INTERNATIONAL GCSE BIOLOGY

1 The nature and variety of living organisms

The following sub-topics are covered in this section.

(a) Characteristics of living organisms

(b) Variety of living organisms

(a) Characteristics of living organisms	**2011 specification reference**	**CIE spec reference** Note CIE content is divided into **core** and **supplement** reflecting tiers of entry
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.	1.1	1.1 Characteristics of living organisms
(b) Variety of living organisms		
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	1.2: a single specification statement covering all organisms i.e. new specification 1.2, 1.3 and 1.4; rather than splitting into eukaryotes, prokaryotes and viruses	1.2 Concept and use of a classification system (more detail on classification) 1.4 Dichotomous keys Not on Edexcel

	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 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.		1.3 Features of organisms
1.3	describe the common features shown by prokaryotic organisms such as bacteria Bacteria: these are microscopic single-celled organisms; they have a cell wall, cell membrane, cytoplasm and plasmids; they lack a nucleus but contain a circular chromosome of DNA; some bacteria can carry out photosynthesis but most feed off other living or dead organisms. Examples include *Lactobacillus bulgaricus*, a rod-shaped bacterium used in the production of yoghurt from milk, and *Pneumococcus*, a spherical bacterium that acts as the pathogen causing pneumonia.		
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	1.3: "recall the term pathogen…"	1.3 16.7 Sexually transmitted infections (STIs)

AIDS.		

2 Structure and functions in living organisms

The following sub-topics are covered in this section.

(a) Level of organisation

(b) Cell structure

(c) Biological molecules

(d) Movement of substances into and out of cells

(e) Nutrition

(f) Respiration

(g) Gas exchange

(h) Transport

(i) Excretion

(j) Co-ordination and response

(a)	**Level of organisation**	**2011 specification reference**	**CIE spec reference**
2.1	describe the levels of organisation in organisms: organelles, cells, tissues, organs and systems	2.1	2.2 Levels of organisation
(b)	**Cell structure**		
2.2	describe cell structures, including the nucleus, cytoplasm, cell membrane, cell wall, mitochondria, chloroplasts, ribosomes and vacuole	2.2	2.1 Cell structure and organisation
2.3	describe the functions of the nucleus, cytoplasm, cell membrane, cell wall, mitochondria, chloroplasts, ribosomes and vacuole	2.3	
2.4	know the similarities and differences in the structure of plant and animal cells	2.4: reworded as "similarities and differences"	2.1 Cell structure and organisation
2.5B	**explain the importance of cell differentiation in the development of specialised cells**	**New statement**	17.3 Mitosis
2.6B	**understand the advantages and disadvantages of using stem cells in medicine**	**New statement**	

(c)	**Biological molecules**		
2.7	identify the chemical elements present in carbohydrates, proteins and lipids (fats and oils)	2.5	4.1 Biological molecules
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	2.6	4.1 Biological molecules
2.9	*Practical: investigate food samples for the presence of glucose, starch, protein and fat*	2.7: becomes a practical statement	4.1 Biological molecules
2.10	understand the role of enzymes as biological catalysts in metabolic reactions	2.8	5.1 Enzymes
2.11	understand how temperature changes can affect enzyme function, including changes to the shape of active site	2.9: slightly re-worded	5.1 Enzymes
2.12	*Practical: investigate how enzyme activity can be affected by changes in temperature*	2.11: becomes a practical statement	5.1 Enzymes
2.13	understand how enzyme function can be affected by changes in pH altering the active site	**2.10: was bold statement**	5.1 Enzymes
2.14B	***Practical: investigate how enzyme activity can be affected by changes in pH***	**New statement**	5.1 Enzymes
(d)	**Movement of substances into and out of cells**		3 Movement in and out of cells
2.15	understand the processes of diffusion, osmosis and active transport by which substances move into and out of cells	2.12 & 2.13 combined and slightly re-worded	3.1 Diffusion 3.2 Osmosis 3.3 Active transport
		2.14: statement deleted	
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	2.15	3.1 Diffusion
2.17	*Practical: investigate diffusion and osmosis using living and non-living systems*	2.16: becomes a practical statement	
(e)	**Nutrition**		
Flowering plants			6 Plant nutrition
2.18	understand the process of photosynthesis and its importance in the conversion of light energy to chemical energy	2.17	6.1 Photosynthesis
2.19	know the word equation and the balanced chemical symbol equation for	2.18	6.1 Photosynthesis

