

**King Edward VI School,
Southampton**

**Topic summaries
for IGCSE Biology
for examinations
in June 2019**

A summary of topics for IGCSE Biology

- Practical work shown in bold is included in the specification
- Teachers can also include other practical work to support their teaching

Third Year Topics		Approximate timing	Practical work
3.1	Living organisms and cells	3 weeks	<ul style="list-style-type: none"> • Microscopy - cells and pond organisms
3.2	Nutrition in humans	7 weeks	<ul style="list-style-type: none"> • Rat dissection • Energy content of foods • Food tests • Effect of temp. on enzyme activity • Effect of pH on enzyme activity
3.3	Respiration	6 weeks	<ul style="list-style-type: none"> • Carbon dioxide and heat from respiring organisms
3.4	Gas exchange in humans		<ul style="list-style-type: none"> • Effect of exercise on breathing rate
3.5	Plant nutrition	3 weeks	<ul style="list-style-type: none"> • Oxygen from elodea • Starch tests – light, chlorophyll and CO₂
3.6	Gas exchange in plants	3 weeks	<ul style="list-style-type: none"> • Effect of light on gas exchange in leaves
3.7	Ecology	4 weeks	<ul style="list-style-type: none"> • Population study using quadrats
	Total	26 weeks	

Topics where SMSC could be addressed

Topic 3.2 the importance of a balanced diet and possible eating disorders.

Topic 3.4 the social impact of smoking

Fourth Year Topics		Approximate timing	Practical work
4.1	Movement of substances into and out of cells	3 weeks	<ul style="list-style-type: none"> • Diffusion and osmosis
4.2	Transport in plants	3 weeks	<ul style="list-style-type: none"> • Effect of environmental factors on transpiration rates
4.3	Transport in humans	3 weeks	<ul style="list-style-type: none"> • Heart dissection • Effect of exercise on heart rate
4.4	Nerves and Eyes	3 weeks	<ul style="list-style-type: none"> • <i>Sensitivity investigations</i> • Eye dissection
4.5	Human excretion	3 weeks	<ul style="list-style-type: none"> • Kidney dissection
4.6	Coordination and homeostasis in humans	3 weeks	
4.7	Plant coordination and response	2 weeks	<ul style="list-style-type: none"> • Growth responses
4.8	Reproduction	4 weeks	<ul style="list-style-type: none"> • Flower structure • PSHE talks
	Total	24 weeks	

NB under the previous syllabus the topics for nutrient cycles and food production appeared as 4.9 and 4.10 – it is likely that at least one of these topics will be taught at the end of the 4th year but there is still time in the 5th year to teach them if necessary.

Topics where SMSC could be addressed

Topic 4.8 – Reproduction and the moral questions around sexual activity

Fifth Year Topics		Approximate timing	Practical work
5.1	Food production	2 weeks	
5.2	Carbon, nitrogen and water cycles	2 weeks	
5.3	Microorganisms	4 weeks	<ul style="list-style-type: none"> • Aseptic technique • CO₂ from yeast investigations
5.4	Inheritance	4 weeks	<ul style="list-style-type: none"> • DNA extraction
5.5	Cell division	2 weeks	
5.6	Cloning and stem cells	2 weeks	<ul style="list-style-type: none"> • Cuttings
5.7	Selective breeding	1 weeks	
5.8	Genetic modification	2 weeks	
5.9	Human influences on the environment	2 weeks	
	Total	21 weeks	

Topics where SMSC could be addressed

Topic 5.4, 5.6 and 5.8 the ethical issues around cloning and GM organisms

Topic 5.9 decisions concerned with global warming

3.1 Living organisms and cells

Content detail	IGCSE Exam. Paper
<p>Understand that living organisms share the following characteristics:</p> <ul style="list-style-type: none"> • 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 and 2
<p>Describe the levels of organisation within organisms: organelles, cells, tissues, organs and systems</p> <p>Describe cell structures, including the nucleus, cytoplasm, cell membrane, cell wall, mitochondria, chloroplast, ribosomes and vacuole</p> <p>Describe the functions of the nucleus, cytoplasm, cell membrane, cell wall, mitochondria, chloroplasts, ribosomes and vacuole</p> <p>Know the similarities and differences in the structure of plant and animal cells</p>	1 and 2
<p>Describe the common features shown by eukaryotic organisms: plants, animals, fungi and protoctists</p> <p>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).</p> <p>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).</p> <p style="text-align: right;">(continued)</p>	1 and 2

