Pearson
Edexcel

INTERNATIONAL GCSE

BIOLOGY

4BI1

Mapping from Cambridge International Examinations to Pearson Edexcel (0610 to 4BI1)

Qualification at a Glance

<table>
<tr><th>Cambridge International</th><th>Pearson Edexcel</th></tr>
<tr><td>
Availability
Two Tiers: Core and Extended
Number of Papers: Three Papers at Core and Three at Extended

Content Summary:
Characteristics and classification of living organisms
Organisation of the organism
Movement in and out of cells
Biological molecules
Enzymes
Plant nutrition
Human nutrition
Transport in plants
Transport in animals
Diseases and immunity
Gas exchange in humans
Respiration
Excretion in humans
Coordination and response
Drugs
Reproduction
Inheritance
Variation and selection
Organisms and their environment
Biotechnology and genetic engineering
Human influences on ecosystems

Paper 1C: 45 minutes, 30% of the qualification, Multiple-Choice Questions
Paper 3C: 1 hour 15, 50% of the qualification, Short-answer and structured questions
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Availability: January and June
Number of Papers: Two Papers

Content Summary:
The nature and variety of living organisms
Structure and functions in living organisms
Reproduction and inheritance
Ecology and the environment
Use of biological resources

Paper 1: 2 hours, 61.1% of the qualification
Paper 2: 1 hour 15, 38.9% of the qualification

Calculator may be used in the examinations.

<table>
<tr><td>AO1</td><td>Knowledge and understanding of biology</td><td>38–42%</td></tr>
<tr><td>AO2</td><td>Application of knowledge and understanding, analysis and evaluation of biology</td><td>38–42%</td></tr>
<tr><td>AO3</td><td>Experimental skills, analysis and evaluation of data and methods in biology</td><td>19–21%</td></tr>
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<table>
<tr><th rowspan="2">Unit</th><th colspan="3">Assessment Objective</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th></tr>
<tr><td>Paper 1</td><td>23.2–25.7%</td><td>23.2–25.7%</td><td>11.6–12.8%</td></tr>
<tr><td>Paper 2</td><td>14.8–16.3%</td><td>14.8–16.3%</td><td>7.4–8.2%</td></tr>
<tr><td>Total</td><td>38–42%</td><td>38–42%</td><td>19–21%</td></tr>
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Or
Paper 2E: 45 minutes, 30% of the qualification, Multiple-Choice Questions
Paper 4E: 1 hour 15, 50% of the qualification, Short-answer and structured questions

All candidates also have to take Component 5 or 6.
Paper 5C: 1 hour 15, 20% of the qualification, **Practical Test:** questions based on experimental skills
Paper 6E: 1 hour, 20% of the qualification, **Alternative to Practical:** questions based on experimental skills

Core: Targeted at C-G candidates
Extended: Targeted at A*-C candidates

AO1	Knowledge and understanding	50 %
AO2	Handling information and problem solving	30 %
AO3	Experimental skills and investigations	20 %

Unit	**Assessment Objective**		
	AO1	**AO2**	**AO3**
Paper 1 and 2	25 %	15 %	0 %
Paper 3 and 4	25 %	15 %	0 %
Paper 5 and 6	0 %	0 %	20 %
Total	50 %	30 %	20 %

Cambridge IGCSE Biology Mapped Against Edexcel International GCSE

1. Detailed Comparison of Specifications

This is broken down by Cambridge specification heading

Bold: Supplementary content on Cambridge IGCSE

1 Characteristics and classification of living organisms

Cambridge	Edexcel	Notes
1.1 Characteristics of living organisms Describe the characteristics of living organisms by defining the terms: – movement as an action by an organism causing a change of position or place – respiration as the chemical reactions in cells that break down nutrient molecules and release energy – sensitivity as the ability to detect and respond to changes in the environment – growth as a permanent increase in size – reproduction as the processes that make more of the same kind of organism – excretion as removal from organisms of toxic materials and substances in excess of requirements – nutrition as taking in of materials for energy, growth and development	1.1 understand how living organisms share the following characteristics: • they require nutrition • they respire • they excrete their waste • they respond to their surroundings • they move • they control their internal conditions • they reproduce • they grow and develop.	Both require similar understanding of the characteristics of living organisms. Cambridge gives more detail as to the definitions needed for core and supplement. Edexcel has simpler definitions.

Define the terms: **– movement as an action by an organism or part of an organism causing a change of position or place** **– respiration as the chemical reactions in cells that break down nutrient molecules and release energy for metabolism** **– sensitivity as the ability to detect or sense stimuli in the internal or external environment and to make appropriate responses** **– growth as a permanent increase in size and dry mass by an increase in cell number or cell size or both** **– excretion as removal from organisms of the waste products of metabolism (chemical reactions in cells including respiration), toxic materials, and substances in excess of requirements** **– nutrition as taking in of materials for energy, growth and development; plants require light, carbon dioxide, water and ions; animals need organic compounds**		
1.2 Concept and use of a classification system State that organisms can be classified into groups by the features that they share Define species as a group of organisms that can reproduce to produce fertile offspring Define and describe the binomial system of naming species as an internationally agreed	1.2 describe the common features shown by eukaryotic organisms: plants, animals, fungi and protoctists	This whole topic is only on the Cambridge IGCSE, although section 1.2 on the Edexcel specification requires a knowledge of the characteristics of some kingdoms.

system in which the scientific name of an organism is made up of two parts showing the genus and species **Explain that classification systems aim to reflect evolutionary relationships** **Explain that classification is traditionally based on studies of morphology and anatomy** **Explain that the sequences of bases in DNA and of amino acids in proteins are used as a more accurate means of classification** **Explain that organisms which share a more recent ancestor (are more closely related) have base sequences in DNA that are more similar than those that share only a distant ancestor**		
1.3 Features of organisms List the features in the cells of all living organisms, limited to cytoplasm, cell membrane and DNA as genetic material **List the features in the cells of all living organisms, limited to ribosomes for protein synthesis and enzymes involved in respiration** List the main features used to place animals and plants into the appropriate kingdoms **List the main features used to place all organisms into one of the five kingdoms: Animal, Plant,**	1.2 describe the common features shown by eukaryotic organisms: plants, animals, fungi and protoctists Plants: these are multicellular organisms; their cells contain chloroplasts and are able to carry out photosynthesis; their cells have cellulose cell walls; they store carbohydrates as starch or sucrose. Examples include flowering plants, such as a cereal (for example, maize), and a herbaceous legume (for example, peas or beans). Animals: these are multicellular organisms; their cells do not contain chloroplasts and are not able to carry out photosynthesis; they have no cell	Both require a similar understanding of the main features of organisms. Edexcel gives more details and gives examples.

Fungus, Prokaryote, Protoctist	walls; they usually have nervous co-ordination and are able to move from one place to another; they often store carbohydrate as glycogen. Examples include mammals (for example, humans) and insects (for example, housefly and mosquito). Fungi: these are organisms that are not able to carry out photosynthesis; their body is usually organised into a mycelium made from thread-like structures called hyphae, which contain many nuclei; some examples are single-celled; their cells have walls made of chitin; they feed by extracellular secretion of digestive enzymes onto food material and absorption of the organic products; this is known as saprotrophic nutrition; they may store carbohydrate as glycogen. Examples include Mucor, which has the typical fungal hyphal structure, and yeast, which is single-celled. Protoctists: these are microscopic single-celled organisms. Some, like Amoeba, that live in pond water, have features like an animal cell, while others, like Chlorella, have chloroplasts and are more like plants. A pathogenic example is Plasmodium, responsible for causing malaria.	
List the main features used to place organisms into groups within the animal kingdom, limited to: — the main groups of vertebrates: mammals, birds, reptiles, amphibians, fish — the main groups of arthropods: myriapods,		Only Cambridge requires an understanding of the classification of animals and plants.

insects, arachnids, crustaceans **List the main features used to place organisms into groups within the plant kingdom, limited to ferns and flowering plants (dicotyledons and monocotyledons)** **List the features of viruses, limited to protein coat and genetic material**	1.4 understand the term pathogen and know that pathogens may include fungi, bacteria, protoctists or viruses Viruses: these are not living organisms. They are small particles, smaller than bacteria; they are parasitic and can reproduce only inside living cells; they infect every type of living organism. They have a wide variety of shapes and sizes; they have no cellular structure but have a protein coat and contain one type of nucleic acid, either DNA or RNA. Examples include the tobacco mosaic virus that causes discolouring of the leaves of tobacco plants by preventing the formation of chloroplasts, the influenza virus that causes 'flu' and the HIV virus that causes AIDS.	Both require a similar understanding of the structure of viruses. Edexcel gives additional detail.
1.4 Dichotomous keys Construct and use simple dichotomous keys based on easily identifiable features		Only Cambridge requires in understanding of dichotomous keys.

2 Organisation of the Organism

Cambridge	Edexcel	Notes
2.1 Cell structure and organisation		
Describe and compare the structure of a plant cell with an animal cell, as seen under a light microscope, limited to cell wall, nucleus, cytoplasm, chloroplasts, vacuoles and location of the cell membrane	2.2 describe cell structures, including the nucleus, cytoplasm, cell membrane, cell wall, mitochondria, chloroplasts, ribosomes and vacuole	Both require similar understanding of the functions of cell organelles.
State the functions of the structures seen under the light microscope in the plant cell and in the animal cell	2.3 describe the functions of the nucleus, cytoplasm, cell membrane, cell wall, mitochondria, chloroplasts, ribosomes and vacuole	
	2.4 know the similarities and differences in the structure of plant and animal cells	Both require similar understanding of differences between plant and animal cells.
State that the cytoplasm of all cells contains structures, limited to ribosomes on rough endoplasmic reticulum and vesicles		Both require knowledge of mitochondria and ribosomes. Only Cambridge requires a knowledge of the rough E.R.
State that almost all cells, except prokaryotes, have mitochondria and rough endoplasmic reticulum	1.2 describe the common features shown by eukaryotic organisms: plants, animals, fungi and protoctists	Both require a basic understanding of the differences between prokaryotes and eukaryotes.
Identify mitochondria and rough endoplasmic reticulum in diagrams and images of cells	1.3 describe the common features shown by prokaryotic organisms such as bacteria	

State that aerobic respiration occurs in mitochondria **State that cells with high rates of metabolism require large numbers of mitochondria to provide sufficient energy**	2.3 describe the functions of the nucleus, cytoplasm, cell membrane, cell wall, mitochondria, chloroplasts, ribosomes and vacuole	Both require a similar understanding of the role of mitochondria.
2.2 Levels of organisation Relate the structure of the following to their functions: – ciliated cells – movement of mucus in the trachea and bronchi – root hair cells – absorption – xylem vessels – conduction and support – palisade mesophyll cells – photosynthesis – nerve cells – conduction of impulses – red blood cells – transport of oxygen – sperm and egg cells – reproduction Define tissue as a group of cells with similar structures, working together to perform a shared function Define organ as a structure made up of a group of tissues, working together to perform specific functions Define organ system as a group of organs with related functions, working together to perform body functions	2.1 describe the levels of organisation in organisms: organelles, cells, tissues, organs and systems 2.5B explain the importance of cell differentiation in the development of specialised cells	Both require an understanding of the levels of organisation. Cambridge gives definitions of each level of organisation. Cambridge also gives specific examples of cell types, Edexcel gives examples of cell types in different topics, e.g. palisade cells in the photosynthesis section.

State examples of tissues, organs and organ systems from sections 6 to 16 Identify the different levels of organisation in drawings, diagrams and images of familiar material **Identify the different levels of organisation in drawings, diagrams and images of unfamiliar material**		
2.3 Size of specimens Calculate magnification and size of biological specimens using millimetres as units **Calculate magnification and size of biological specimen**		Only Cambridge requires an understanding of how to calculate magnification although this could be asked in an Edexcel examination as part of a mathematical skills question if the formulae are given.
	2.5B explain the importance of cell differentiation in the development of specialised cells 2.6B understand the advantages and disadvantages of using stem cells in medicine	Only Edexcel requires an understanding of the uses of stem cells and cell differentiation.

