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GCSE (9-1)

***TWENTY FIRST CENTURY SCIENCE BIOLOGY B***

**J257**

For first teach in 2016­

**Student revision checklist**

Version 1

# Student revision checklist

**Revision checklists**

The tables below can be used as a revision checklist.

For more information please see the [OCR GCSE Twenty First Century Science Biology B specification.](https://www.ocr.org.uk/Images/234595-specification-accredited-gcse-twenty-first-century-science-suite-biology-b-j257.pdf)

The table headings are explained below:

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| --- | --- | --- | --- | --- |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| Here is a list of the learning outcomes for this qualification and the content you need to cover and work on.  **Please note the learning outcomes in bold are for Higher tier only.** | You can use the tick boxes to show when you have revised an item and how confident you feel about it.  R = **RED** means you are really unsure and lack confidence; you might want to focus your revision here and possibly talk to your teacher for help.  A = **AMBER** means you are reasonably confident but need some extra practice.  G = **GREEN** means you are very confident.  As your revision progresses, you can concentrate on the **RED** and **AMBER** items in order to turn them into **GREEN** items.  You might find it helpful to highlight each topic in red, orange or green to help you prioritise. | | | You can use the comments column to:   * add more information about the details for each point * add formulae or notes * include a reference to a useful resource * highlight areas of difficulty or things that you need to talk to your teacher about or look up in a textbook. |

| **B1.1 What is the genome and what does it do?** | | | | |
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| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 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 |  |  |  |  |
| 1. b) describe how to use a light microscope to observe a variety of plant and animal cells |  |  |  |  |
| 1. describe the genome as the entire genetic material of an organism |  |  |  |  |
| 1. describe DNA as a polymer made up of nucleotides, forming two strands in a double helix |  |  |  |  |
| 1. 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   Information *Learners are not expected to describe epigenetic effects* |  |  |  |  |
| 1. explain the terms chromosome, gene, allele, variant, genotype and phenotype |  |  |  |  |
| 1. 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 |  |  |  |  |
| 1. 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)* |  |  |  |  |
| 1. **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)* |  |  |  |  |

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| **B1.1 What is the genome and what does it do?** | | | | |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 9. **recall a simple description of protein synthesis, in which:**   * **a copy of a gene is made 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**   Information ***Learners are not expected to recall details of transcription and translation***  *(separate science only)* |  |  |  |  |
| 1. **recall that all genetic variants arise from mutations**   *(separate science only)* |  |  |  |  |
| 1. **describe how genetic variants in coding DNA may influence phenotype by altering the activity of a protein**   *(separate science only)* |  |  |  |  |
| 1. **describe how genetic variants in non-coding DNA may influence phenotype by altering how genes are expressed**   *(separate science only)* |  |  |  |  |

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| **B1.2 How is genetic information inherited?** | | | | |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 1. explain the terms gamete, homozygous, heterozygous, dominant and recessive |  |  |  |  |
| 1. explain single gene inheritance, including dominant and recessive alleles and use of genetic diagrams |  |  |  |  |
| 1. predict the results of single gene crosses |  |  |  |  |
| 1. use direct proportions and simple ratios in genetic crosses |  |  |  |  |
| 1. use the concept of probability in predicting the outcome of genetic crosses |  |  |  |  |

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| **B1.2 How is genetic information inherited?** | | | | |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 1. recall that most phenotypic features are the result of multiple genes rather than single gene inheritance   Information *Learners are not expected to describe epistasis and its effects* |  |  |  |  |
| 1. describe the development of our understanding of genetics including the work of Mendel **and the modern day use of genome sequencing**   *(separate science only)* |  |  |  |  |
| 1. describe sex determination in humans |  |  |  |  |
| **B1.3 How can and should gene technology be used?** | | | | |
| 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. describe genetic engineering as a process which involves modifying the genome of an organism to introduce desirable characteristics |  |  |  |  |

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| **B1.3 How can and should gene technology be used?** | | | | |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 1. **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** |  |  |  |  |
| 1. explain some of the possible benefits and risks, including practical and ethical considerations, of using gene technology in modern agriculture and medicine |  |  |  |  |

