | 1: cell structure | 10 |  |
| **B4.4 How is plant growth controlled? (separate science only)** | | | |
| B4.4.1 a) explain how plant hormones are important in the control and coordination of plant growth and development, with reference to the role of auxins in phototropisms and gravitropisms b) describe practical investigations into the role of auxin in phototropism PAG6 | 13:plant hormones (control & coordination. Auxins) | 169, 170 |  |
| **B4.4.2 describe some of the variety of effects of plant hormones, relating to gibberellins and ethene** | 13:plant hormones (other hormones) | 171, 172 |  |
| **B4.4.3 describe some of the different ways in which people use plant hormones to control plant growth** | 13:plant hormones (use of plant hormones) | 172, 173 |  |
| **B4.5 Should we use stem cells to treat damage and disease?** | | | |
| B4.5.1 discuss potential benefits, risks and ethical issues associated with the use of stem cells in medicine | 2: cell division (stem cell research) | 23, 24 |  |
| **Chapter B5 The human body - staying alive** | | | |
| **B5.1 How do substances get into, out of and around our bodies?** | | | |
| B5.1.1 describe some of the substances transported into and out of the human body in terms of the requirements of cells, including oxygen, carbon dioxide, water, dissolved food molecules and urea | 3: transport in cells | 29-32 |  |
| B5.1.2 explain how the partially-permeable cell membranes of animal cells are related to diffusion, osmosis and active transport | 3: transport in cells | 28-36 |  |
| B5.1.3 describe the human circulatory system, including its relationships with the gaseous exchange system, the digestive system and the excretory system | 4: animal tissues organs and organ systems (the heart and blood vessels) | 51-52, 54 | p54 = diagram showing exchange |
| B5.1.4 explain how the structure of the heart is adapted to its function, including cardiac muscle, chambers and valves | 4: animal tissues organs and organ systems (the heart and blood vessels) | 51-54 |  |
| B5.1.5 explain how the structures of arteries, veins and capillaries are adapted to their functions, including differences in the vessel walls and the presence of valves | 4: animal tissues organs and organ systems (the heart and blood vessels) | 51-54 |  |
| B5.1.6 explain how red blood cells and plasma are adapted to their functions in the blood | 4: animal tissues organs and organ systems (blood) | 55-56 |  |
| B5.1.7 explain the need for exchange surfaces and a transport system in multicellular organisms in terms of surface area : volume ratio | 3: transport in cells | 29-32 |  |
| B5.1.8 calculate surface area : volume ratios | 3: transport in cells (diffusion) | 32 | Activity |
| **B5.2 How does the nervous system help us respond to changes?** | | | |
| B5.2.1 explain how the components of the nervous system work together to enable it to function, including sensory receptors, sensory neurons, the CNS, motor neurons and effectors | 11: the human nervous system (structure and function) | 134 |  |
| B5.2.2 explain how the structures of nerve cells and synapses relate to their functions   *i Learners are not expected to explain nerve impulse transmission in terms of membrane potentials* | 11: the human nervous system (structure and function) | 133-137 |  |
| B5.2.3 a) explain how the structure of a reflex arc, including the relay neuron, is related to its function b) describe practical investigations into reflex actions PAG6 | 11: the human nervous system (structure and function) | 135, 136 |  |
| B5.2.4 describe the structure and function of the brain and roles of the cerebral cortex (intelligence, memory, language and consciousness), cerebellum (conscious movement) and brain stem (regulation of heart and breathing rate) (separate science only) | 11: the human nervous system (the brain) | 138, 139 |  |
| **B5.2.5 explain some of the difficulties of investigating brain function (separate science only)** | 11: the human nervous system (the brain) | 139 | more about history rather than difficulties |
| **B5.3 How do hormones control responses in the human body?** | | | |
| B5.3.1 describe the principles of hormonal coordination and control by the human endocrine system | 12:hormonal coordination in humans | 149, 150 |  |
| **B5.3.2 explain the roles of thyroxine and adrenaline in the body, including thyroxine as an example of a negative feedback system** | 12:hormonal coordination in humans | 150 | mentioned in a table of hormones. Not used as eg of negative feedback (Negative feedback p156 (ADH) and 163) |
| **B5.4 Why do we need to maintain a constant internal environment?** | | | |
| B5.4.1 explain the importance of maintaining a constant internal environment in response to internal and external change | 11: the human nervous system (homeostasis) | 132, 133 |  |
| B5.4.2 a) describe the function of the skin in the control of body temperature, including changes to sweating, hair erection and blood flow b) describe practical investigations into temperature control of the body PAG6 (separate science only) | 11: the human nervous system (control of body temperature) | 143-145 |  |
| **B5.4.3 explain the response of the body to different temperature challenges, including receptors, processing, responses and negative feedback (separate science only)** | 11: the human nervous system (control of body temperature) 12:hormonal coordination in humans (maintaining water and nitrogen balance in the body) | 144, 145, 155-157 |  |
| B5.4.4 explain the effect on cells of osmotic changes in body fluids  *i Learners are not expected to discuss water potential (separate science only)* | 3: transport in cells (comparing water concentrations) | 34 |  |
| B5.4.5 describe the function of the kidneys in maintaining the water balance of the body, including filtering water and urea from the blood into kidney tubules then reabsorbing as much water as required (separate science only) | 12:hormonal coordination in humans (maintaining water and nitrogen balance in the body) | 155-157 |  |
| **B5.4.6 describe the effect of ADH on the permeability of the kidney tubules (separate science only)** | 12:hormonal coordination in humans (maintaining water and nitrogen balance in the body) | 156 |  |
| **B5.4.7 explain the response of the body to different osmotic challenges, including receptors, processing, response, and negative feedback (separate science only)** | 11: the human nervous system (control of body temperature) 12:hormonal coordination in humans (maintaining water and nitrogen balance in the body) | 144, 145, 155-157 |  |
| B5.4.8 in the context of maintaining a constant internal environment: a) extract and interpret data from graphs, charts and tables b) translate information between numerical and graphical forms | working scientifically: dealing with data (data types and graphs) | 209, 210 |  |