3 Movement in and out of cells

Cambridge	Edexcel	Notes
3.1 Diffusion Define diffusion as the net movement of particles from a region of their higher concentration to a region of their lower concentration down a	2.15 understand the process of diffusion, by which substances move into and out of cells	Both specifications require a similar understanding of the process of diffusion. Both require an understanding of the effects of

concentration gradient, as a result of their random movement **State that the energy for diffusion comes from the kinetic energy of random movement of molecules and ions** Describe the importance of diffusion of gases and solutes State that substances move into and out of cells by diffusion through the cell membrane **Investigate the factors that influence diffusion, limited to surface area, temperature, concentration gradients and distance**	2.16 understand how factors affect the rate of movement of substances into and out of cells, including the effects of surface area to volume ratio, distance, temperature and concentration gradient 2.17 practical: investigate diffusion and osmosis using living and non-living systems	surface area, temperature, distance and concentration gradients. Both require practical work to be carried out on diffusion.
3.2 Osmosis State that water diffuses through partially permeable membranes by osmosis **Define osmosis as the net movement of water molecules from a region of higher water potential (dilute solution) to a region of lower water potential (concentrated solution), through a partially permeable membrane**	2.15 understand the process of osmosis by which substances move into and out of cells	Both require an understanding of osmosis. Cambridge gives a definition but this is expected by Edexcel (an understanding is required).

State that water moves in and out of cells by osmosis through the cell membrane Investigate and describe the effects on plant tissues of immersing them in solutions of different concentrations **Explain the effects on plant tissues of immersing them in solutions of different concentrations by using the terms turgid, turgor pressure, plasmolysis and flaccid** **Explain the importance of water potential and osmosis in the uptake of water by plants** **Explain the importance of water potential and osmosis on animal cells and tissues** State that plants are supported by the pressure of water inside the cells pressing outwards on the cell wall **Explain how plants are supported by the turgor pressure within cells, in terms of water pressure acting against an inelastic cell wall**	2.17 practical: investigate diffusion and osmosis using living and non-living systems 2.16 understand how factors affect the rate of movement of substances into and out of cells, including the effects of surface area to volume ratio, distance, temperature and concentration gradient	Both require practical investigation of osmosis. Only Cambridge now requires the terms turgid, turgor, plasmolysis and flaccid. Only Cambridge used the term, water potential. Only Cambridge requires an understanding of turgor pressure.
3.3 Active transport Define active transport as the movement of particles through a cell membrane from a region of lower concentration to a region of higher concentration using energy from respiration	2.15 understand the process of active transport by which substances move into and out of cells	Both require an understanding of active transport. Cambridge gives specific examples although Edexcel mentions similar examples. e.g. selective reabsorption in the kidney, at other places in the specification.

Discuss the importance of active transport as a process for movement across membranes: **– e.g. ion uptake by root hairs and uptake of glucose by epithelial cells of villi and kidney tubules** **Explain how protein molecules move particles across a membrane during active transport**		Only Cambridge specifically refers to the role of protein pumps.

4 Biological molecules

Cambridge	Edexcel	Notes
4.1 Biological molecules List the chemical elements that make up: – carbohydrates – fats – proteins	2.7 identify the chemical elements present in carbohydrates, proteins and lipids (fats and oils)	Both require a similar understanding of the chemical elements in the main biochemical groups.
State that large molecules are made from smaller molecules, limited to: – starch and glycogen from glucose – cellulose from glucose – proteins from amino acids – fats and oils from fatty acids and glycerol	2.8 describe the structure of carbohydrates, proteins and lipids as large molecules made up from smaller basic units: starch and glycogen from simple sugars, protein from amino acids, and lipid from fatty acids and glycerol	Both require a similar understanding of the molecular structures of the food groups.
Describe the use of: – iodine solution to test for starch – Benedict's solution to test for reducing sugars – biuret test for proteins – ethanol emulsion test for fats and oils – DCPIP test for vitamin C	2.9 practical: investigate food samples for the presence of glucose, starch, protein and fat	Both require a similar knowledge of the biochemical tests for food groups.

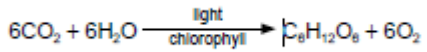
Explain that different sequences of amino acids give different shapes to protein molecules **Relate the shape and structure of protein molecules to their function, limited to the active site of enzymes and the binding site of antibodies**	3.35B understand how a change in DNA can affect the phenotype by altering the sequence of amino acids in a protein	Only Cambridge requires specific detail about the shapes of protein. Edexcel requires an understanding of the effects of mutations on protein structure.
Describe the structure of DNA as: **– two strands coiled together to form a double helix** **– each strand contains chemicals called bases** **– cross-links between the strands are formed by pairs of bases** **– the bases always pair up in the same way: A with T, and C with G (full names are not required)**	3.16B describe a DNA molecule as two strands coiled to form a double helix, the strands being linked by a series of paired bases: adenine (A) with thymine (T), and cytosine (C) with guanine (G)	Both require a similar understanding of the structure of DNA.
State that water is important as a solvent Supplement **Describe the roles of water as a solvent in organisms with respect to digestion, excretion and transport**		Only Cambridge requires an understanding of the role of water.

5 Enzymes

Cambridge	Edexcel	Notes
5.1 Enzymes Define the term *catalyst* as a substance that increases the rate of a chemical reaction and is not changed by the reaction	2.10 understand the role of enzymes as biological catalysts in metabolic reactions	Both require a similar understanding of the roles of enzymes.
Define *enzymes* as proteins that function as biological catalysts		
Describe why enzymes are important in all living organisms in terms of reaction speed necessary to sustain life		
Describe enzyme action with reference to the complementary shape of an enzyme and its substrate and the formation of a product (knowledge of the term *active site* is **not** required)	2.11 understand how temperature changes can affect enzyme function, including changes to the shape of active site	Both require a similar understanding of the role of the active site and the effects of temperature and pH. Only Cambridge refers to enzyme-substrate complexes.
Explain enzyme action with reference to the active site, enzyme-substrate complex, substrate and product		
Explain the specificity of enzymes in terms of the complementary shape and fit of the active site with the substrate	2.11 understand how temperature changes can affect enzyme function, including changes to the shape of active site	
Investigate and describe the effect of changes in temperature and pH on enzyme activity	2.12 practical: investigate how enzyme activity can be affected by changes in temperature	

	2.14B practical: investigate how enzyme activity can be affected by changes in pH	Both require similar practical investigations into the effect of temperature and pH on enzyme activity.
Explain the effect of changes in temperature on enzyme activity in terms of kinetic energy, shape and fit, frequency of effective collisions and denaturation **Explain the effect of changes in pH on enzyme activity in terms of shape and fit and denaturation**	2.11 understand how temperature changes can affect enzyme function, including changes to the shape of active site 2.13 understand how enzyme function can be affected by changes in pH altering the active site	Both require a similar understanding of the effect of temperature and pH.

6 Plant nutrition

Cambridge	Edexcel	Notes
6.1 Photosynthesis Define photosynthesis as the process by which plants manufacture carbohydrates from raw materials using energy from light State the word equation for photosynthesis: carbon dioxide + water → glucose + oxygen, in the presence of light and chlorophyll **State the balanced chemical equation for photosynthesis** 	2.18 understand the process of photosynthesis and its importance in the conversion of light energy to chemical energy 2.19 know the word equation and the balanced chemical symbol equation for photosynthesis	Both require a similar understanding of the process of photosynthesis including the word and chemical equations.

Explain that chlorophyll transfers light energy into chemical energy in molecules, for the synthesis of carbohydrates **Outline the subsequent use and storage of the carbohydrates made in photosynthesis**		Only Cambridge refers to the use and storage of carbohydrates produced by photosynthesis.
Investigate the necessity for chlorophyll, light and carbon dioxide for photosynthesis, using appropriate controls Investigate and describe the effects of varying light intensity, carbon dioxide concentration and temperature on the rate of photosynthesis, e.g. in submerged aquatic plants	2.23 practical: investigate photosynthesis, showing the evolution of oxygen from a water plant, the production of starch and the requirements of light, carbon dioxide and chlorophyll	Both require similar practical experimentation on factors affecting photosynthesis.
Define the term limiting factor as something present in the environment in such short supply that it restricts life processes **Identify and explain the limiting factors of photosynthesis in different environmental conditions**	2.20 understand how varying carbon dioxide concentration, light intensity and temperature affect the rate of photosynthesis	Both require a similar understanding of limiting factors.
Describe the use of carbon dioxide enrichment, optimum light and optimum temperatures in glasshouses in temperate and tropical countries	5.1 describe how glasshouses and polythene tunnels can be used to increase the yield of certain crops 5.2 understand the effects on crop yield of increased carbon dioxide and increased temperature in glasshouses	Both require a similar understanding of how greenhouses are used to enhance photosynthesis.

Use hydrogencarbonate indicator solution to investigate the effect of gas exchange of an aquatic plant kept in the light and in the dark	2.44B understand how respiration continues during the day and night, but that the net exchange of carbon dioxide and oxygen depends on the intensity of light 2.45B practical: investigate the effect of light on net gas exchange from a leaf, using hydrogen-carbonate indicator	Both require similar practical work on the use of hydrogen-carbonate indicator to investigated gas exchange.
6.2 Leaf structure Identify chloroplasts, cuticle, guard cells and stomata, upper and lower epidermis, palisade mesophyll, spongy mesophyll, vascular bundles, xylem and phloem in leaves of a dicotyledonous plant **Explain how the internal structure of a leaf is adapted for photosynthesis**	2.21 describe the structure of the leaf and explain how it is adapted for photosynthesis 2.70 understand the origin of carbon dioxide and oxygen as waste products of metabolism and their loss from the stomata of a leaf	Both require a similar understanding of the structure of a leaf and how it is adapted for photosynthesis. Cambridge lists the key features.
6.3 Mineral requirements Describe the importance of: – nitrate ions for making amino acids – magnesium ions for making chlorophyll **Explain the effects of nitrate ion and magnesium ion deficiency on plant growth**	2.22 understand that plants require mineral ions for growth, and that magnesium ions are needed for chlorophyll and nitrate ions are needed for amino acids	Both require a similar understanding of the role of nitrates and magnesium.

7 Human nutrition

Cambridge	Edexcel	Notes
7.1 Diet		
State what is meant by the term balanced diet for humans	2.24 understand that a balanced diet should include appropriate proportions of carbohydrate, protein, lipid, vitamins, minerals, water and dietary fibre	Both require a similar understanding of balanced diets, changing energy requirements and the roles of key nutrients.
Explain how age, gender and activity affect the dietary needs of humans including during pregnancy and whilst breast-feeding	2.26 understand how energy requirements vary with activity levels, age and pregnancy	
Describe the effects of malnutrition in relation to starvation, constipation, coronary heart disease, obesity and scurvy List the principal sources of, and describe the dietary importance of: – carbohydrates – fats – proteins – vitamins, limited to C and D – mineral salts, limited to calcium and iron – fibre (roughage) – water	2.25 identify the sources and describe the functions of carbohydrate, protein, lipid (fats and oils), vitamins A, C and D, the mineral ions calcium and iron, water and dietary fibre as components of the diet	
Explain the causes and effects of vitamin D and iron deficiencies		

Explain the causes and effects of protein-energy malnutrition, e.g. kwashiorkor and marasmus		Only Cambridge requires an understanding of kwashiorkor and marasmus.
7.2 Alimentary canal Define ingestion as the taking of substances, e.g. food and drink, into the body through the mouth Define mechanical digestion as the breakdown of food into smaller pieces without chemical change to the food molecules Define chemical digestion as the breakdown of large, insoluble molecules into small, soluble molecules Define absorption as the movement of small food molecules and ions through the wall of the intestine into the blood Define assimilation as the movement of digested food molecules into the cells of the body where they are used, becoming part of the cells Define egestion as the passing out of food that has not been digested or absorbed, as faeces, through the anus Describe diarrhoea as the loss of watery faeces Outline the treatment of diarrhoea using oral rehydration therapy		Only Cambridge lists definitions of ingestion, digestion, absorption, assimilation and egestion. These may be subsumed into the section on 'functions of human alimentary canal' by Edexcel.