<p>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.</p> <p>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.</p> <p><i>Features and examples of bacteria and viruses are included in Topic 5.3</i></p>	1 and 2
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3.2 Nutrition in humans

Content detail	IGCSE Exam. Paper
<p>Understand that a balanced diet should include appropriate proportions of carbohydrate, protein, lipid, vitamins, minerals, water and dietary fibre</p>	1 and 2
<p>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</p>	1 and 2
<p>Understand how energy requirements vary with activity levels, age and pregnancy</p>	1 and 2
<p>Identify the chemical elements present in carbohydrates, proteins and lipids (fats and oils)</p>	1 and 2
<p>Describe the structure of carbohydrates, proteins and lipids as large molecules made up from smaller basic units:</p> <ul style="list-style-type: none"> • starch and glycogen from simple sugars • protein from amino acids • lipid from fatty acids and glycerol 	1 and 2
<p>Practical tasks:</p> <p><i>Investigate food samples for the presence of glucose, starch, protein and fat</i></p> <p><i>Investigate the energy content in a food sample</i></p>	1 and 2 2
<p>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</p> <p>Understand how food is moved through the gut by peristalsis</p> <p>Understand the role of digestive enzymes including</p> <ul style="list-style-type: none"> • 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. 	1 and 2
<p>Understand that bile is produced by the liver and stored in the gall bladder.</p> <p>Understand the role of bile in neutralising stomach acid and emulsifying lipids.</p> <p>Understand how the small intestine is adapted for absorption, including the structure of a villus</p> <p style="text-align: right;">(continued)</p>	1 and 2

Understand the role of enzymes as biological catalysts in metabolic reactions	1 and 2
Understand how temperature changes can affect enzyme function, including changes to the shape of active site	1 and 2
Understand how enzyme function can be affected by changes in pH altering the active site	1 and 2
<i>Practical task:</i>	
<i>Investigate how enzyme activity can be affected by changes in temperature</i>	1 and 2
<i>Investigate how enzyme activity can be affected by changes in pH</i>	2

3.3 Respiration

Content detail	IGCSE Exam. Paper
<p>Understand how the process of respiration produces ATP in living organisms</p> <p>Know that ATP provides energy for cells</p> <p>Describe the differences between aerobic and anaerobic respiration</p> <p>Know the word equation and the balanced chemical symbol equation for aerobic respiration in living organisms.</p> <p>Know the word equation for anaerobic respiration in plants and in animals.</p> <p>Practical tasks:</p> <p><i>Investigate the evolution of carbon dioxide and heat from respiring seeds or other suitable living organisms</i></p>	<p>1 and 2</p>

3.4 Gas exchange in humans

Content detail	IGCSE Exam. Paper
Describe the structure of the thorax, including the ribs, intercostal muscles, diaphragm, trachea, bronchi, bronchioles, alveoli and pleural membranes	1 and 2
Understand the role of the intercostal muscles and the diaphragm in ventilation	1 and 2
Explain how alveoli are adapted for gas exchange by diffusion between air in the lungs and blood in capillaries.	1 and 2
Understand the role of diffusion in gas exchange.	2
Understand the biological consequences of smoking in relation to the lungs and the circulatory system, including coronary heart disease.	1 and 2
<i>Practical task:</i> <i>Investigate breathing in humans, including the release of carbon dioxide and the effect of exercise</i>	1 and 2