	photosynthesis		
2.20	understand how varying carbon dioxide concentration, light intensity and temperature affect the rate of photosynthesis	2.19	6.1 Photosynthesis
2.21	describe the structure of the leaf and explain how it is adapted for photosynthesis	2.20	6.2 Leaf structure
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	2.21	6.3 Mineral requirements
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*	2.22: becomes a practical statement	6.1 Photosynthesis
Humans			
2.24	understand that a balanced diet should include appropriate proportions of carbohydrate, protein, lipid, vitamins, minerals, water and dietary fibre	**2.23: was a bold statement**	7 Human nutrition 7.1 Diet
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	2.24	7.1 Diet
2.26	understand how energy requirements vary with activity levels, age and pregnancy	**2.25: was a bold statement**	7.1 Diet
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	2.26	7.2 Alimentary canal 7.5 Absorption
		2.27: deleted	
2.28	understand how food is moved through the gut by peristalsis	2.28	
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	2.29	7.4 Chemical digestion
2.30	understand that bile is produced by the liver and stored in the gall bladder	2.30: now split into two statements	7.4 Chemical digestion
2.31	understand the role of bile in neutralising stomach acid and emulsifying lipids	2.30: now split into two statements	7.4 Chemical digestion
2.32	understand how the small intestine is adapted for absorption, including the structure of a villus	2.31: statement re-worded	7.5 Absorption
2.33B	***Practical: investigate the energy content in a food sample***	**2.32: becomes a practical statement**	

(f)	**Respiration**		
2.34	understand how the process of respiration produces ATP in living organisms	2.33	12 Respiration 12.1 Respiration
2.35	know that ATP provides energy for cells	New statement	
2.36	describe the differences between aerobic and anaerobic respiration	2.34	12.2 Aerobic respiration 12.3 Anaerobic respiration
2.37	know the word equation and the balanced chemical symbol equation for aerobic respiration in living organisms	2.35	12.2 Aerobic respiration
2.38	know the word equation for anaerobic respiration in plants and in animals	2.36	12.3 Anaerobic respiration
2.39	*Practical: investigate the evolution of carbon dioxide and heat from respiring seeds or other suitable living organisms*	**2.37: was a bold statement; also becomes a practical statement**	12.2 Aerobic respiration
(g)	**Gas exchange**		
2.40B	**understand the role of diffusion in gas exchange**	2.38: becomes a bold statement	
Flowering plants			
2.41B	**understand gas exchange (of carbon dioxide and oxygen) in relation to respiration and photosynthesis**	2.39: becomes a bold statement	
2.42B	**understand how the structure of the leaf is adapted for gas exchange**	2.41: becomes a bold statement	6.2 Leaf structure
2.43B	**describe the role of stomata in gas exchange**	2.42: becomes a bold statement	6.1 Photosynthesis
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**	**2.40**	6.1 Photosynthesis
2.45B	***Practical: investigate the effect of light on net gas exchange from a leaf, using hydrogen-carbonate indicator***	**2.43: becomes a practical statement**	6.1 Photosynthesis
Humans			
2.46	describe the structure of the thorax, including the ribs, intercostal muscles, diaphragm, trachea, bronchi, bronchioles, alveoli and pleural membranes	2.44	11.1 Gas exchange in humans
2.47	understand the role of the intercostal muscles and the diaphragm in ventilation	2.45	11.1 Gas exchange in humans