Describe cholera as a disease caused by a bacterium **Explain that the cholera bacterium produces a toxin that causes secretion of chloride ions into the small intestine, causing osmotic movement of water into the gut, causing diarrhoea, dehydration and loss of salts from blood** Identify the main regions of the alimentary canal and associated organs, limited to mouth, salivary glands, oesophagus, stomach, small intestine (duodenum and ileum), pancreas, liver, gall bladder and large intestine (colon, rectum, anus) Describe the functions of the regions of the alimentary canal listed above, in relation to ingestion, digestion, absorption, assimilation and egestion of food	 2.27 describe the structure and function of the human alimentary canal, including the mouth, oesophagus, stomach, small intestine (duodenum and ileum), large intestine (colon and rectum) and pancreas 2.28 understand how food is moved through the gut by peristalsis	Only Cambridge requires a knowledge of oral rehydration therapy and cholera. Both require a similar understanding of the structures and functions of the alimentary canal.
7.3 Mechanical digestion Identify the types of human teeth (incisors, canines, premolars and molars) Describe the structure of human teeth, limited to enamel, dentine, pulp, nerves and cement, as well as the gums Describe the functions of the types of human teeth in mechanical digestion of food State the causes of dental decay in terms of		Only Cambridge requires a detailed understanding of the structure of teeth and dental care.

a coating of bacteria and food on teeth, the bacteria respiring sugars in the food, producing acid which dissolves the enamel and dentine Describe the proper care of teeth in terms of diet and regular brushing		
7.4 Chemical digestion State the significance of chemical digestion in the alimentary canal in producing small, soluble molecules that can be absorbed State the functions of enzymes as follows: – amylase breaks down starch to simpler sugars – protease breaks down protein to amino acids – lipase breaks down fats to fatty acids and glycerol State where, in the alimentary canal, amylase, protease and lipase are secreted **Describe the digestion of starch in the alimentary canal:** **– amylase is secreted into the alimentary canal and breaks down starch to maltose** **– maltose is broken down by maltase to glucose on the membranes of the epithelium lining the small intestine**	2.29 understand the role of digestive enzymes, including the digestion of starch to glucose by amylase and maltase, the digestion of proteins to amino acids by proteases and the digestion of lipids to fatty acids and glycerol by lipases	Both require a similar understanding of the role of the digestive enzymes.

Describe pepsin and trypsin as two protease enzymes that function in different parts of the alimentary canal: **– pepsin in the stomach** **– trypsin in the small intestine** State the functions of the hydrochloric acid in gastric juice, limited to killing bacteria in food and giving an acid pH for enzymes **Explain the functions of the hydrochloric acid in gastric juice, limited to the low pH:** **– denaturing enzymes in harmful microorganisms in food** **– giving the optimum pH for pepsin activity** **Outline the role of bile in neutralising the acidic mixture of food and gastric juices entering the duodenum from the stomach, to provide a suitable pH for enzyme action** **Outline the role of bile in emulsifying fats to increase the surface area for the chemical digestion of fat to fatty acids and glycerol by lipase**	2.30 understand that bile is produced by the liver and stored in the gall bladder 2.31 understand the role of bile in neutralising stomach acid and emulsifying lipids 2.33B practical: investigate the energy content in a food sample	Only Cambridge refers to pepsin and trypsin, Edexcel refers to proteases. Both require a similar understanding of the functions of bile. Only Edexcel requires students to carry out this practical on energy content of food.
7.5 Absorption Identify the small intestine as the region for the absorption of digested food **Explain the significance of villi and microvilli in**		Both require a similar understanding of the structure and functions of villi.

increasing the internal surface area of the small intestine **Describe the structure of a villus** **Describe the roles of capillaries and lacteals in villi** State that water is absorbed in both the small intestine and the colon, but that most absorption of water happens in the small intestine	2.32 understand how the small intestine is adapted for absorption, including the structure of a villus 2.27 describe the structure and function of the human alimentary canal, including the mouth, oesophagus, stomach, small intestine (duodenum and ileum), large intestine (colon and rectum) and pancreas	

8 Transport in plants

Cambridge	Edexcel	Notes
8.1 Transport in plants State the functions of xylem and phloem Identify the position of xylem and phloem as seen in sections of roots, stems and leaves, limited to non-woody dicotyledonous plants	2.53 describe the role of phloem in transporting sucrose and amino acids between the leaves and other parts of the plant 2.54 describe the role of xylem in transporting water and mineral ions from the roots to other parts of the plant	Both require a similar understanding of the functions of xylem and phloem.
8.2 Water uptake		

Identify root hair cells, as seen under the light microscope, and state their functions **Explain that the large surface area of root hairs increases the rate of the absorption of water by osmosis and ions by active transport** State the pathway taken by water through root, stem and leaf as root hair cell, root cortex cells, xylem and mesophyll cells Investigate, using a suitable stain, the pathway of water through the above-ground parts of a plant	2.55B understand how water is absorbed by root hair cells	Both require a similar understanding of the roles of root hairs, although Cambridge requires more detail on adaptations, root structures and the identification of root hairs. Only Cambridge requires students to carry out this practical.
8.3 Transpiration State that water is transported from the roots to leaves through the xylem vessels Define transpiration as loss of water vapour from plant leaves by evaporation of water at the surfaces of the mesophyll cells followed by diffusion of water vapour through the stomata **Explain how water vapour loss is related to the large surface area of cell surfaces, interconnecting air spaces and stomata** **Explain the mechanism by which water moves upwards in the xylem in terms of a transpiration**	2.54 describe the role of xylem in transporting water and mineral ions from the roots to other parts of the plant 2.56B understand that transpiration is the evaporation of water from the surface of a plant 2.40B understand the role of diffusion in gas exchange 2.41B understand gas exchange (of carbon dioxide and oxygen) in relation to respiration and photosynthesis 2.42B understand how the structure of the leaf is adapted for gas exchange	Both require a similar level of detailed understanding of the nature of transpiration.

pull that draws up a column of water molecules, held together by cohesion **Explain how and why wilting occurs** Investigate and describe the effects of variation of temperature and humidity on transpiration rate **Explain the effects of variation of temperature and humidity on transpiration rate**	2.43B describe the role of stomata in gas exchange 2.58B practical: investigate the role of environmental factors in determining the rate of transpiration from a leafy shoot 2.57B understand how the rate of transpiration is affected by changes in humidity, wind speed, temperature and light intensity	Both require students to carry out practical work into the effects of environmental factors on the rate of transpiration.
8.4 Translocation **Define translocation in terms of the movement of sucrose and amino acids in phloem:** **– from regions of production (source)** **– to regions of storage OR to regions where they are used in respiration or growth (sink)** **Explain that some parts of a plant may act as a source and a sink at different times during the life of a plant**	2.53 describe the role of phloem in transporting sucrose and amino acids between the leaves and other parts of the plant	Only Cambridge uses the term, translocation. Both require a similar knowledge of the role of phloem. Cambridge requires more detail about translocation such as the roles of sources and sinks.

9 Transport in animals

Cambridge	Edexcel	Notes
9.1 Transport in animals Describe the circulatory system as a system of blood vessels with a pump and valves to ensure one-way flow of blood **Describe the single circulation of a fish** **Describe the double circulation of a mammal** **Explain the advantages of a double circulation**	2.52 understand the need for a transport system in multicellular organisms 2.69 understand the general structure of the circulation system, including the blood vessels to and from the heart and lungs, liver and kidneys	Both require a similar understanding of the role of transport systems. Only Cambridge requires an understanding of fish circulation.
9.2 Heart Name and identify the structures of the mammalian heart, limited to the muscular wall, the septum, the left and right ventricles and atria, one-way valves and coronary arteries State that blood is pumped away from the heart into arteries and returns to the heart in veins **Name and identify the atrioventricular and semilunar valves in the mammalian heart** **Explain the relative thickness:** **– of the muscle wall of the left and right ventricles**	2.65 describe the structure of the heart and how it functions	Both require a similar understanding of the structure of the heart. Cambridge gives extra details that are subsumed by Edexcel under 'functions of heart structures' Only Cambridge gives extra detail on the functions of structures. These are covered by Edexcel under 'functions of heart structures.'

– of the muscle wall of the atria compared to that of the ventricles **Explain the importance of the septum in separating oxygenated and deoxygenated blood** **Describe the functioning of the heart in terms of the contraction of muscles of the atria and ventricles and the action of the valves**		
State that the activity of the heart may be monitored by ECG, pulse rate and listening to sounds of valves closing		Only Cambridge requires an understanding of ECGs.
Investigate and state the effect of physical activity on the pulse rate **Explain the effect of physical activity on the heart rate**	2.66 explain how the heart rate changes during exercise and under the influence of adrenaline	Both require a similar understanding of the effect of exercise on heart rate.
Describe coronary heart disease in terms of the blockage of coronary arteries and state the possible risk factors as diet, stress, smoking, genetic predisposition, age and gender **Discuss the roles of diet and exercise in the prevention of coronary heart disease**	2.67 understand how factors may increase the risk of developing coronary heart disease	Both require a similar understanding of factors affecting heart disease.
Describe ways in which coronary heart disease may be treated, limited to drug treatment with aspirin and surgery (stents, angioplasty and bypass)		Only Cambridge requires an understanding of heart disease treatments.

9.3 Blood and lymphatic vessels Describe the structure and functions of arteries, veins and capillaries **Explain how the structures of arteries, veins and capillaries are adapted for their functions** **State the function of arterioles, venules and shunt vessels** Name the main blood vessels to and from the: – heart, limited to vena cava, aorta, pulmonary artery and pulmonary vein – lungs, limited to the pulmonary artery and pulmonary vein – kidney, limited to the renal artery and renal vein **Outline the lymphatic system in terms of lymphatic vessels and lymph nodes** **Describe the function of the lymphatic system in the circulation of body fluids and the protection of the body from infection**	2.68 understand how the structure of arteries, veins and capillaries relate to their function 2.69 understand the general structure of the circulation system, including the blood vessels to and from the heart and lungs, liver and kidneys	Both require a similar understanding of the structures and functions of blood vessels and the circulatory system. Only Cambridge requires an understanding of arterioles and venules. Only Cambridge requires an understanding of the lymphatic system.
9.4 Blood List the components of blood as red blood cells, white blood cells, platelets and plasma Identify red and white blood cells, as seen under the light microscope, on prepared slides and in	2.59 describe the composition of the blood: red blood cells, white blood cells, platelets and plasma	Both require a similar understanding of the structure and components of blood.

diagrams and photomicrographs **Identify lymphocyte and phagocyte white blood cells, as seen under the light microscope, on prepared slides and in diagrams and photomicrographs** **State the functions of:** **– lymphocytes – antibody production** **– phagocytes – phagocytosis** State the functions of the following components of blood: – red blood cells in transporting oxygen, including the role of haemoglobin – white blood cells in phagocytosis and antibody production – platelets in clotting (details are not required) – plasma in the transport of blood cells, ions, soluble nutrients, hormones and carbon dioxide **Describe the process of clotting as the conversion of fibrinogen to fibrin to form a mesh** **State the roles of blood clotting as preventing blood loss and preventing the entry of pathogens**	2.62 understand how the immune system responds to disease using white blood cells, illustrated by phagocytes ingesting pathogens and lymphocytes releasing antibodies specific to the pathogen 2.61 understand how adaptations of red blood cells make them suitable for the transport of oxygen, including shape, the absence of a nucleus and the presence of haemoglobin 2.64B understand how platelets are involved in blood clotting, which prevents blood loss and the entry of micro-organisms 2.60 understand the role of plasma in the transport of carbon dioxide, digested food, urea, hormones and heat energy	Only Cambridge requires an understanding of the role of fibrinogen.