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| **B2.1 What are the causes of disease?** | | | | |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 1. describe the relationship between health and disease |  |  |  |  |
| 1. describe different types of disease (including communicable and non-communicable diseases) |  |  |  |  |
| 1. explain how communicable diseases (caused by viruses, bacteria, protists and fungi) are spread in animals and plants |  |  |  |  |
| 1. 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) |  |  |  |  |
| 1. describe plant diseases including tobacco mosaic virus (viral), ash dieback (fungal) and crown gall disease (bacterial) |  |  |  |  |

| **B2.2 How do organisms protect themselves against pathogens?** | | | | |
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| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 1. describe non-specific defence systems of the human body against pathogens, including examples of physical, chemical and microbial defences |  |  |  |  |
| 1. explain how platelets are adapted to their function in the blood |  |  |  |  |
| 1. describe physical plant defences, including leaf cuticle and cell wall   *(separate science only)* |  |  |  |  |
| 1. explain the role of the immune system of the human body in defence against disease |  |  |  |  |
| 1. explain how white blood cells are adapted to their functions in the blood, including what they do and how it helps protect against disease |  |  |  |  |
| 1. describe chemical plant defence responses, including antimicrobial substances   *(separate science only)* |  |  |  |  |

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| **B2.3 How can we prevent the spread of infection?** | | | | |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 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 |  |  |  |  |
| 1. 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 |  |  |  |  |
| **B2.4 How can we identify the cause of an infection? *(separate science only)*** | | | | |
| 1. a) describe ways in which diseases, including plant diseases, can be detected and identified, in the lab and in the field |  |  |  |  |
| 1. b) describe how to use a light microscope to observe microorganisms |  |  |  |  |
| 1. describe and explain the aseptic techniques used in culturing organisms |  |  |  |  |

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| **B2.4 How can we identify the cause of an infection? *(separate science only)*** | | | | |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 1. calculate cross-sectional areas of bacterial cultures and of clear zones around antibiotic discs on agar jelly using |  |  |  |  |
| 1. **describe how monoclonal antibodies are producing including the following steps:**  * **antigen injected into an animal** * **antibody-producing cells taken from animal** * **cells producing the correct antibody selected then cultured** |  |  |  |  |
| 1. **describe some of the ways in which monoclonal antibodies can be used in diagnostic tests** |  |  |  |  |
| **B2.5 How can lifestyle, genes and the environment affect health?** | | | | |
| 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 |  |  |  |  |
| **B2.5 How can lifestyle, genes and the environment affect health?** | | | | |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 1. b) describe how to practically investigate the effect of exercise on pulse rate and recovery rate |  |  |  |  |
| 1. 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 |  |  |  |  |
| 1. in the context of data related to the causes, spread, effects and treatment of disease: 2. translate information between graphical and numerical forms |  |  |  |  |
| 3. b) construct and interpret frequency tables and diagrams, bar charts and histograms |  |  |  |  |
| 3. c) understand the principles of sampling as applied to scientific data |  |  |  |  |
| 3. d) use a scatter diagram to identify a correlation between two variables |  |  |  |  |

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| **B2.5 How can lifestyle, genes and the environment affect health?** | | | | |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 1. describe interactions between different types of disease |  |  |  |  |
| **B2.6 How can we treat disease?** | | | | |
| 1. explain the use of medicines, including antibiotics, in the treatment of disease |  |  |  |  |
| 1. calculate cross-sectional areas of bacterial cultures and of clear zones around antibiotic discs on agar jelly using |  |  |  |  |
| 1. evaluate some different treatments for cardiovascular disease, including lifestyle changes, medicines and surgery |  |  |  |  |
| 1. describe the process of discovery and development of potential new medicines including preclinical and clinical testing |  |  |  |  |

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| **B2.6 How can we treat disease?** | | | | |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 1. **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)* |  |  |  |  |

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| **B3.1 What happens during photosynthesis?** | | | | |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 1. a) describe the process of photosynthesis, including the inputs and outputs of the two main stages and the requirement of light in the first stage, and describe photosynthesis as an endothermic process |  |  |  |  |
| 1. b) describe practical investigations into the requirements and products of photosynthesis |  |  |  |  |
| 2. explain how chloroplasts in plant cells are related to photosynthesis |  |  |  |  |
| 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 |  |  |  |  |
| 3. b) describe practical investigations into the effect of substrate concentration, temperature and pH on the rate of enzyme controlled reactions |  |  |  |  |