2.48	explain how alveoli are adapted for gas exchange by diffusion between air in the lungs and blood in capillaries	2.46	11.1 Gas exchange in humans
2.49	understand the biological consequences of smoking in relation to the lungs and the circulatory system, including coronary heart disease	2.47	9.2 Heart 15.3 Misused drugs
2.50	*Practical: investigate breathing in humans, including the release of carbon dioxide and the effect of exercise*	2.48: becomes a practical statement	11.1 Gas exchange in humans
(h)	**Transport**		
2.51	understand why simple, unicellular organisms can rely on diffusion for movement of substances in and out of the cell	2.49	
2.52	understand the need for a transport system in multicellular organisms	2.50	9.1 Transport in animals
Flowering plants			
2.53	describe the role of phloem in transporting sucrose and amino acids between the leaves and other parts of the plant	**2.51: was a bold statement**	8.4 Translocation
2.54	describe the role of xylem in transporting water and mineral ions from the roots to other parts of the plant	2.52	8.3 Transpiration
2.55B	**understand how water is absorbed by root hair cells**	2.53: becomes a bold statement	2.2 Levels of organisation
2.56B	**understand that transpiration is the evaporation of water from the surface of a plant**	2.54: becomes a bold statement	8.3 Transpiration
2.57B	**understand how the rate of transpiration is affected by changes in humidity, wind speed, temperature and light intensity**	2.55: becomes a bold statement	8.3 Transpiration
2.58B	***Practical: investigate the role of environmental factors in determining the rate of transpiration from a leafy shoot***	2.56: becomes a bold statement; also becomes a practical statement	8.3 Transpiration
Humans			
2.59	describe the composition of the blood: red blood cells, white blood cells, platelets and plasma	2.57	9.4 Blood
2.60	understand the role of plasma in the transport of carbon dioxide, digested food, urea, hormones and heat energy	2.58	9.4 Blood
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	2.59: slightly re-worded	9.4 Blood
2.62	understand how the immune system responds to disease using white blood cells,	2.60	10.1 Diseases and immunity

	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**	**2.61**	10.1 Diseases and immunity
2.64B	**understand how platelets are involved in blood clotting, which prevents blood loss and the entry of micro-organisms**	**2.62**	9.4 Blood
2.65	describe the structure of the heart and how it functions	2.63	9.2 Heart
2.66	explain how the heart rate changes during exercise and under the influence of adrenaline	2.64	9.2 Heart
2.67	understand how factors may increase the risk of developing coronary heart disease	New statement	9.2 Heart
2.68	understand how the structure of arteries, veins and capillaries relate to their function	2.65: slightly re-worded	9.3 Blood and lymphatic vessels
2.69	understand the general structure of the circulation system, including the blood vessels to and from the heart and lungs, liver and kidneys	2.66	9.3 Blood and lymphatic vessels
(i)	**Excretion**		
Flowering plants			
2.70	understand the origin of carbon dioxide and oxygen as waste products of metabolism and their loss from the stomata of a leaf	2.67	
Humans			
2.71	know the excretory products of the lungs, kidneys and skin (organs of excretion)	2.68: slightly re-worded	13.1 Excretion in humans
2.72B	**understand how the kidney carries out its roles of excretion and osmoregulation**	2.69: becomes a bold statement	13.1 Excretion in humans
2.73B	**describe the structure of the urinary system, including the kidneys, ureters, bladder and urethra**	2.70: becomes a bold statement	13.1 Excretion in humans
2.74B	**describe the structure of a nephron, including the Bowman's capsule and glomerulus, convoluted tubules, loop of Henle and collecting duct**	2.71: becomes a bold statement	13.1 Excretion in humans
2.75B	**describe ultrafiltration in the Bowman's capsule and the composition of the glomerular filtrate**	2.72: becomes a bold statement	13.1 Excretion in humans
2.76B	**understand how water is reabsorbed into the blood from the collecting duct**	2.73: becomes a bold statement	13.1 Excretion in humans