Describe the transfer of materials between capillaries and tissue fluid (details of the roles of water potential and hydrostatic pressure are not required)	2.64B understand how platelets are involved in blood clotting, which prevents blood loss and the entry of micro-organisms	

10 Diseases and immunity

Cambridge	Edexcel	Notes
10.1 Diseases and immunity Define pathogen as a disease-causing organism Define transmissible disease as a disease in which the pathogen can be passed from one host to another State that the pathogen for a transmissible disease may be transmitted either through direct contact, e.g. through blood or other body fluids, or indirectly, e.g. from contaminated surfaces or food, from animals, or from the air State that the body has defences: – mechanical barriers, limited to skin and hairs in the nose – chemical barriers, limited to mucus and stomach acid – cells, limited to phagocytosis and antibody production by white blood cells – which can be enhanced by vaccination	1.4 understand the term pathogen and know that pathogens may include fungi, bacteria, protoctists or viruses	Both require a similar knowledge of pathogens. Only Cambridge requires an understanding of transmission mechanisms and barriers to infection.

Explain the importance of hygienic food preparation, good personal hygiene, waste disposal and sewage treatment in controlling the spread of disease		Only Cambridge requires an understanding of the roles of food hygiene and sewage treatment.
State that antibodies lock on to antigens leading to direct destruction of pathogens, or marking of pathogens for destruction by phagocytes		Only Cambridge requires an understanding of how antibodies interact with antigens.
Explain how each pathogen has its own antigens, which have specific shapes, so specific antibodies which fit the specific shapes of the antigens are needed		
Define active immunity as defence against a pathogen by antibody production in the body **Explain that active immunity is gained after an infection by a pathogen, or by vaccination** **Explain the process of vaccination:** **– harmless pathogen given which has antigens** **– antigens trigger an immune response by lymphocytes which produce antibodies** **– memory cells are produced that give long-term immunity** **Explain the role of vaccination in controlling the spread of diseases**	2.62 understand how the immune system responds to disease using white blood cells, illustrated by phagocytes ingesting pathogens and lymphocytes releasing antibodies specific to the pathogen 2.63B understand how vaccination results in the manufacture of memory cells, which enable future antibody production to the pathogen to occur sooner, faster and in greater quantity	Both require a similar understanding of how active immunity occurs and how vaccines work.
Explain that passive immunity is short-term defence against a pathogen by antibodies		Only Cambridge requires an understanding of passive immunity.

acquired from another individual, e.g. mother to infant **State that memory cells are not produced in passive immunity** **Explain the importance of passive immunity for breast-fed infants** **State that some diseases are caused by the immune system targeting and destroying body cells, limited to Type 1 diabetes**		Only Cambridge requires an understanding of autoimmune disorders.

11 Gas exchange in humans

Cambridge	Edexcel	Notes
11.1 Gas exchange in humans List the features of gas exchange surfaces in humans, limited to large surface area, thin surface, good blood supply and good ventilation with air Name and identify the lungs, diaphragm, ribs, intercostal muscles, larynx, trachea, bronchi, bronchioles, alveoli and associated capillaries **Name and identify the internal and external intercostal muscles**	2.48 explain how alveoli are adapted for gas exchange by diffusion between air in the lungs and blood in capillaries 2.46 describe the structure of the thorax, including the ribs, intercostal muscles, diaphragm, trachea, bronchi, bronchioles, alveoli and pleural membranes	Both require a similar understanding of alveolus structure and the structure of the thorax.

State the functions of the cartilage in the trachea		
Explain the role of the ribs, the internal and external intercostal muscles and the diaphragm in producing volume and pressure changes in the thorax leading to the ventilation of the lungs	2.47 understand the role of the intercostal muscles and the diaphragm in ventilation	Both require a similar understanding of ventilation.
State the differences in composition between inspired and expired air, limited to oxygen, carbon dioxide and water vapour **Explain the differences in composition between inspired and expired air**		Only Cambridge requires an understanding of the differences in composition of inhaled and exhaled air, although this could be tested as part of a data response question by Edexcel.
Use limewater as a test for carbon dioxide to investigate the differences in composition between inspired and expired air Investigate and describe the effects of physical activity on rate and depth of breathing	2.50 practical: investigate breathing in humans, including the release of carbon dioxide and the effect of exercise	Both require practical investigation into breathing.
Explain the link between physical activity and rate and depth of breathing in terms of the increased carbon dioxide concentration in the blood, detected by the brain, causing an increased rate of breathing		Both require an understanding of the effect of exercise on breathing rate. Cambridge requires extra detail on the detection of carbon dioxide.
Explain the role of goblet cells, mucus and ciliated cells in protecting the gas exchange system from pathogens and particles	2.49 understand the biological consequences of smoking in relation to the lungs and the	

	circulatory system, including coronary heart disease	

12 Respiration

Cambridge	Edexcel	Notes
12.1 Respiration Core State the uses of energy in the body of humans: muscle contraction, protein synthesis, cell division, active transport, growth, the passage of nerve impulses and the maintenance of a constant body temperature State that respiration involves the action of enzymes in cells	2.34 understand how the process of respiration produces ATP in living organisms 2.35 know that ATP provides energy for cells	Both require an understanding of the roles of respiration; Cambridge lists some uses of energy. Only Edexcel requires a knowledge of ATP.
12.2 Aerobic respiration Define aerobic respiration as the chemical reactions in cells that use oxygen to break down nutrient molecules to release energy State the word equation for aerobic respiration as glucose + oxygen → carbon dioxide + water **State the balanced chemical equation for aerobic respiration as** **$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$**	2.37 know the word equation and the balanced chemical symbol equation for aerobic respiration in living organisms	Both require a similar understanding of the word and chemical equations for aerobic respiration.

Investigate the uptake of oxygen by respiring organisms, such as arthropods and germinating seeds **Investigate the effect of temperature on the rate of respiration of germinating seeds**	2.39 practical: investigate the evolution of carbon dioxide and heat from respiring seeds or other suitable living organisms	Both require students to carry out similar practicals on seed respiration.
12.3 Anaerobic respiration Define anaerobic respiration as the chemical reactions in cells that break down nutrient molecules to release energy without using oxygen State the word equations for anaerobic respiration in muscles during vigorous exercise (glucose → lactic acid) and the microorganism yeast (glucose → alcohol + carbon dioxide) **State the balanced chemical equation for anaerobic respiration in the microorganism yeast as** **$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$** State that anaerobic respiration releases much less energy per glucose molecule than aerobic respiration **State that lactic acid builds up in muscles and**	2.38 know the word equation for anaerobic respiration in plants and in animals	Both require a similar understanding of anaerobic respiration. Both require the word equations for anaerobic respiration; in addition, Cambridge requires the chemical equation for anaerobic respiration by yeast.

blood during vigorous exercise causing an oxygen debt **Outline how the oxygen debt is removed during recovery, limited to:** **– aerobic respiration of lactic acid in the liver** **– continuation, after exercise, of fast heart rate to transport lactic acid in blood from muscles to the liver** **– continuation, after exercise, of deeper breathing supplying oxygen for aerobic respiration of lactic acid**	2.36 describe the differences between aerobic and anaerobic respiration	Only Cambridge requires an understanding of the effects of an oxygen debt.

13 Excretion in humans

Cambridge	Edexcel	Notes
13.1 Excretion in humans State that urea is formed in the liver from excess amino acids **Describe the role of the liver in the assimilation of amino acids by converting them to proteins, including plasma proteins, e.g. fibrinogen** **Define deamination as the removal of the nitrogen-containing part of amino acids to form urea**	2.71 know the excretory products of the lungs, kidneys and skin (organs of excretion)	Both require a similar basic understanding of the excretory products. Only Cambridge requires an understanding of the role of the liver.

State that carbon dioxide is excreted through the lungs State that the kidneys excrete urea and excess water and salts **Explain the need for excretion, limited to toxicity of urea and carbon dioxide** Explain that the volume and concentration of urine produced is affected by water intake, temperature and exercise Identify on drawings, diagrams and images, the ureters, bladder and urethra **Outline the structure of the kidney, limited to the cortex, medulla and ureter** **Outline the structure and functioning of a kidney tubule, including:** **– the role of the glomerulus in the filtration from the blood of water, glucose, urea and salts** **– the role of the tubule in the reabsorption of all of the glucose, most of the water and some salts back into the blood, leading to the concentration of urea in the urine as well as loss**	2.71 know the excretory products of the lungs, kidneys and skin (organs of excretion) 2.72B understand how the kidney carries out its roles of excretion and osmoregulation 2.79B understand that urine contains water, urea and ions 2.73B describe the structure of the urinary system, including the kidneys, ureters, bladder and urethra 2.74B describe the structure of a nephron, including the Bowman's capsule and glomerulus, convoluted tubules, loop of Henle and collecting duct 2.75B describe ultrafiltration in the Bowman's capsule and the composition of the glomerular filtrate 2.76B understand how water is reabsorbed into the blood from the collecting duct 2.77B understand why selective reabsorption of glucose occurs at the proximal convoluted tubule	Both require a similar understanding of the role of the kidney in excretion. Only Edexcel requires an understanding of the role of ADH in osmoregulation.

of excess water and salts (details of these processes are not required) **Explain dialysis in terms of salt balance, the maintenance of glucose concentration and the removal of urea** **Describe the use of dialysis in kidney machines** **Discuss the advantages and disadvantages of kidney transplants, compared with dialysis**	2.78B describe the role of ADH in regulating the water content of the blood	Only Cambridge requires an understanding of dialysis.

14 Coordination and response

Cambridge	Edexcel	Notes
14.1 Nervous control in humans Describe a nerve impulse as an electrical signal that passes along nerve cells called neurones Describe the human nervous system in terms of: – the central nervous system consisting of brain and spinal cord – the peripheral nervous system – coordination and regulation of body functions	2.86 describe how nervous and hormonal communication control responses and understand the differences between the two systems 2.87 understand that the central nervous system consists of the brain and spinal cord and is linked to sense organs by nerves 2.82 understand that a co-ordinated response requires a stimulus, a receptor and an effector	Both require a similar understanding of the nervous system.

Distinguish between voluntary and involuntary actions Identify motor (effector), relay (connector) and sensory neurones from diagrams Describe a simple reflex arc in terms of receptor, sensory neurone, relay neurone, motor neurones and effector Describe a reflex action as a means of automatically and rapidly integrating and coordinating stimuli with the responses of effectors (muscles and glands) Define a synapse as a junction between two neurones **Describe the structure of a synapse, including the presence of neurotransmitter containing vesicles, the synaptic cleft and neurotransmitter receptor molecules** **Describe how an impulse triggers the release of a neurotransmitter from vesicles into the synaptic gap and how the neurotransmitter diffuses across to bind with receptor molecules, in the membrane of the neurone after the synaptic gap, causing the impulse to continue** **State that in a reflex arc the synapses ensure that impulses travel in one direction only**	2.88 understand that stimulation of receptors in the sense organs sends electrical impulses along nerves into and out of the central nervous system, resulting in rapid responses 2.90 describe the structure and functioning of a simple reflex arc illustrated by the withdrawal of a finger from a hot object 2.89 understand the role of neurotransmitters at synapses	Only Cambridge requires an understanding of voluntary and involuntary actions. Both require a similar understanding of the nature of a reflex arc.

State that many drugs, e.g. heroin, act upon synapses		Only Cambridge requires an understanding of the action of drugs on synapses.
14.2 Sense organs Define sense organs as groups of receptor cells responding to specific stimuli: light, sound, touch, temperature and chemicals		
Identify the structures of the eye, limited to cornea, iris, pupil, lens, retina, optic nerve and blind spot Describe the function of each part of the eye, limited to: – cornea – refracts light – iris – controls how much light enters pupil – lens – focuses light onto retina – retina – contains light receptors, some sensitive to light of different colours – optic nerve – carries impulses to the brain	2.91 describe the structure and function of the eye as a receptor	Both require a similar understanding of the structure and function of the eye. Cambridge lists the structures that students need to know.
Explain the pupil reflex in terms of light intensity and pupil diameter only		
Explain the pupil reflex in terms of light intensity and antagonistic action of circular and radial muscles in the iris **Explain accommodation to view near and distant objects in terms of the contraction and relaxation of the ciliary muscles, tension in the suspensory ligaments, shape of the lens and refraction of light**	2.92 understand the function of the eye in focusing on near and distant objects, and in responding to changes in light intensity	Both require a similar understanding of the pupil reflex and accommodation.