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| **B3.1 What happens during photosynthesis?** | | | | |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 1. a) explain the effect of temperature, light intensity and carbon dioxide concentration on the rate of photosynthesis |  |  |  |  |
| 4 b) describe practical investigations into the effect of environmental factors on the rate of photosynthesis |  |  |  |  |
| **5.** **use the inverse square law to explain changes in the rate of photosynthesis with distance from a light source** |  |  |  |  |
| **6. explain the interaction of temperature, light intensity and carbon dioxide, concentration in limiting the rate of photosynthesis, and use graphs depicting the effects** |  |  |  |  |
| 7. in the context of the rate of photosynthesis:  a) understand and use simple compound measures such as the rate of a reaction |  |  |  |  |

| **B3.1 What happens during photosynthesis?** | | | | |
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| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 7. in the context of the rate of photosynthesis:  b) translate information between graphical and numerical form |  |  |  |  |
| 7. in the context of the rate of photosynthesis:  c) plot and draw appropriate graphs selecting appropriate scales for axes |  |  |  |  |
| 7. in the context of the rate of photosynthesis:  d) extract and interpret information from graphs, charts and tables |  |  |  |  |
| **B3.2 How do produces get the substances they need?** | | | | |
| 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 |  |  |  |  |

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| **B3.2 How do produces get the substances they need?** | | | | |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 1. a) explain how substances are transported into and out of cells through diffusion, osmosis and active transport   Information *Learners are not expected to explain osmosis in terms of water potential* |  |  |  |  |
| 1. b) describe practical investigations into the processes of diffusion and osmosis |  |  |  |  |
| 1. explain how the partially-permeable cell membranes of plant cells and prokaryotic cells are related to diffusion, osmosis and active transport |  |  |  |  |
| 4. explain how water and mineral ions are taken up by plants, relating to the structure of the root hair cells to their function |  |  |  |  |
| 5. a) explain how the structure of xylem and phloem are adapted to their functions in the plant |  |  |  |  |
| 5. b) describe how to use a light microscope to observe the structure of the xylem and phloem |  |  |  |  |

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| **B3.2 How do produces get the substances they need?** | | | | |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 1. a) describe the processes of transpiration and translocation, including the structure and function of the stomata   Information *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* |  |  |  |  |
| 6. b) describe how to use a light microscope to observe the structure of stomata |  |  |  |  |
| 6. c) describe how to use a simple potometer |  |  |  |  |
| 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 |  |  |  |  |
| 7. b) describe practical investigations into the effect of environmental factors on the rate of water uptake by a plant |  |  |  |  |

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| **B3.2 How do produces get the substances they need?** | | | | |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 8. in the context of water uptake by plants:  a) use simple compound measures such as rate |  |  |  |  |
| 8. in the context of water uptake by plants:  b) carry out rate calculations |  |  |  |  |
| 8. in the context of water uptake by plants:  c) plot, draw and interpret appropriate graphs |  |  |  |  |
| 8. in the context of water uptake by plants:  d) calculate percentage gain and loss of mass |  |  |  |  |
| **B3.3 How are organisms in an ecosystem interdependent?** | | | | |
| 1. a) explain the importance of sugars, fatty acids and glycerol, and amino acids in the synthesis and breakdown of carbohydrates, lipids and proteins |  |  |  |  |