2.77B	**understand why selective reabsorption of glucose occurs at the proximal convoluted tubule**	2.74: becomes a bold statement	13.1 Excretion in humans
2.78B	**describe the role of ADH in regulating the water content of the blood**	2.75: becomes a bold statement	13.1 Excretion in humans
2.79B	**understand that urine contains water, urea and ions**	2.76: becomes a bold statement	13.1 Excretion in humans
(j)	**Co-ordination and response**		
2.80	understand how organisms are able to respond to changes in their environment	2.77	14 Coordination and response
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	2.78	14.4 Homeostasis
2.82	understand that a co-ordinated response requires a stimulus, a receptor and an effector	2.79	14 Coordination and response
Flowering plants			
2.83	understand that plants respond to stimuli	2.80	14.5 Tropic responses
2.84	describe the geotropic and phototropic responses of roots and stems	2.18 & 2.82: combined and re-worded	14.5 Tropic responses
2.85	understand the role of auxin in the phototropic response of stems	New statement	14.5 Tropic responses
Humans			
2.86	describe how nervous and hormonal communication control responses and understand the differences between the two systems	2.83: slightly reworded	14.1 Nervous control in humans
2.87	understand that the central nervous system consists of the brain and spinal cord and is linked to sense organs by nerves	2.84	14.1 Nervous control in humans
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	2.85	14.1 Nervous control in humans
2.89	understand the role of neurotransmitters at synapses	New statement	14.1 Nervous control in humans
2.90	describe the structure and functioning of a simple reflex arc illustrated by the withdrawal of a finger from a hot object	2.86	14.1 Nervous control in humans
2.91	describe the structure and function of the eye as a receptor	2.87	14.2 Sense organs
2.92	understand the function of the eye in focusing on near and distant objects, and in responding to changes in light intensity	**2.88: was a bold statement**	14.2 Sense organs

2.93	describe the role of the skin in temperature regulation, with reference to sweating, vasoconstriction and vasodilation	**2.89: was a bold statement**	14.4 Homeostasis
2.94	understand the sources, roles and effects of the following hormones: adrenaline, insulin, testosterone, progesterone and oestrogen	2.90: ADH removed from Double Award	14.3 Hormones in humans
2.95B	**understand the sources, roles and effects of the following hormones: ADH, FSH and LH**	2.90: becomes a bold statement with additional hormones	14.3 Hormones in humans

3 Reproduction and inheritance

The following sub-topics are covered in this section.

(a) Reproduction

(b) Inheritance

(a)	**Reproduction**	**2011 specification reference**	**CIE spec reference**
3.1	understand the differences between sexual and asexual reproduction	3.1	16 Reproduction 16.1 Asexual reproduction
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	3.2	16.2 Sexual reproduction
Flowering plants			
3.3	describe the structures of an insect-pollinated and a wind-pollinated flower and explain how each is adapted for pollination	3.3	16.3 Sexual reproduction in plants
3.4	understand that the growth of the pollen tube followed by fertilisation leads to seed and fruit formation	3.4	16.3 Sexual reproduction in plants
3.5	*Practical: investigate the conditions needed for seed germination*	3.5: becomes a practical statement	16.3 Sexual reproduction in plants
3.6	understand how germinating seeds utilise food reserves until the seedling can carry out photosynthesis	**3.6: was a bold statement**	16.3 Sexual reproduction in plants
3.7	understand that plants can reproduce asexually by natural methods (illustrated by runners) and by artificial methods (illustrated by cuttings)	3.7	16.1 Asexual reproduction
Humans			
3.8	understand how the structure of the male and female reproductive systems are adapted for their functions	3.8: re-worded	16.4 Sexual reproduction in humans
3.9	understand the roles of oestrogen and progesterone in the menstrual cycle	3.9	16.4 Sexual reproduction in humans
3.10B	**understand the roles of FSH and LH in the menstrual cycle**	**New statement**	16.4 Sexual reproduction in humans
3.11	describe the role of the placenta in the nutrition of the developing embryo	**3.10: was a bold statement**	16.4 Sexual reproduction in humans
3.12	understand how the developing embryo is protected by amniotic fluid	**3.11: was a bold statement**	16.4 Sexual reproduction in humans
3.13	understand the roles of oestrogen and testosterone in the development of secondary sexual characteristics	3.12	16.4 Sexual reproduction in humans