| **B5.5 What role do hormones play in human reproduction?** | | | |
| B5.5.1 describe the role of hormones in human reproduction, including the control of the menstrual cycle | 12:hormonal coordination in humans (hormones in human reproduction) | 158, 159 |  |
| **B5.5.2 explain the interactions of FSH, LH, oestrogen and progesterone in the control of the menstrual cycle** | 12:hormonal coordination in humans (the menstrual cycle) | 159, 160 |  |
| B5.5.3 explain the use of hormones in contraception and evaluate hormonal and non-hormonal methods of contraception | 12:hormonal coordination in humans (contraception) | 160, 161 |  |
| **B5.5.4 explain the use of hormones in modern reproductive technologies to treat infertility** | 12:hormonal coordination in humans (use of hormones to treat fertility) | 162-164 |  |
| **B5.6 What can happen when organs and control systems stop working?** | | | |
| B5.6.1 explain how insulin controls the blood sugar level in the body | 12:hormonal coordination in humans (control of blood glucose concentration) | 152 |  |
| **B5.6.2 explain how glucagon and insulin work together to control the blood sugar level in the body** | 12:hormonal coordination in humans (control of blood glucose concentration) | 152 |  |
| B5.6.3 compare type 1 and type 2 diabetes and explain how they can be treated | 12:hormonal coordination in humans (control of blood glucose concentration) | 152, 154 |  |
| B5.6.4 a) explain how the main structures of the eye are related to their functions, including the cornea, iris, lens, ciliary muscle and retina and to include the use of ray diagrams b) describe practical investigations into the response of the pupil in different light conditions PAG6 (separate science only) | 11: the human nervous system (the eye) | 140, 141 |  |
| B5.6.5 describe common defects of the eye, including short-sightedness, long-sightedness and cataracts, and explain how these problems may be overcome, including using ray diagrams to illustrate the effect of lenses (separate science only) | 11: the human nervous system (the eye) | 142 |  |
| **B5.6.6 explain some of the limitations in treating damage and disease in the brain and other parts of the nervous system (separate science only)** | 0 | 0 | not found |
| **Chapter B6 Life on Earth - past, present and future** | | | |
| **B6.1 How was the theory of evolution developed?** | | | |
| B6.1.1 state that there is usually extensive genetic variation within a population of a species | 15: variation (causes of variation) | 198 | not very satisfactory |
| B6.1.2 recall that genetic variants arise from mutations, and that most have no effect on the phenotype, some influence phenotype and a very few determine phenotype | 15: variation (mutations) | 200 |  |
| B6.1.3 explain how evolution occurs through natural selection of variants that give rise to phenotypes better suited to their environment | 16: the development of understanding of genetics and evolution (the theory of evolution) | 212 |  |
| B6.1.4 explain the importance of competition in a community, with regard to natural selection | 18: Adaptations, interdependence and competition (communities) | 236 | paragraph on competition and Darwin |
| B6.1.5 describe evolution as a change in the inherited characteristics of a population over a number of generations through a process of natural selection which may result in the formation of new species | 16: the development of understanding of genetics and evolution (the theory of evolution by natural selection) | 214 |  |
| B6.1.6 explain the impact of the selective breeding of food plants and domesticated animals | 15: variation (selective breeding) | 200, 201 |  |
| B6.1.7 describe how fossils provide evidence for evolution | 16: the development of understanding of genetics and evolution (evidence for evolution) | 218-222 |  |
| B6.1.8 describe the work of Darwin and Wallace in the development of the theory of evolution by natural selection (separate science only) | 16: the development of understanding of genetics and evolution (Charles Darwin) | 212, 213 |  |
| B6.1.9 describe modern examples of evidence for evolution including antibiotic resistance in bacteria | 16: the development of understanding of genetics and evolution (evidence for evolution) | 218-222 |  |
| B6.1.10 explain the impact of these ideas on modern biology and society (separate science only) | 16: the development of understanding of genetics and evolution (Charles Darwin) | 212, 213 |  |
| **B6.2 How do sexual and asexual reproduction affect evolution? (separate science only)** | | | |
| B6.2.1 explain some of the advantages and disadvantages of asexual and sexual reproduction in a range of organisms | 14: reproduction (advantages of sexual and asexual reproduction) | 182 |  |
| **B6.3 How does our understanding of biology help us classify the diversity of organisms on Earth?** | | | |
| B6.3.1 describe the impact of developments in biology on classification systems, including the use of DNA analysis to classify organisms | 17: classification of living organisms | 227-231 |  |
| **B6.4 How is biodiversity threatened and how can we protect it?** | | | |
| B6.4.1 describe both positive and negative human interactions within ecosystems and explain their impact on biodiversity | 20: biodiversity and the effect of human interaction on ecosystems (land use) |  |  |
| **B6.4.2 evaluate evidence for the impact of environmental changes on the distribution of organisms, with reference to water and atmospheric gases (separate science only)** | 19: organisation of an ecosystem (impact of environmental change on distribution of organisms) | 262-264 |  |
| B6.4.3 describe some of the biological factors affecting levels of food security including increasing human population, changing diets in wealthier populations, new pests and pathogens, environmental change, sustainability and cost of agricultural inputs (separate science only) | 22: food production (factors affecting food security) | 296 |  |
| B6.4.4 explain some of the benefits and challenges of maintaining local and global biodiversity | 20: biodiversity and the effect of human interaction on ecosystems (maintaining biodiversity) | 280-282 |  |
| B6.4.5 extract and interpret information related to biodiversity from charts, graphs and tables | working scientifically: experimental skills (drawing conclusions from data) | 109, 110 |  |
| B6.4.6 describe and explain some possible biotechnological and agricultural solutions, including genetic modification, to the demands of the growing human population (separate science only) | 22: food production (role of biotechnology) | 300-302 |  |