| **B3.3 How are organisms in an ecosystem interdependent?** | | | | |
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| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 1. b) describe the use of qualitative tests for biological molecules |  |  |  |  |
| 2. describe photosynthetic organisms as the main producers of food and therefore biomass for life on Earth |  |  |  |  |
| 3. describe some of the substances transported into organisms in terms of the requirements of those organisms, including dissolved food molecules |  |  |  |  |
| 4. describe different levels of organisation in an ecosystem from individual organisms to the whole ecosystem |  |  |  |  |
| 5. explain the importance of interdependence and competition in a community |  |  |  |  |
| 6. describe the differences between the trophic levels of organisms within an ecosystem  *(separate science only)* |  |  |  |  |
| 7. describe pyramids of biomass and explain, with examples, how biomass is lost between the different trophic levels  *(separate science only)* |  |  |  |  |
| 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)* |  |  |  |  |
| 9. recall that many different substances cycle through the abiotic and biotic components of an ecosystem, including carbon and water |  |  |  |  |
| 10. explain the importance of the carbon cycle and the water cycle to living organisms |  |  |  |  |
| 11. explain the role of the microorganisms in the cycling of substances through an ecosystem |  |  |  |  |
| 12. calculate the percentage of mass, in the context of the use and cycling of substances in ecosystems |  |  |  |  |
| 13. explain the effect of factors such as temperature and water content on rate of decomposition in aerobic and anaerobic environments  *(separate science only)* |  |  |  |  |
| 14. calculate rate changes in the decay of biological material  *(separate science only)* |  |  |  |  |
| **B3.4 How are populations affected by conditions in an ecosystem?** | | | | |
| 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 |  |  |  |  |
| 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 |  |  |  |  |
| 3. in the context of data related to organisms within a population:  a) calculate arithmetic means |  |  |  |  |
| 3. in the context of data related to organisms within a population:  b) use fractions and percentages |  |  |  |  |
| 3. in the context of data related to organisms within a population:  c) plot and draw appropriate graphs selecting appropriate scales for the axes |  |  |  |  |
| 3. in the context of data related to organisms within a population:  d) extract and interpret information from charts, graphs and tables |  |  |  |  |

| **B4.1 What happens during cellular respiration?** | | | | |
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| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 1. compare the processes of aerobic and anaerobic respiration, including conditions under which they occur, the inputs and outputs, and comparative yields of ATP |  |  |  |  |
| 2. explain why cellular respiration occurs continuously in all living cells |  |  |  |  |
| 3. explain how mitochondria in eukaryotic cells (plants and animals) are related to cellular respiration |  |  |  |  |
| 4. describe cellular respiration as an exothermic process |  |  |  |  |
| 5. a) describe practical investigations into the effect of different substances on the rate of respiration in yeast |  |  |  |  |
| 5. b) carry out rate calculations for chemical reactions in the context of cellular respiration |  |  |  |  |

| **B4.2 How do we know about mitochondria and other cell structures?** | | | | |
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| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 1. explain how electron microscopy has increased our understanding of sub-cellular structures |  |  |  |  |
| 2. in the context of cells and sub-cellar structures:  a) demonstrate an understanding of number, size and scale and the quantitative relationship between units |  |  |  |  |
| 2. in the context of cells and sub-cellar structures:  b) use estimations and explain when they should be used |  |  |  |  |
| 2. in the context of cells and sub-cellar structures:  c) **calculate with numbers written in standard form** |  |  |  |  |

| **B4.3 How do organisms grow and develop?** | | | | |
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| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 1. a) describe the role of the cell cycle in growth, including interphase and mitosis  Information *Learners are not expected to recall intermediate phases* |  |  |  |  |
| 1. b) describe how to use a light microscope to observe stages of mitosis |  |  |  |  |
| 2. describe cancer as the result of changes in cells that lead to uncontrolled growth and division |  |  |  |  |
| 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  Information *Learners are not expected to recall intermediate phases* |  |  |  |  |
| 4. describe the function of stem cells in embryonic and adult animals and meristems in plants |  |  |  |  |

| **B4.3 How do organisms grow and develop?** | | | | |
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| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 5. explain the importance of cell differentiation, in which cells become specialised by switching genes off and on to form tissues with particular functions |  |  |  |  |
| **B4.4 How is plant growth controlled? *(separate science only)*** | | | | |
| 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 |  |  |  |  |
| 1. b) describe practical investigations into the role of auxin in phototropism |  |  |  |  |
| 2. **describe some of the variety of effects of plant hormones, relating to gibberellins and ethene** |  |  |  |  |
| 3. **describe some of the different ways in which people use plant hormones to control plant growth** |  |  |  |  |