State the distribution of rods and cones in the retina of a human **Outline the function of rods and cones, limited to greater sensitivity of rods for night vision and three different kinds of cones absorbing light of different colours for colour vision** **Identify the position of the fovea**		Only Cambridge requires an understanding of rods, cones and the fovea.
14.3 Hormones in humans Define a hormone as a chemical substance, produced by a gland and carried by the blood, which alters the activity of one or more specific target organs Identify specific endocrine glands and their secretions, limited to adrenal glands and adrenaline, pancreas and insulin, testes and testosterone and ovaries and oestrogen Describe adrenaline as the hormone secreted in 'fight or flight' situations and its effects, limited to increased breathing and pulse rate and widened pupils **Discuss the role of the hormone adrenaline in the chemical control of metabolic activity, including increasing the blood glucose concentration and pulse rate**	2.86 describe how nervous and hormonal communication control responses and understand the differences between the two systems 2.94 understand the sources, roles and effects of the following hormones: adrenaline, insulin, testosterone, progesterone and oestrogen 2.66 explain how the heart rate changes during exercise and under the influence of adrenaline	Both require a similar understanding of the same hormones. Edexcel also requires an understanding of ADH, FSH and LH.

Give examples of situations in which adrenaline secretion increases **Compare nervous and hormonal control systems in terms of speed and longevity of action** State the functions of insulin, oestrogen and testosterone	2.86 describe how nervous and hormonal communication control responses and understand the differences between the two systems 2.95B understand the sources, roles and effects of the following hormones: ADH, FSH and LH	
14.4 Homeostasis Define homeostasis as the maintenance of a constant internal environment **Explain that homeostasis is the control of internal conditions within set limits** **Explain the concept of control by negative feedback** **Describe the control of the glucose concentration of the blood by the liver and the roles of insulin and glucagon from the pancreas** **Outline the symptoms and treatment of Type 1 diabetes (detail of β cells is not required)** Name and identify on a diagram of the skin:	2.80 understand how organisms are able to respond to changes in their environment 2.81 understand that homeostasis is the maintenance of a constant internal environment, and that body water content and body temperature are both examples of homeostasis 2.94 understand the sources, roles and effects of the following hormones: insulin	Both require a similar understanding of homeostasis. Both require an understanding of insulin, only Cambridge requires an understanding of glucagon and diabetes. Both require a similar understanding of the mechanism of thermoregulation.

hairs, hair erector muscles, sweat glands, receptors, sensory neurones, blood vessels and fatty tissue Describe the maintenance of a constant internal body temperature in humans in terms of insulation, sweating, shivering and the role of the brain (limited to blood temperature receptors and coordination) **Describe the maintenance of a constant internal body temperature in humans in terms of vasodilation and vasoconstriction of arterioles supplying skin surface capillaries**	2.93 describe the role of the skin in temperature regulation, with reference to sweating, vasoconstriction and vasodilation	
14.5 Tropic responses Define gravitropism as a response in which parts of a plant grow towards or away from gravity Define phototropism as a response in which parts of a plant grow towards or away from the direction from which light is coming Investigate gravitropism and phototropism in shoots and roots **Explain phototropism and gravitropism of a shoot as examples of the chemical control of plant growth** **Explain the role of auxin in controlling shoot growth, limited to:**	2.83 understand that plants respond to stimuli 2.84 describe the geotropic and phototropic responses of roots and stems 2.85 understand the role of auxin in the phototropic response of stems	Both require a similar understanding of phototropism and geotropism.

– auxin made in shoot tip (only) **– auxin spreads through the plant from the shoot tip** **– auxin is unequally distributed in response to light and gravity** **– auxin stimulates cell elongation** **Describe the use in weedkillers of the synthetic plant hormone 2,4-D**		Both require a similar understanding of the role of auxins although Cambridge gives specific details. Only Cambridge requires an understanding of the use of weedkillers.

15 Drugs

Cambridge	Edexcel	Notes
15.1 Drugs Define a drug as any substance taken into the body that modifies or affects chemical reactions in the body		Only Cambridge requires an understanding of drugs.
15.2 Medicinal drugs Describe the use of antibiotics for the treatment of bacterial infection		

State that some bacteria are resistant to antibiotics which reduces the effectiveness of antibiotics **Explain how development of resistant bacteria such as MRSA can be minimised, limited to using antibiotics only when essential and ensuring treatment is completed** State that antibiotics kill bacteria but do not affect viruses **Explain why antibiotics kill bacteria, but do not affect viruses**	3.39 understand how resistance to antibiotics can increase in bacterial populations, and appreciate how such an increase can lead to infections being difficult to control	Both require a similar understanding of antibiotic resistance in bacteria; Cambridge requires some additional detail, such as methods to minimise resistance.
15.3 Misused drugs Describe the effects of excessive alcohol consumption and abuse of heroin, limited to: – powerful depressant drugs – effect on reaction times and self-control – addiction and withdrawal symptoms – negative social implications, e.g. crime **Explain how heroin affects the nervous system, limited to its effect on the function of synapses** State that injecting heroin can cause infections such as HIV State that excessive alcohol consumption can cause liver damage State that tobacco smoking can cause chronic		Only Cambridge requires an understanding of the misuse of drugs such as heroin.

obstructive pulmonary disease (COPD), lung cancer and coronary heart disease Describe the effects on the gas exchange system of tobacco smoke and its major toxic components, limited to carbon monoxide, nicotine and tar **Discuss the evidence for the link between smoking and lung cancer** State that the liver is the site of break down of alcohol and other toxins **Discuss the use of hormones to improve sporting performance, limited to testosterone and anabolic steroids**	2.49 understand the biological consequences of smoking in relation to the lungs and the circulatory system, including coronary heart disease	Both require a similar understanding of the effects of smoking. Only Cambridge requires an understanding of the role of the liver in detoxification and the effect of drugs in sport.

16 Reproduction

Cambridge	Edexcel	Notes
16.1 Asexual reproduction Define asexual reproduction as a process resulting in the production of genetically identical offspring from one parent Identify examples of asexual reproduction from information provided **Discuss the advantages and disadvantages of**	3.1 understand the differences between sexual and asexual reproduction 3.7 understand that plants can reproduce asexually by natural method (illustrated by runners) and by artificial methods (illustrated by cuttings)	Both require a similar understanding of asexual reproduction.

asexual reproduction: **– to a population of a species in the wild** **– to crop production**		
16.2 Sexual reproduction Define sexual reproduction as a process involving the fusion of the nuclei of two gametes (sex cells) to form a zygote and the production of offspring that are genetically different from each other Define fertilisation as the fusion of gamete nuclei **State that the nuclei of gametes are haploid and that the nucleus of a zygote is diploid** **Discuss the advantages and disadvantages of sexual reproduction:** **– to a population of a species in the wild** **– to crop production**	3.2 understand that fertilisation involves the fusion of a male and female gamete to produce a zygote that undergoes cell division and develops into an embryo 3.32 know that in human cells the diploid number of chromosomes is 46 and the haploid number is 23 3.28 understand how division of a diploid cell by mitosis produces two cells that contain identical sets of chromosomes 3.30 understand how division of a cell by meiosis produces four cells, each with half the number of chromosomes, and that this results in the formation of genetically different haploid gametes 3.31 understand how random fertilisation produces genetic variation of offspring	Both require a similar understanding of sexual reproduction and its function.
16.3 Sexual reproduction in plants		

Identify and draw, using a hand lens if necessary, the sepals, petals, stamens, filaments and anthers, carpels, style, stigma, ovary and ovules, of an insect-pollinated flower State the functions of the sepals, petals, anthers, stigmas and ovaries Use a hand lens to identify and describe the anthers and stigmas of a wind-pollinated flower Distinguish between the pollen grains of insect-pollinated and wind-pollinated flowers Define pollination as the transfer of pollen grains from the anther to the stigma **Define self-pollination as the transfer of pollen grains from the anther of a flower to the stigma of the same flower or different flower on the same plant** **Define cross-pollination as transfer of pollen grains from the anther of a flower to the stigma of a flower on a different plant of the same species** **Discuss the implications to a species of self-pollination and cross-pollination in terms of variation, capacity to respond to changes in the environment and reliance on pollinators** State that fertilisation occurs when a pollen	3.3 describe the structures of an insect-pollinated and a wind-pollinated flower and explain how each is adapted for pollination	Both require a similar understanding of the structures of insect and wind pollinated flowers. Only Cambridge requires students to carry out practical work on flowers. Only Cambridge considers the effects of self and cross pollination.

nucleus fuses with a nucleus in an ovule Describe the structural adaptations of insect-pollinated and wind-pollinated flowers **Describe the growth of the pollen tube and its entry into the ovule followed by fertilisation (details of production of endosperm and development are not required)** Investigate and state the environmental conditions that affect germination of seeds, limited to the requirement for water, oxygen and a suitable temperature	3.4 understand that the growth of the pollen tube followed by fertilisation leads to seed and fruit formation 3.5 practical: investigate the conditions needed for seed germination 3.6 understand how germinating seeds utilise food reserves until the seedling can carry out photosynthesis	Both require a similar understanding of plant fertilisation, seed development and seed germination. Both require similar practical investigation into seed germination.
16.4 Sexual reproduction in humans Identify and name on diagrams of the male reproductive system: the testes, scrotum, sperm ducts, prostate gland, urethra and penis, and state the functions of these parts Identify and name on diagrams of the female reproductive system: the ovaries, oviducts, uterus, cervix and vagina, and state the functions of these parts Describe fertilisation as the fusion of the nuclei from a male gamete (sperm) and a female gamete (egg cell/ovum)	3.8 understand how the structure of the male and female reproductive systems are adapted for their functions 3.2 understand that fertilisation involves the fusion of a male and female gamete to produce a zygote that undergoes cell division and develops into an embryo	Both require a similar understanding of the human reproductive systems. Cambridge lists the required structures.

Compare male and female gametes in terms of size, structure, motility and numbers State the adaptive features of sperm, limited to flagellum and the presence of enzymes **Explain the adaptive features of sperm, limited to flagellum, mitochondria and enzymes in the acrosome** State the adaptive features of egg cells, limited to energy stores and a jelly coating that changes after fertilisation **Explain the adaptive features of egg cells, limited to energy stores and the jelly coat that changes at fertilisation** State that in early development, the zygote forms an embryo which is a ball of cells that implants into the wall of the uterus		Only Cambridge requires an understanding of the differences between male and female gametes, although this could be tested as data interpretation by Edexcel.
State the functions of the umbilical cord, placenta, amniotic sac and amniotic fluid **Describe the function of the placenta and umbilical cord in relation to exchange of dissolved nutrients, gases and excretory products and providing a barrier to toxins and pathogens (structural details are not required)**	3.11 describe the role of the placenta in the nutrition of the developing embryo 3.12 understand how the developing embryo is protected by amniotic fluid	Both require a similar understanding of the roles of placenta, umbilical cord and amniotic fluid.
Outline the growth and development of the fetus		Only Cambridge requires an understanding of fetal development, pregnancy and child birth.

in terms of increasing complexity in the early stages and increasing size towards the end of pregnancy Describe the antenatal care of pregnant women, limited to special dietary needs and the harm from smoking and alcohol consumption **State that some toxins, e.g. nicotine, and pathogens, e.g. rubella virus, can pass across the placenta and affect the fetus** Outline the processes involved in labour and birth, limited to: – breaking of the amniotic sac – contraction of the muscles in the uterus wall – dilation of the cervix – passage through the vagina – tying and cutting the umbilical cord – delivery of the afterbirth **Discuss the advantages and disadvantages of breast-feeding compared with bottle-feeding using formula milk**		
16.5 Sex hormones in humans Describe the roles of testosterone and oestrogen in the development and regulation of secondary sexual characteristics during puberty Describe the menstrual cycle in terms of changes in the ovaries and in the lining of the uterus	3.13 understand the roles of oestrogen and testosterone in the development of secondary sexual characteristics	Both require a similar understanding of the roles of the sex hormones in the menstrual cycle and puberty.