(b)	**Inheritance**		
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	3.14: statement re-worded	17 Inheritance
3.15	understand that the nucleus of a cell contains chromosomes on which genes are located	3.13	17.2 Chromosomes, genes and proteins
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)**	3.15: becomes a bold statement	4.1 Biological molecules
3.17B	**understand that an RNA molecule is single stranded and contains uracil (U) instead of thymine (T)**	**New statement**	17.2 Chromosomes, genes and proteins
3.18B	**describe the stages of protein synthesis including transcription and translation, including the role of mRNA, ribosomes, tRNA, codons and anticodons**	**New statement**	17.2 Chromosomes, genes and proteins
3.19	understand how genes exist in alternative forms called alleles which give rise to differences in inherited characteristics	3.16	17.2 Chromosomes, genes and proteins
3.20	understand the meaning of the terms: dominant, recessive, homozygous, heterozygous, phenotype, and genotype	3.17	17.5 Monohybrid inheritance
3.21B	**understand the meaning of the term codominance**	**3.17**	17.5 Monohybrid inheritance
3.22	understand that most phenotypic features are the result of polygenic inheritance rather than single genes	New statement	18.1 Variation
3.23	describe patterns of monohybrid inheritance using a genetic diagram	3.18	17.5 Monohybrid inheritance
3.24	understand how to interpret family pedigrees	3.19	17.5 Monohybrid inheritance
3.25	predict probabilities of outcomes from monohybrid crosses	3.20	17.5 Monohybrid inheritance
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	3.21	17.2 Chromosomes, genes and proteins
3.27	describe the determination of the sex of offspring at fertilisation, using a genetic diagram	3.22	17.2 Chromosomes, genes and proteins
3.28	understand how division of a diploid cell by mitosis produces two cells that contain identical sets of chromosomes	3.23	17.3 Mitosis
3.29	understand that mitosis occurs during growth, repair, cloning and asexual reproduction	3.24	17.3 Mitosis

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	3.25	17.4 Meiosis
3.31	understand how random fertilisation produces genetic variation of offspring	3.26	16.2 Sexual reproduction
3.32	know that in human cells the diploid number of chromosomes is 46 and the haploid number is 23	3.27	17.2 Chromosomes, genes and proteins
3.33	understand that variation within a species can be genetic, environmental, or a combination of both	3.28	18.1 Variation
3.34	understand that mutation is a rare, random change in genetic material that can be inherited	3.29	18.1 Variation
3.35B	**understand how a change in DNA can affect the phenotype by altering the sequence of amino acids in a protein**	**New statement**	18.1 Variation
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**	3.31: becomes a bold statement; also re-worded	
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)**	**3.33**	18.1 Variation
3.38	explain Darwin's theory of evolution by natural selection	3.30: slightly re-worded	18.3 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	3.32	18.3 Selection

4 Ecology and the environment

The following sub-topics are covered in this section.

(a) The organism in the environment

(b) Feeding relationships

(c) Cycles with ecosystems

(d) Human influences on the environment

(a)	**The organism in the environment**	**2011 specification reference**	**CIE spec reference**
4.1	understand the terms population, community, habitat and ecosystem	4.1	19 Organisms and their environment 19.4 Population size
4.2	*Practical: investigate the population size of an organism in two different areas using quadrats*	4.2: becomes a practical statement	
4.3B	**understand the term biodiversity**	**New statement**	
4.4B	***Practical: investigate the distribution of organisms in their habitats and measure biodiversity using quadrats***	4.3: becomes a bold statement; also becomes a practical statement	
4.5	understand how abiotic and biotic factors affect the population size and distribution of organisms	New statement	19.4 Population size
(b)	**Feeding relationships**		
4.6	understand the names given to different trophic levels, including producers, primary, secondary and tertiary consumers and decomposers	4.4	19.2 Food chains and food webs
4.7	understand the concepts of food chains, food webs, pyramids of number, pyramids of biomass and pyramids of energy transfer	4.5	19.2 Food chains and food webs
4.8	understand the transfer of substances and energy along a food chain	4.6	19.2 Food chains and food webs
4.9	understand why only about 10% of energy is transferred from one trophic level to the next	4.7	19.2 Food chains and food webs
(c)	**Cycles within ecosystems**		19.3 Nutrient cycles
		4.8: statement deleted	