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| **B4.5 Should we use stem cells to treat damage and disease?** | | | | |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 1. discuss potential benefits, risks and ethical issues associated with the use of stem cells in medicine |  |  |  |  |

| **B5.1 How do substances get into, out of and around our bodies?** | | | | |
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| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 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 |  |  |  |  |
| 2. explain how the partially-permeable cell membranes of animal cells are related to diffusion, osmosis and active transport |  |  |  |  |
| 3. describe the human circulatory system, including its relationships with the gaseous exchange system, the digestive system and the excretory system |  |  |  |  |
| 4. explain how the structure of the heart is adapted to its function, including cardiac muscle, chambers and valves |  |  |  |  |
| 5. explain how the structure of arteries, veins and capillaries are adapted to their functions, including differences in the vessel walls and the presence of valves |  |  |  |  |

| **B5.1 How do substances get into, out of and around our bodies?** | | | | |
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| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 6. explain how red blood cells and plasma are adapted to their functions in the blood |  |  |  |  |
| 7. explain the need for exchanges surfaces and a transport system in multicellular organisms in terms of surface area:volume ratio |  |  |  |  |
| 8. calculate surface area:volume ratios |  |  |  |  |
| **B5.2 How does the nervous system help us respond to changes?** | | | | |
| 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 |  |  |  |  |
| 1. explain how the structure of nerve cells and synapses relate to their functions   Information *Learners are not expected to explain nerve impulse transmission in terms of membrane potentials* |  |  |  |  |

| **B5.2 How does the nervous system help us respond to changes?** | | | | |
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| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 3. a) explain how the structure of a reflex arc, including the relay neuron, is related to its function |  |  |  |  |
| 3. b) describe practical investigations into reflex actions |  |  |  |  |
| 1. 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. **explain some of the difficulties of investigating brain function**  *(separate science only)* |  |  |  |  |
| **B5.3 How do hormones control responses in the human body?** | | | | |
| 1. describe the principles of hormonal coordination and control by the human endocrine system |  |  |  |  |
| **2. explain the roles of thyroxine and adrenaline in the body, including thyroxine as an example of a negative feedback system** |  |  |  |  |

| **B5.4 Why do we need to maintain a constant internal environment?** | | | | |
| --- | --- | --- | --- | --- |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 1. explain the importance of maintaining a constant internal environment in response to internal and external change |  |  |  |  |
| 2. a) describe the function of the skin in the control of body temperature, including changes to sweating, hair erection and blood flow *(separate science only)* |  |  |  |  |
| 2. b) describe practical investigations into temperature control of the body  *(separate science only)* |  |  |  |  |
| 3. **explain the response of the body to different temperature challenges, including receptors, processing, responses and negative feedback**  *(separate science only)* |  |  |  |  |
| 4. explain the effect on cells of osmotic changes in body fluids  Information *Learners are not expected to discuss water potential*  *(separate science only)* |  |  |  |  |
| 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)* |  |  |  |  |
| **6. describe the effect of ADH on the permeability of the kidney tubules**  *(separate science only)* |  |  |  |  |
| 7. **explain the response of the body to different osmotic challenges, including receptors, processing, response and negative feedback**  *(separate science only)* |  |  |  |  |
| 8. in the context of maintaining a constant internal environment:  a) extract and interpret data from graphs, charts and tables |  |  |  |  |
| 8. in the context of maintaining a constant internal environment:   1. translate information between numerical and graphical forms |  |  |  |  |

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| **B5.5 What role do hormones play in human reproduction?** | | | | |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 1. describe the role of hormones in human reproduction, including the control of the menstrual cycle |  |  |  |  |
| 2. **explain the interactions of FSH, LH, oestrogen and progesterone in the control of the menstrual cycle** |  |  |  |  |
| 3. explain the use of hormones in contraception and evaluate hormonal and non-hormonal methods of contraception |  |  |  |  |
| 4. **explain the use of hormones in modern reproductive technologies to treat infertility** |  |  |  |  |
| **B5.6 What can happen when organs and control systems stop working?** | | | | |
| 1. explain how insulin controls the blood sugar level in the body |  |  |  |  |
| 2. **explain how glucagon and insulin work together to control the blood sugar level in the body** |  |  |  |  |
| **B5.6 What can happen when organs and control systems stop working?** | | | | |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 3. compare type 1 and type 2 diabetes and explain how they can be treated |  |  |  |  |
| 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  *(separate science only)* |  |  |  |  |
| 4. b) describe practical investigations into the response of the pupil in different light conditions *(separate science only)* |  |  |  |  |
| 5. describe common defects of the eye, including short-sightedness, long-sightedness and cataracts, and explain how these problems may be overcome, including ray diagrams to illustrate the effect of lenses  *(separate science only)* |  |  |  |  |
| 6. **explain some of the limitations in treating damage and disease in the brain and other parts of the nervous systems**  *(separate science only)* |  |  |  |  |
| **B6.1 How was the theory of evolution developed?** | | | | |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 1. state that there is usually extensive genetic variation within a population of a species |  |  |  |  |
| 2. recall that genetic variants arise from mutations, and that most have no effect on the phenotype, some influence on phenotype and a very few determine phenotype |  |  |  |  |
| 3. explain how evolution occurs through natural selection of variants that give rise to phenotypes better suited to their environment |  |  |  |  |
| 4. explain the importance of competition in a community, with regard to natural selection |  |  |  |  |
| 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 |  |  |  |  |
| 6. explain the impact of the selective breeding of food plants and domesticated animals |  |  |  |  |