Describe the sites of production of oestrogen and progesterone in the menstrual cycle and in pregnancy **Explain the role of hormones in controlling the menstrual cycle and pregnancy, limited to FSH, LH, progesterone and oestrogen**	3.9 understand the roles of oestrogen and progesterone in the menstrual cycle 3.10B understand the roles of FSH and LH in the menstrual cycle	
16.6 Methods of birth control in humans Outline the following methods of birth control: – natural, limited to abstinence, monitoring body temperature and cervical mucus – chemical, limited to IUD, IUS, contraceptive pill, implant and injection – barrier, limited to condom, femidom, diaphragm – surgical, limited to vasectomy and female sterilisation **Outline the use of hormones in contraception and fertility treatments** **Outline artificial insemination (AI)** **Outline in vitro fertilisation (IVF)** **Discuss the social implications of contraception and fertility treatments**		Only Cambridge requires an understanding of contraception.

16.7 Sexually transmitted infections (STIs) Define sexually transmitted infection as an infection that is transmitted via body fluids through sexual contact State that human immunodeficiency virus (HIV) is an example of an STI Explain how the spread of STIs is controlled Describe the methods of transmission of HIV State that HIV infection may lead to AIDS **Outline how HIV affects the immune system, limited to decreased lymphocyte numbers and reduced ability to produce antibodies**	1.4 understand the term pathogen and know that pathogens may include fungi, bacteria, protoctists or viruses Examples include the tobacco mosaic virus that causes discolouring of the leaves of tobacco plants by preventing the formation of chloroplasts, the influenza virus that causes 'flu' and the HIV virus that causes AIDS.	Only Cambridge requires an understanding of STIs, although Edexcel requires a basic knowledge of HIV.

17 Inheritance

Cambridge	Edexcel	Notes
17.1 Inheritance Define inheritance as the transmission of genetic information from generation to generation	3.19 understand how genes exist in alternative forms called alleles which give rise to differences in inherited characteristics	
17.2 Chromosomes, genes and proteins Define chromosome as a thread-like structure of DNA, carrying genetic information in the form of	3.15 understand that the nucleus of a cell contains chromosomes on which genes are	Both require a very similar understanding of the nature of genes, alleles and protein synthesis.

genes Define gene as a length of DNA that codes for a protein Define allele as a version of a gene Describe the inheritance of sex in humans with reference to XX and XY chromosomes **Explain that the sequence of bases in a gene is the genetic code for putting together amino acids in the correct order to make a specific protein (knowledge of the details of nucleotide structure is not required)** **Explain that DNA controls cell function by controlling the production of proteins (some of which are enzymes), antibodies and receptors for neurotransmitters** **Explain how a protein is made, limited to:** **– the gene coding for the protein remains in the nucleus**	located 3.14 understand that the genome is the entire DNA of an organism and that a gene is a section of a molecule of DNA that codes for a specific protein 3.19 understand how genes exist in alternative forms called alleles which give rise to differences in inherited characteristics 3.26 understand how the sex of a person is controlled by one pair of chromosomes, XX in a female and XY in a male 3.27 describe the determination of the sex of offspring at fertilisation, using a genetic diagram 3.14 understand that the genome is the entire DNA of an organism and that a gene is a section of a molecule of DNA that codes for a specific protein 3.35B understand how a change in DNA can affect the phenotype by altering the sequence of amino acids in a protein 3.16B describe a DNA molecule as two strands coiled to form a double helix, the strands being linked by a series of paired bases: adenine (A)	

– mRNA molecules carry a copy of the gene to the cytoplasm **– the mRNA passes through ribosomes** **– the ribosome assembles amino acids into protein molecules** **– the specific order of amino acids is determined by the sequence of bases in the mRNA (knowledge of the details of transcription or translation is not required)** **Explain that all body cells in an organism contain the same genes, but many genes in a particular cell are not expressed because the cell only makes the specific proteins it needs** **Define a haploid nucleus as a nucleus containing a single set of unpaired chromosomes, e.g. in gametes** **Define a diploid nucleus as a nucleus containing two sets of chromosomes, e.g. in body cells** **State that in a diploid cell, there is a pair of each type of chromosome and in a human diploid cell there are 23 pairs**	with thymine (T), and cytosine (C) with guanine (G) 3.17B understand that an RNA molecule is single stranded and contains uracil (U) instead of thymine (T) 3.18B describe the stages of protein synthesis including transcription and translation, including the role of mRNA, ribosomes, tRNA, codons and anticodons 3.32 know that in human cells the diploid number of chromosomes is 46 and the haploid number is 23	Only Edexcel requires an understanding of RNA structure.
17.3 Mitosis Define mitosis as nuclear division giving rise to genetically identical cells (details of stages are not required) State the role of mitosis in growth, repair of	3.28 understand how division of a diploid cell by mitosis produces two cells that contain identical sets of chromosomes 3.29 understand that mitosis occurs during growth, repair, cloning and asexual reproduction	Both require a similar understanding of mitosis.

damaged tissues, replacement of cells and asexual reproduction **State that the exact duplication of chromosomes occurs before mitosis** **State that during mitosis, the copies of chromosomes separate, maintaining the chromosome number (details of stages of mitosis are not required)** **Describe stem cells as unspecialised cells that divide by mitosis to produce daughter cells that can become specialised for specific functions**	2.5B explain the importance of cell differentiation in the development of specialised cells 2.6B understand the advantages and disadvantages of using stem cells in medicine	
17.4 Meiosis Define meiosis as nuclear division giving rise to cells that are genetically different (details of stages are not required) Define meiosis as reduction division in which the chromosome number is halved from diploid to haploid resulting in genetically different cells (details of stages are not required) State that meiosis is involved in the production of gametes	3.30 understand how division of a cell by meiosis produces four cells, each with half the number of chromosomes, and that this results in the formation of genetically different haploid gametes	Both require a similar understanding of meiosis.

Explain how meiosis produces variation by forming new combinations of maternal and paternal chromosomes (specific details are not required)		
17.5 Monohybrid inheritance Define genotype as the genetic make-up of an organism in terms of the alleles present Define phenotype as the observable features of an organism Define homozygous as having two identical alleles of a particular gene State that two identical homozygous individuals that breed together will be pure-breeding Define heterozygous as having two different alleles of a particular gene State that a heterozygous individual will not be pure-breeding Define dominant as an allele that is expressed if it is present Define recessive as an allele that is only expressed when there is no dominant allele of the gene present	3.20 understand the meaning of the terms: dominant, recessive, homozygous, heterozygous, phenotype, and genotype	Both require a similar understanding of key genetic terms. Cambridge gives definitions of each term.
Interpret pedigree diagrams for the inheritance of a given characteristic	3.23 describe patterns of monohybrid inheritance using a genetic diagram	Both require a similar understanding of monohybrid inheritance.

Use genetic diagrams to predict the results of monohybrid crosses and calculate phenotypic ratios, limited to 1:1 and 3:1 ratios	3.24 understand how to interpret family pedigrees 3.25 predict probabilities of outcomes from monohybrid crosses	
Explain how to use a test cross to identify an unknown genotype		Only Cambridge requires the use of test crosses.
Use Punnett squares in crosses which result in more than one genotype to work out and show the possible different genotypes		
Explain co-dominance by reference to the inheritance of ABO blood groups – phenotypes being A, B, AB and O blood groups and alleles being IA, IB and IO	3.21B understand the meaning of the term codominance	Both require an understanding of codominance. Cambridge gives a specific example (blood groups.)
Define a sex-linked characteristic as a characteristic in which the gene responsible is located on a sex chromosome and that this makes it more common in one sex than in the other		Only Cambridge requires an understanding of sex-linkage.
Describe colour blindness as an example of sex linkage		
Use genetic diagrams to predict the results of monohybrid crosses involving co-dominance or sex linkage and calculate phenotypic ratios	3.23 describe patterns of monohybrid inheritance using a genetic diagram	

18 Variation and selection

Cambridge	Edexcel	Notes
18.1 Variation		
Define variation as differences between individuals of the same species		Both require a similar knowledge of the causes of variation.
Distinguish between phenotypic variation and genetic variation		Only Edexcel requires an understanding of polygenic inheritance.
State that phenotypic variation is caused by both genetic and environmental factors	3.33 understand that variation within a species can be genetic, environmental, or a combination of both	
State that continuous variation results in a range of phenotypes between two extremes, e.g. height in humans	3.22 understand that most phenotypic features are the result of polygenic inheritance rather than single genes	Only Cambridge refers to continuous and discontinuous variation.
State that discontinuous variation results in a limited number of phenotypes with no intermediates, e.g. tongue rolling		
State that discontinuous variation is mostly caused by genes alone, e.g. A, B, AB and O blood groups in humans		
Record and present the results of investigations into continuous and discontinuous variation		Only Cambridge requires students to carry out practical work into variation.
Define mutation as genetic change	3.34 understand that mutation is a rare, random change in genetic material that can be inherited	Both require a similar understanding of mutations.

Define gene mutation as a change in the base sequence of DNA State that mutation is the way in which new alleles are formed State that ionising radiation and some chemicals increase the rate of mutation **Describe the symptoms of sickle-cell anaemia** **Explain how a change in the base sequence of the gene for haemoglobin results in abnormal haemoglobin and sickle-shaped red blood cells** **Use genetic diagrams to show how sickle-cell anaemia is inherited** **State that people who are heterozygous (HbS HbA) for the sickle-cell allele have a resistance to malaria** **Explain the distribution of the sickle-cell allele in human populations with reference to the distribution of malaria (Teaching of human inherited conditions should be done with sensitivity at all times.)**	3.35B understand how a change in DNA can affect the phenotype by altering the sequence of amino acids in a protein 3.36B understand how most genetic mutations have no effect on the phenotype, some have a small effect and rarely do they have a significant effect 3.37B understand that the incidence of mutations can be increased by exposure to ionising radiation (for example, gamma rays, x-rays and ultraviolet rays) and some chemical mutagens (for example, chemicals in tobacco)	Only Cambridge requires an understanding of sickle-cell anaemia.
18.2 Adaptive features		

Define adaptive feature as an inherited feature that helps an organism to survive and reproduce in its environment **Define adaptive feature as the inherited functional features of an organism that increase its fitness** Interpret images or other information about a species to describe its adaptive features **Define fitness as the probability of an organism surviving and reproducing in the environment in which it is found** **Explain the adaptive features of hydrophytes and xerophytes to their environments**		Only Cambridge has a section on adaptations and gives specific examples (e.g. xerophytes.) Edexcel refers to adaptations at other sections of the specification, for example leaf adaptations for photosynthesis and gas exchange.
18.3 Selection Describe natural selection with reference to: – variation within populations – production of many offspring – competition for resources – struggle for survival – reproduction by individuals that are better adapted to the environment than others – passing on of their alleles to the next generation **Describe evolution as the change in adaptive features of a population over time as the result of natural selection**	3.38 explain Darwin's theory of evolution by natural selection	Both require a similar understanding of natural selection. Cambridge lists the stages involved in the process of natural selection.

Define the process of adaptation as the process, resulting from natural selection, by which populations become more suited to their environment over many generations **Describe the development of strains of antibiotic resistant bacteria as an example of evolution by natural selection**	3.39 understand how resistance to antibiotics can increase in bacterial populations, and appreciate how such an increase can lead to infections being difficult to control	Both require a similar understanding of the development of antibiotic resistance in bacteria.
Describe selective breeding with reference to: – selection by humans of individuals with desirable features – crossing these individuals to produce the next generation – selection of offspring showing the desirable features **State the differences between natural and artificial selection** **Outline how selective breeding by artificial selection is carried out over many generations to improve crop plants and domesticated animals**	5.10 understand how selective breeding can develop plants with desired characteristics 5.11 understand how selective breeding can develop animals with desired characteristics	Both require a similar understanding of selective breeding in animals and plants.