4.10	describe the stages in the carbon cycle, including respiration, photosynthesis, decomposition and combustion	4.9	19.3 Nutrient cycles
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)**	**4.10**	19.3 Nutrient cycles
(d)	**Human influences on the environment**		21 Human influences on ecosystems
4.12	understand the biological consequences of pollution of air by sulfur dioxide and carbon monoxide	4.11	21.3 Pollution
4.13	understand that water vapour, carbon dioxide, nitrous oxide, methane and CFCs are greenhouse gases	4.12	21.3 Pollution
4.14	understand how human activities contribute to greenhouse gases	4.13	21.3 Pollution
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	4.14	21.3 Pollution
4.16	understand the biological consequences of pollution of water by sewage	**4.15: was a bold statement; also re-worded**	21.3 Pollution
4.17	understand the biological consequences of eutrophication caused by leached minerals from fertiliser	4.16: slightly re-worded	21.3 Pollution
4.18B	**understand the effects of deforestation, including leaching, soil erosion, disturbance of evapotranspiration and the carbon cycle, and the balance of atmospheric gases**	4.17: becomes a bold statement; also slightly re-worded	21.3 Pollution

5 Use of biological resources

The following sub-topics are covered in this section.

(a) Food production

(b) Selective breeding

(c) Genetic modification (genetic engineering)

(d) Cloning

(a) Food production		**2011 specification reference**	**CIE spec reference**
Crop plants			
5.1	describe how glasshouses and polythene tunnels can be used to increase the yield of certain crops	5.1	6.1 Photosynthesis 21.1 Food supply
5.2	understand the effects on crop yield of increased carbon dioxide and increased temperature in glasshouses	5.2	6.1 Photosynthesis 21.1 Food supply
5.3	understand how the use of fertiliser can increase crop yield	5.3	21.1 Food supply
5.4	understand the reasons for pest control and the advantages and disadvantages of using pesticides and biological control with crop plants	5.4	
Micro-organisms			
5.5	understand the role of yeast in the production of food including bread	5.5: slightly re-worded	20.2 Biotechnology
5.6	*Practical: investigate the role of anaerobic respiration by yeast in different conditions*	5.6: becomes a practical statement	
5.7	understand the role of bacteria (*Lactobacillus*) in the production of yoghurt	**5.7: was a bold statement**	20.2 Biotechnology
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 micro-organisms	**5.8: was a bold statement**	20.2 Biotechnology
Fish farming			
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**	5.9: becomes a bold statement	No specific reference

(b)	**Selective breeding**		
5.10	understand how selective breeding can develop plants with desired characteristics	5.10: slightly re-worded	21.1 Food supply
5.11	understand how selective breeding can develop animals with desired characteristics	5.11: slightly re-worded	21.1 Food supply
(c)	**Genetic modification (genetic engineering)**		20.3 Genetic engineering
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	5.12	20.3 Genetic engineering
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	5.13	20.3 Genetic engineering
5.14	understand how large amounts of human insulin can be manufactured from genetically modified bacteria that are grown in a fermenter	5.14	20.3 Genetic engineering
5.15	understand how genetically modified plants can be used to improve food production	5.15: slightly re-worded	20.3 Genetic engineering
5.16	understand that the term transgenic means the transfer of genetic material from one species to a different species	**5.16: was a bold statement**	
(d)	**Cloning**		No specific reference
5.17B	**describe the process of micropropagation (tissue culture) in which explants are grown *in vitro***	5.17: becomes a bold statement; also slightly re-worded	
5.18B	**understand how micropropagation can be used to produce commercial quantities of genetically identical plants with desirable characteristics**	5.18: becomes a bold statement	
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**	5.19: becomes a bold statement	
5.20B	**understand how cloned transgenic animals can be used to produce human proteins**	**5.20: statement re-worded**	