| **B6.1 How was the theory of evolution developed?** | | | | |
| --- | --- | --- | --- | --- |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 7. describe how fossils provide evidence for evolution |  |  |  |  |
| 8. describe the work of Darwin and Wallace in the development of the theory of evolution by natural selection  *(separate science only)* |  |  |  |  |
| 9. describe modern examples of evidence for evolution including antibiotic resistance in bacteria |  |  |  |  |
| 10. explain the impact of these ideas on modern biology and society  *(separate science only)* |  |  |  |  |
| **B6.2 How do sexual and asexual reproduction affect evolution? *(separate science only)*** | | | | |
| 1. explain some of the advantages and disadvantages of asexual and sexual reproduction in a range of organisms |  |  |  |  |

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| **B6.3 How does our understanding of biology help us classify the diversity of organisms on Earth?** | | | | |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 1. describe the impact of developments in biology on classification systems, including the use of DNA analysis to classify organisms |  |  |  |  |
| **B6.4 How is biodiversity threatened and how can we protect it?** | | | | |
| 1. describe both positive and negative human interactions within ecosystems and explain their impact on biodiversity |  |  |  |  |
| 2. **evaluate evidence for the impact of environmental changes on the distribution of organisms, with reference to water and atmospheric gases**  *(separate science only)* |  |  |  |  |
| 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)* |  |  |  |  |

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| **B6.4 How is biodiversity threatened and how can we protect it?** | | | | |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 4. explain some of the benefits and challenges of maintaining local and global biodiversity |  |  |  |  |
| 5. extract and interpret information related to biodiversity from charts, graphs and tables |  |  |  |  |
| 6. describe and explain some possible biotechnological and agricultural genetic modification, to the demands of the growing human population  *(separate science only)* |  |  |  |  |

| **B7.1 What needs to be considered when investigating a phenomenon scientifically?** | | | | |
| --- | --- | --- | --- | --- |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 1. in given contexts use scientific theories and tentative explanations to develop and justify hypotheses and predictions |  |  |  |  |
| 2. suggest appropriate apparatus, materials and techniques, justifying the choice with reference to the precision, accuracy and validity of the data that will be collected |  |  |  |  |
| 3. recognise the importance of scientific quantities and understand how they are determined |  |  |  |  |
| 4. identify factors that need to be controlled, and the ways in which they could be controlled |  |  |  |  |
| 5. suggest an appropriate sample size and/or range of values to be measured and justify the suggestion |  |  |  |  |

| **B7.1 What needs to be considered when investigating a phenomenon scientifically?** | | | | |
| --- | --- | --- | --- | --- |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 6. plan experiments or devise procedures by constructing clear and logically sequenced strategies to:   * make observations * produce or characterise a substance * test hypotheses * collect and check data * explore phenomena |  |  |  |  |
| 7. identify hazards associated with the data collection and suggest ways of minimising the risk |  |  |  |  |
| 8. use appropriate scientific vocabulary, terminology and definitions to communicate the rationale for an investigation and the methods used using diagrammatic, graphical, numerical and symbolic forms |  |  |  |  |
| **B7.2 What conclusions can we make from data?** | | | | |
| 1. present observations and other data using appropriate formats |  |  |  |  |