19 Organisms and their environment

Cambridge	Edexcel	Notes
19.1 Energy flow State that the Sun is the principal source of energy input to biological systems **Describe the flow of energy through living organisms including light energy from the Sun and chemical energy in organisms and its eventual transfer to the environment**	4.8 understand the transfer of substances and energy along a food chain	Both require a similar understanding of the transfer of energy through food chains.
19.2 Food chains and food webs Define a food chain as showing the transfer of energy from one organism to the next, beginning with a producer State that energy is transferred between organisms in a food chain by ingestion **Describe how energy is transferred between trophic levels** Construct simple food chains **Define trophic level as the position of an organism in a food chain, food web, pyramid of numbers or pyramid of biomass** **Explain why the transfer of energy from one**	4.7 understand the concepts of food chains, food webs, pyramids of number, pyramids of biomass and pyramids of energy transfer 4.7 understand the concepts of food chains, food webs, pyramids of number, pyramids of biomass and pyramids of energy transfer 4.8 understand the transfer of substances and energy along a food chain 4.6 understand the names given to different trophic levels, including producers, primary, secondary and tertiary consumers and decomposers	Both require a similar understanding of the efficiency of energy transfer through food chains. Both require an understanding of pyramids of number and biomass. Only Edexcel requires the concepts of pyramids of energy.

trophic level to another is inefficient **Explain why food chains usually have fewer than five trophic levels** **Explain why there is a greater efficiency in supplying plants as human food, and that there is a relative inefficiency in feeding crop plants to livestock that will be used as food** Define a food web as a network of interconnected food chains Define producer as an organism that makes its own organic nutrients, usually using energy from sunlight, through photosynthesis Define consumer as an organism that gets its energy by feeding on other organisms State that consumers may be classed as primary, secondary and tertiary according to their position in a food chain **Identify producers, primary consumers, secondary consumers, tertiary consumers and quaternary consumers as the trophic levels in food webs, food chains, pyramids of numbers and pyramids of biomass** Define herbivore as an animal that gets its energy by eating plants	4.9 understand why only about 10% of energy is transferred from one trophic level to the next 4.6 understand the names given to different trophic levels, including producers, primary, secondary and tertiary consumers and decomposers 4.7 understand the concepts of food chains, food webs, pyramids of number, pyramids of biomass and pyramids of energy transfer	Both require a similar understanding of ecological terms such as the trophic levels. Cambridge also defines terms such as herbivore and carnivore.

Define carnivore as an animal that gets its energy by eating other animals Define decomposer as an organism that gets its energy from dead or waste organic material Interpret food chains and food webs in terms of identifying producers and consumers Use food chains and food webs to describe the impacts humans have through over-harvesting of food species and through introducing foreign species to a habitat Draw, describe and interpret pyramids of numbers **Draw, describe and interpret pyramids of biomass** **Discuss the advantages of using a pyramid of biomass rather than a pyramid of numbers to represent a food chain**	4.7 understand the concepts of food chains, food webs, pyramids of number, pyramids of biomass and pyramids of energy transfer 4.3B understand the term biodiversity	Only Edexcel refers to biodiversity.
19.3 Nutrient cycles Describe the carbon cycle, limited to photosynthesis, respiration, feeding, decomposition, fossilisation and combustion	4.10 describe the stages in the carbon cycle, including respiration, photosynthesis, decomposition and combustion	Both require a similar understanding of the carbon cycle.

Discuss the effects of the combustion of fossil fuels and the cutting down of forests on the carbon dioxide concentrations in the atmosphere Describe the water cycle, limited to evaporation, transpiration, condensation and precipitation **Describe the nitrogen cycle in terms of:** **– decomposition of plant and animal protein to ammonium ions** **– nitrification** **– nitrogen fixation by lightning and bacteria** **– absorption of nitrate ions by plants** **– production of amino acids and proteins** **– feeding and digestion of proteins** **– deamination** **– denitrification** **State the roles of microorganisms in the nitrogen cycle, limited to decomposition, nitrification, nitrogen fixation and denitrification (generic names of individual bacteria, e.g. Rhizobium, are not required)**	4.11B describe the stages in the nitrogen cycle, including the roles of nitrogen fixing bacteria, decomposers, nitrifying bacteria and denitrifying bacteria (specific names of bacteria are not required)	Only Cambridge requires an understanding of the water cycle, although Edexcel requires a knowledge of it inked to deforestation. Both require a similar understanding of the nitrogen cycle.
19.4 Population size Define population as a group of organisms of one species, living in the same area, at the same time **Define community as all of the populations of different species in an ecosystem**	4.1 understand the terms population, community, habitat and ecosystem	Both require a similar understanding of key ecological terms, such as population.

Define ecosystem as a unit containing the community of organisms and their environment, interacting together, e.g. a decomposing log, or a lake Identify and state the factors affecting the rate of population growth for a population of an organism, limited to food supply, predation and disease **Identify the lag, exponential (log), stationary and death phases in the sigmoid population growth curve for a population growing in an environment with limited resources** **Explain the factors that lead to each phase in the sigmoid curve of population growth, making reference, where appropriate, to the role of limiting factors** Discuss the increase in human population size over the past 250 years and its social and environmental implications Interpret graphs and diagrams of human	4.5 understand how abiotic and biotic factors affect the population size and distribution of organisms 4.2 practical: investigate the population size of an organism in two different areas using quadrats 4.4B practical: investigate the distribution of organisms in their habitats and measure biodiversity using quadrats	Both require a similar understanding of the effects of biotic and abiotic factors on populations Only Edexcel requires students to carry out practical work on ecology. Only Cambridge requires an understanding of population growth curves and human population changes.

population growth		

20 Biotechnology and genetic engineering

Cambridge	Edexcel	Notes
20.1 Biotechnology and genetic engineering Core State that bacteria are useful in biotechnology and genetic engineering due to their rapid reproduction rate and their ability to make complex molecules **Discuss why bacteria are useful in biotechnology and genetic engineering, limited to:** **– lack of ethical concerns over their manipulation and growth** **– genetic code shared with all other organisms** **– presence of plasmids**	5.14 understand how large amounts of human insulin can be manufactured from genetically modified bacteria that are grown in a fermenter	Both require a similar understanding of the role of bacteria in biotechnology. Edexcel requires an understanding of insulin production.
20.2 Biotechnology Describe the role of anaerobic respiration in yeast during production of ethanol for biofuels Describe the role of anaerobic respiration in yeast during bread-making Investigate and describe the use of pectinase in fruit juice production Investigate and describe the use of biological washing powders that contain enzymes	5.5 understand the role of yeast in the production of food including bread 5.6 practical: investigate the role of anaerobic respiration by yeast in different conditions	Both require a similar understanding of the role of yeast anaerobic respiration in bread making. Only Cambridge requires students to investigate pectinase and biological washing powder.

Investigate and explain the use of lactase to produce lactose-free milk **Describe the role of the fungus *Penicillium* in the production of the antibiotic penicillin**		Only Cambridge requires an understanding of the use of lactase and the production of penicillin.
Explain how fermenters are used in the production of penicillin	5.8 understand the use of an industrial fermenter and explain the need to provide suitable conditions in the fermenter, including aseptic precautions, nutrients, optimum temperature and pH, oxygenation and agitation, for the growth of microorganisms	Both require a similar understanding of fermenters. Edexcel gives additional details about fermenter design.
20.3 Genetic engineering Define genetic engineering as changing the genetic material of an organism by removing, changing or inserting individual genes		
State examples of genetic engineering: – the insertion of human genes into bacteria to produce human insulin – the insertion of genes into crop plants to confer resistance to herbicides – the insertion of genes into crop plants to confer resistance to insect pests – the insertion of genes into crop plants to provide additional vitamins	5.14 understand how large amounts of human insulin can be manufactured from genetically modified bacteria that are grown in a fermenter 5.15 understand how genetically modified plants can be used to improve food production	Both require a similar understanding of genetic engineering and the methods used to genetically engineer bacteria.

Outline genetic engineering using bacterial production of a human protein as an example, limited to: **– isolation of the DNA making up a human gene using restriction enzymes, forming sticky ends** **– cutting of bacterial plasmid DNA with the same restriction enzymes, forming complementary sticky ends** **– insertion of human DNA into bacterial plasmid DNA using DNA ligase to form a recombinant plasmid** **– insertion of plasmid into bacteria (specific detail is not required)** **– replication of bacteria containing recombinant plasmids which make human protein as they express the gene**	5.12 understand how restriction enzymes are used to cut DNA at specific sites and ligase enzymes are used to join pieces of DNA together 5.13 understand how plasmids and viruses can act as vectors, which take up pieces of DNA, and then insert this recombinant DNA into other cells 5.16 understand that the term transgenic means the transfer of genetic material from one species to a different species	
Discuss the advantages and disadvantages of genetically modifying crops, such as soya, maize and rice		Only Cambridge requires an evaluation of the advantages and disadvantages of genetically modifying crops.
	5.17B describe the process of micropropagation (tissue culture) in which explants are grown in vitro 5.18B understand how micropropagation can be used to produce commercial quantities of genetically identical plants with desirable characteristics 5.19B describe the stages in the production of cloned mammals involving the introduction of a	Only Edexcel requires an understanding of plant and animal cloning.

	diploid nucleus from a mature cell into an enucleated egg cell, illustrated by Dolly the sheep 5.20B understand how cloned transgenic animals can be used to produce human proteins	

21 Human influences on ecosystems

Cambridge	Edexcel	Notes
21.1 Food supply State how modern technology has resulted in increased food production in terms of: – agricultural machinery to use larger areas of land and improve efficiency – chemical fertilisers to improve yields – insecticides to improve quality and yield – herbicides to reduce competition with weeds – selective breeding to improve production by crop plants and livestock, e.g. cattle, fish and poultry	5.1 describe how glasshouses and polythene tunnels can be used to increase the yield of certain crops 5.2 understand the effects on crop yield of increased carbon dioxide and increased temperature in glasshouses 5.3 understand how the use of fertiliser can increase crop yield 5.10 understand how selective breeding can develop plants with desired characteristics 5.11 understand how selective breeding can develop animals with desired characteristics	Both require a similar knowledge of the use of modern technology in food production.
Discuss the social, environmental and economic implications of providing sufficient food for an increasing human global population		Only Cambridge requires an understanding of the problems of producing food for humans.

Discuss the problems which contribute to famine including unequal distribution of food, drought and flooding, increasing population and poverty Describe the negative impacts to an ecosystem of large-scale monocultures of crop plants Describe the negative impacts to an ecosystem of intensive livestock production	5.4 understand the reasons for pest control and the advantages and disadvantages of using pesticides and biological control with crop plants 5.7 understand the role of bacteria (*Lactobacillus*) in the production of yoghurt 5.9B understand the methods used to farm large numbers of fish to provide a source of protein, including maintaining water quality, controlling intraspecific and interspecific predation, controlling disease, removing waste products, controlling the quality and frequency of feeding, and selective breeding	Only Cambridge requires an understanding of the negative impacts of monoculture and intensive livestock production Only Edexcel requires an understanding of pesticides and biological control. Only Edexcel requires an understanding of yoghurt production and fish farming.
21.2 Habitat destruction Describe the reasons for habitat destruction, limited to: – increased area for food crop growth, livestock production and housing – extraction of natural resources – marine pollution		Only Cambridge requires an understanding of the reasons for habitat destruction.

State that through altering food webs and food chains, humans can have a negative impact on habitats List the undesirable effects of deforestation as an example of habitat destruction, to include extinction, loss of soil, flooding and increase of carbon dioxide in the atmosphere **Explain the undesirable effects of deforestation on the environment**	4.18B understand the effects of deforestation, including leaching, soil erosion, disturbance of evapotranspiration and the carbon cycle, and the balance of atmospheric gases	Both require a similar understanding of the effects of deforestation.
21.3 Pollution State the sources and effects of pollution of land and water, e.g. rivers, lakes and the sea, by insecticides, herbicides and by nuclear fall-out State the sources and effects of pollution of water (rivers, lakes and the sea) by chemical waste, discarded rubbish, untreated sewage and fertilisers **Explain the process of eutrophication of water in terms of:** **– increased availability of nitrate and other ions** **– increased growth of producers** **– increased decomposition after death of producers** **– increased aerobic respiration by decomposers** **– reduction in dissolved oxygen**	4.16 understand the biological consequences of pollution of water by sewage 4.17 understand the biological consequences of eutrophication caused by leached minerals from fertiliser	Both require a similar understanding of the effects of sewage and fertiliser pollution.