## Want to switch to OCR?

If you’re an OCR-approved centre, all you need to do is download the specification and start teaching. Your exams officer can complete an intention to teach form which enables us to provide appropriate support. When you’re ready to enter your students, you just need to speak to your exams officer to:

1. Make estimated entries by 10 October so we can prepare the question papers and ensure we’ve got enough examiners.
2. Make final entries by 21 February. If you are not already an OCR-approved centre please refer your exams officer to the centre approval section of our admin guide.

## Next steps

1. Familiarise yourself with the specification, sample assessment materials and teaching resources on the OCR Biology B qualification page of the OCR website.

<http://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-biology-b-j257-from-2016/>

1. Browse the online delivery guides for teaching ideas and use the Scheme of Work builder to create your personal scheme of work.   
   <http://ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-biology-b-j257-from-2016/planning-and-teaching/>
2. Get a login for our secure extranet, Interchange – this allows you to access the latest past/practice papers and use our results analysis service, Active Results.

<https://interchange.ocr.org.uk>

1. Sign up to receive subject updates by email.   
   <http://www.ocr.org.uk/i-want-to/email-updates>
2. Sign up to attend a training event or take part in webinars on specific topics running throughout the year and our Q&A webinar sessions every half term.   
   <https://www.cpdhub.ocr.org.uk>
3. Attend one of our free teacher network events that are run in each region every term. These are hosted at the end of the school day in a school or college near you, with teachers sharing best practice and subject specialists on hand to lead discussion and answer questions.  
   <http://ocr.org.uk/qualifications/professional-development/teacher-networks/>