| **B7.2 What conclusions can we make from data?** | | | | |
| --- | --- | --- | --- | --- |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 2. when processing data use SI units where appropriate (e.g. kg, g, mg; km, m, mm; kJ, J) and IUPAC chemical nomenclature unless inappropriate |  |  |  |  |
| 3. when processing data use prefixes (e.g. tera, giga, mega, kilo, centi, milli, micro and nano) and powers of ten for orders of magnitude |  |  |  |  |
| 4. be able to translate data from one form to another |  |  |  |  |
| 5. when processing data interconvert units |  |  |  |  |
| 6. when processing data use an appropriate number of significant figures |  |  |  |  |
| 7. when displaying data graphically select an appropriate graphical form, use appropriate axes and scales, plot data points correctly, draw an appropriate line of best fit, and indicate uncertainty (e.g. range bars) |  |  |  |  |
| 8. when analysing data identify patterns/trends, use statistics (range and mean) and obtain values from a line on a graph (including gradient, interpolation and extrapolation) |  |  |  |  |
| 9. in a given context evaluate data in terms of accuracy, precision, repeatability and reproducibility, identify potential sources of random and systematic error, and discuss the decision to discard or retain an outlier |  |  |  |  |
| 10. evaluate an experimental strategy, suggest improvements and explain why they would increase the quality (accuracy, precision, repeatability and reproducibility) of the data collected, and suggest further investigations |  |  |  |  |
| 11. in a given context interpret observations and other data (presented in diagrammatic, graphical, symbolic or numerical form) to make inferences and to draw reasoned conclusions, using appropriate scientific vocabulary and terminology to communicate the scientific rationale for findings and conclusions |  |  |  |  |
| 12. explain the extent to which data increase or decrease confidence in a prediction or hypothesis |  |  |  |  |
| **B7.3 How are scientific explanations developed?** | | | | |
| 1. use ideas about correlation and cause to: 2. identify a correlation in data presented as text, in a table, or as a graph |  |  |  |  |
| 1. use ideas about correlation and cause to:   b) distinguish between a correlation and a cause-effect link |  |  |  |  |
| 1. use ideas about correlation and cause to:   c) suggest factors that might increase the chance of a particular outcome in a given situation, but do not invariably lead to it |  |  |  |  |
| 1. use ideas about correlation and cause to:   d) explain why individual cases do not provide convincing evidence for or against a correlation |  |  |  |  |

| **B7.3 How are scientific explanations developed?** | | | | |
| --- | --- | --- | --- | --- |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 1. use ideas about correlation and cause to:   e) identify the presence (or absence) of a plausible mechanism as reasonable grounds for accepting (or rejecting) a claim that a factor is a cause of an outcome |  |  |  |  |
| 1. describe and explain examples of scientific methods and theories that have developed over time and how theories have been modified when new evidence became available |  |  |  |  |
| 1. describe in broad outline the ‘peer review’ process, in which new scientific claims are evaluated by other scientists |  |  |  |  |
| 4. use a variety of models (including representational, spatial, descriptive, computational and mathematical models) to:   * solve problems * make predictions * develop scientific explanations and understanding * identify limitations of models |  |  |  |  |

| **B7.4 How do science and technology impact society?** | | | | |
| --- | --- | --- | --- | --- |
| **Assessable learning outcomes**  You will be required to: | **R** | **A** | **G** | **Comments** |
| 1. describe and explain examples of applications of science that have made significant positive differences to people’s lives |  |  |  |  |
| 2. identify examples of risks that have arisen from a new scientific or technological advance |  |  |  |  |
| 3. for a given situation:  a) identify risks and benefits to the different individuals and groups involved |  |  |  |  |
| 3. for a given situation:  b) discuss a course of action, taking account of who benefits and who takes the risks |  |  |  |  |
| 3. for a given situation:  c) suggest reasons for people’s willingness to accept the risk |  |  |  |  |
| 3. for a given situation:  d) **distinguish between perceived and calculated risk** |  |  |  |  |
| 1. suggest reasons why different decisions on the same issue might be appropriate in view of differences in personal, social, or economic or environmental context, and be able to make decisions based on the evaluation of evidence and arguments |  |  |  |  |
| 5. distinguish questions that could in principle be answered using a scientific approach, from those that could not; where an ethical issue is involved clearly state what the issue is and summarise the different views that may be held |  |  |  |  |
| 6. explain why scientists should communicate their work to a range of audience |  |  |  |  |

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