– death of organisms requiring dissolved oxygen in water **Discuss the effects of non-biodegradable plastics in the environment, in both aquatic and terrestrial ecosystems**		Only Cambridge requires an understanding of the effects of plastics.
State the sources and effects of pollution of the air by methane and carbon dioxide, limited to the enhanced greenhouse effect and climate change **Explain how increases in carbon dioxide and methane concentrations in the atmosphere cause an enhanced greenhouse effect that leads to climate change**	4.13 understand that water vapour, carbon dioxide, nitrous oxide, methane and CFCs are greenhouse gases 4.14 understand how human activities contribute to greenhouse gases 4.15 understand how an increase in greenhouse gases results in an enhanced greenhouse effect and that this may lead to global warming and its consequences	Both require a similar understanding of greenhouse gases and climate change.
Discuss the causes and effects on the environment of acid rain **State the measures that are taken to reduce sulfur dioxide pollution and reduce the impact of acid rain**	4.12 understand the biological consequences of pollution of air by sulfur dioxide and carbon monoxide	Both require a similar understanding of the effects of acid rain.
Describe the negative impacts of female contraceptive hormones in water courses, limited to reduced sperm count in men and feminisation of aquatic organisms		Only Cambridge requires an understanding of the effects of contraceptive hormones in water courses.
21.4 Conservation Define a sustainable resource as one which is		

produced as rapidly as it is removed from the environment so that it does not run out **Define the term sustainable development as development providing for the needs of an increasing human population without harming the environment** Explain the need to conserve non-renewable resources, limited to fossil fuels State that some resources can be maintained, limited to forests and fish stocks **Explain how forests and fish stocks can be sustained using education, legal quotas and restocking** State that products can be reused or recycled, limited to paper, glass, plastic and metal **Explain that sustainable development requires:** **– management of conflicting demands** **– planning and co-operation at local, national and international levels** Outline how sewage is treated to make the water that it contains safe to return to the environment or for human use Explain why organisms become endangered or extinct, limited to climate change, habitat destruction, hunting, pollution and introduced		Only Cambridge requires an understanding of this topic on conservation.

species **Explain the risks to a species if the population size drops, reducing variation (knowledge of genetic drift is not required)** Describe how endangered species can be conserved, limited to monitoring and protecting species and habitats, education, captive breeding programmes and seed banks **Explain reasons for conservation programmes, to include:** **– reducing extinction** **– protecting vulnerable environments** **– maintaining ecosystem functions, limited to nutrient cycling and resource provision, e.g. food, drugs, fuel and genes**		

2. Major Topic Areas that are Only on One Specification.

Cambridge	Edexcel
1.2 Concept and use of a classification system State that organisms can be classified into groups by the features that they share Define species as a group of organisms that can reproduce to produce fertile offspring Define and describe the binomial system of naming species as an internationally agreed system in which the scientific name of an organism is made up of two parts showing the genus and species Explain that classification systems aim to reflect evolutionary relationships Explain that classification is traditionally based on studies of morphology and anatomy Explain that the sequences of bases in DNA and of amino acids in proteins are used as a more accurate means of classification Explain that organisms which share a more recent ancestor (are more closely related) have base sequences in DNA that are more similar than those that share only a distant ancestor 1.4 Dichotomous keys Construct and use simple dichotomous keys based on easily identifiable features	5.7 understand the role of bacteria (Lactobacillus) in the production of yoghurt
7.2 Describe diarrhoea as the loss of watery faeces Outline the treatment of diarrhoea using oral rehydration therapy Describe cholera as a disease caused by a bacterium Explain that the cholera bacterium produces a toxin that causes secretion of chloride ions into the small intestine, causing osmotic movement of water into the gut, causing diarrhoea, dehydration and loss of salts from blood	5.8 understand the use of an industrial fermenter and explain the need to provide suitable conditions in the fermenter, including aseptic precautions, nutrients, optimum temperature and pH, oxygenation and agitation, for the growth of microorganisms
9.2 Describe ways in which coronary heart disease may be treated, limited to drug treatment with aspirin and surgery (stents, angioplasty and bypass)	5.9B understand the methods used to farm large numbers of fish to provide a source of protein, including maintaining water quality, controlling

9.3 Outline the lymphatic system in terms of lymphatic vessels and lymph nodes Describe the function of the lymphatic system in the circulation of body fluids and the protection of the body from infection	intraspecific and interspecific predation, controlling disease, removing waste products, controlling the quality and frequency of feeding, and selective breeding
10.1 State that the pathogen for a transmissible disease may be transmitted either through direct contact, e.g. through blood or other body fluids, or indirectly, e.g. from contaminated surfaces or food, from animals, or from the air State that the body has defences: – mechanical barriers, limited to skin and hairs in the nose – chemical barriers, limited to mucus and stomach acid – cells, limited to phagocytosis and antibody production by white blood cells – which can be enhanced by vaccination Explain the importance of hygienic food preparation, good personal hygiene, waste disposal and sewage treatment in controlling the spread of disease State that antibodies lock on to antigens leading to direct destruction of pathogens, or marking of pathogens for destruction by phagocytes Explain how each pathogen has its own antigens, which have specific shapes, so specific antibodies which fit the specific shapes of the antigens are needed Explain that passive immunity is short-term defence against a pathogen by antibodies acquired from another individual, e.g. mother to infant State that memory cells are not produced in passive immunity Explain the importance of passive immunity for breast-fed infants State that some diseases are caused by the immune system targeting and destroying body cells, limited to Type 1 diabetes	5.17B describe the process of micropropagation (tissue culture) in which explants are grown in vitro 5.18B understand how micropropagation can be used to produce commercial quantities of genetically identical plants with desirable characteristics 5.19B describe the stages in the production of cloned mammals involving the introduction of a diploid nucleus from a mature cell into an enucleated egg cell, illustrated by Dolly the sheep 5.20B understand how cloned transgenic animals can be used to produce human proteins
13.1 State that urea is formed in the liver from excess	

amino acids Describe the role of the liver in the assimilation of amino acids by converting them to proteins, including plasma proteins, e.g. fibrinogen Define deamination as the removal of the nitrogen-containing part of amino acids to form urea State that urea is formed in the liver from excess amino acids Describe the role of the liver in the assimilation of amino acids by converting them to proteins, including plasma proteins, e.g. fibrinogen Define deamination as the removal of the nitrogen-containing part of amino acids to form urea Explain dialysis in terms of salt balance, the maintenance of glucose concentration and the removal of urea Describe the use of dialysis in kidney machines Discuss the advantages and disadvantages of kidney transplants, compared with dialysis	
14.2 State the distribution of rods and cones in the retina of a human Outline the function of rods and cones, limited to greater sensitivity of rods for night vision and three different kinds of cones absorbing light of different colours for colour vision Identify the position of the fovea	
15.1 Define a drug as any substance taken into the body that modifies or affects chemical reactions in the body 15.3 Describe the effects of excessive alcohol consumption and abuse of heroin, limited to: – powerful depressant drugs – effect on reaction times and self-control – addiction and withdrawal symptoms – negative social implications, e.g. crime Explain how heroin affects the nervous system, limited to its effect on the function of synapses	

State that injecting heroin can cause infections such as HIV State that excessive alcohol consumption can cause liver damage State that the liver is the site of break down of alcohol and other toxins Discuss the use of hormones to improve sporting performance, limited to testosterone and anabolic steroids	
16.4 Compare male and female gametes in terms of size, structure, motility and numbers State the adaptive features of sperm, limited to flagellum and the presence of enzymes Explain the adaptive features of sperm, limited to flagellum, mitochondria and enzymes in the acrosome State the adaptive features of egg cells, limited to energy stores and a jelly coating that changes after fertilisation Explain the adaptive features of egg cells, limited to energy stores and the jelly coat that changes at fertilisation State that in early development, the zygote forms an embryo which is a ball of cells that implants into the wall of the uterus	
16.6 Outline the following methods of birth control: – natural, limited to abstinence, monitoring body temperature and cervical mucus – chemical, limited to IUD, IUS, contraceptive pill, implant and injection – barrier, limited to condom, femidom, diaphragm – surgical, limited to vasectomy and female sterilisation Outline the use of hormones in contraception and fertility treatments Outline artificial insemination (AI) Outline in vitro fertilisation (IVF) Discuss the social implications of contraception and fertility treatments	
16.7	

Define sexually transmitted infection as an infection that is transmitted via body fluids through sexual contact State that human immunodeficiency virus (HIV) is an example of an STI Explain how the spread of STIs is controlled Describe the methods of transmission of HIV State that HIV infection may lead to AIDS Outline how HIV affects the immune system, limited to decreased lymphocyte numbers and reduced ability to produce antibodies	
17.5 Explain co-dominance by reference to the inheritance of ABO blood groups – phenotypes being A, B, AB and O blood groups and alleles being IA, IB and IO Define a sex-linked characteristic as a characteristic in which the gene responsible is located on a sex chromosome and that this makes it more common in one sex than in the other Describe colour blindness as an example of sex linkage Use genetic diagrams to predict the results of monohybrid crosses involving co-dominance or sex linkage and calculate phenotypic ratios	
18.1 State that continuous variation results in a range of phenotypes between two extremes, e.g. height in humans State that discontinuous variation results in a limited number of phenotypes with no intermediates, e.g. tongue rolling State that discontinuous variation is mostly caused by genes alone, e.g. A, B, AB and O blood groups in humans Record and present the results of investigations into continuous and discontinuous variation Describe the symptoms of sickle-cell anaemia Explain how a change in the base sequence of the gene for haemoglobin results in abnormal haemoglobin and sickle-shaped red blood cells Use genetic diagrams to show how sickle-cell anaemia is inherited State that people who are heterozygous (HbS HbA) for the sickle-cell allele have a resistance to malaria	

Explain the distribution of the sickle-cell allele in human populations with reference to the distribution of malaria (Teaching of human inherited conditions should be done with sensitivity at all times.) 18.2 Define adaptive feature as an inherited feature that helps an organism to survive and reproduce in its environment Define adaptive feature as the inherited functional features of an organism that increase its fitness Interpret images or other information about a species to describe its adaptive features Define fitness as the probability of an organism surviving and reproducing in the environment in which it is found Explain the adaptive features of hydrophytes and xerophytes to their environments	
19.4 Identify the lag, exponential (log), stationary and death phases in the sigmoid population growth curve for a population growing in an environment with limited resources Explain the factors that lead to each phase in the sigmoid curve of population growth, making reference, where appropriate, to the role of limiting factors Discuss the increase in human population size over the past 250 years and its social and environmental implications Interpret graphs and diagrams of human population growth	
21.1 Discuss the social, environmental and economic implications of providing sufficient food for an increasing human global population Discuss the problems which contribute to famine including unequal distribution of food, drought and flooding, increasing population and poverty Describe the negative impacts to an ecosystem of large-scale monocultures of crop plants Describe the negative impacts to an ecosystem of intensive livestock production	

21.3 Describe the negative impacts of female contraceptive hormones in water courses, limited to reduced sperm count in men and feminisation of aquatic organisms 21.4 Define a sustainable resource as one which is produced as rapidly as it is removed from the environment so that it does not run out Define the term sustainable development as development providing for the needs of an increasing human population without harming the environment Explain the need to conserve non-renewable resources, limited to fossil fuels State that some resources can be maintained, limited to forests and fish stocks Explain how forests and fish stocks can be sustained using education, legal quotas and restocking State that products can be reused or recycled, limited to paper, glass, plastic and metal Explain that sustainable development requires: – management of conflicting demands – planning and co-operation at local, national and international levels Outline how sewage is treated to make the water that it contains safe to return to the environment or for human use Explain why organisms become endangered or extinct, limited to climate change, habitat destruction, hunting, pollution and introduced species Explain the risks to a species if the population size drops, reducing variation (knowledge of genetic drift is not required) Describe how endangered species can be conserved, limited to monitoring and protecting species and habitats, education, captive breeding programmes and seed banks Explain reasons for conservation programmes, to include: – reducing extinction – protecting vulnerable environments – maintaining ecosystem functions, limited to	

nutrient cycling and resource provision, e.g. food, drugs, fuel and genes	