3.5 Plant nutrition

Content detail	IGCSE Exam. Paper
<p>Understand the process of photosynthesis and understand its importance in conversion of light energy to chemical energy</p> <p>Know the word equation and the balanced chemical symbol equation for photosynthesis</p> <p>Understand how varying carbon dioxide concentration, light intensity and temperature affects the rate of photosynthesis</p> <p>Describe the structure of the leaf and explain how it is adapted for photosynthesis</p> <p>Understand that plants require mineral ions for growth and that magnesium ions are needed for chlorophyll and nitrate ions are needed for amino acids</p> <p>Practical tasks:</p> <p><i>Investigate photosynthesis, showing:</i></p> <ul style="list-style-type: none"> • <i>the evolution of oxygen from a water plant</i> • <i>the production of starch</i> • <i>the requirements of light, carbon dioxide and chlorophyll</i> 	1 and 2

3.6 Gas exchange in plants

Content detail	IGCSE Exam. Paper
Understand the role of diffusion in gas exchange.	2
Understand gas exchange (of carbon dioxide and oxygen) in relation to respiration and photosynthesis	2
Understand that respiration continues during the day and night, but that the net exchange of carbon dioxide and oxygen depends on the intensity of light.	2
Understand how the structure of the leaf is adapted for gas exchange	2
Describe the role of stomata in gas exchange	2
Understand the origin of carbon dioxide and oxygen as waste products of metabolism and their loss from the stomata of a leaf	1 and 2
<i>Practical tasks:</i>	
<i>Investigate the effect of light on net gas exchange from a leaf, using hydrogen-carbonate indicator</i>	2

3.7 Ecology

Content detail	IGCSE Exam. Paper
<p>Understand the terms: population, community, habitat and ecosystem</p> <p>Understand how abiotic and biotic factors affect the population size and distribution of organisms</p> <p>Understand the term biodiversity</p> <p><i>Practical task:</i></p> <p><i>Investigate the population size of an organism in two different areas using quadrats</i></p> <p><i>Investigate the distribution of organisms in their habitats and measure biodiversity using quadrats</i></p>	<p>1 and 2</p> <p>1 and 2</p> <p>2</p> <p>1 and 2</p> <p>2</p>
<p>Understand the names given to different trophic levels to include:</p> <ul style="list-style-type: none"> • producers • primary, secondary and tertiary consumers • decomposers <p>Understand the concepts of:</p> <ul style="list-style-type: none"> • food chains, • food webs, • pyramids of number, • pyramids of biomass and • pyramids of energy transfer. <p>Understand the transfer of substances and of energy along a food chain</p> <p>Understand why only about 10% of energy is transferred from one trophic level to the next</p>	<p>1 and 2</p> <p>1 and 2</p> <p>1 and 2</p> <p>1 and 2</p>

4.1 Movement of substances into and out of cells

Content detail	IGCSE Exam. Paper
<p>Understand the processes of diffusion, osmosis and active transport by which substances move into and out of cells</p> <p>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</p>	1 and 2
<p>Understand why simple, unicellular organisms can rely on diffusion for movement of substances in and out of the cell.</p> <p>Understand the need for a transport system in multicellular organisms.</p>	1 and 2
<p>Practical task:</p> <p><i>Investigate diffusion and osmosis using living and non-living systems.</i></p>	1 and 2

4.2 Transport in plants

Content detail	IGCSE Exam. Paper
Describe the role of phloem in transporting sucrose and amino acids between the leaves and other parts of the plant	2
Describe the role of the xylem in transporting water and mineral salts from the roots to other parts of the plant	1 and 2
Understand how water is absorbed by root hair cells	2
Understand that transpiration is the evaporation of water from the surface of a plant	2
Understand how the rate of transpiration is affected by changes in humidity, wind speed, temperature and light intensity	2
<i>Practical task:</i> <i>Investigate the role of environmental factors in determining the rate of transpiration from a leafy shoot</i>	2

4.3 Transport in humans

Content detail	IGCSE Exam. Paper
<p>Describe the composition of the blood: red blood cells, white blood cells, platelets and plasma</p> <p>Understand the role of plasma in the transport of carbon dioxide, digested food, urea, hormones and heat energy</p> <p>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</p> <p>Understand how platelets are involved in blood clotting, which prevents blood loss and the entry of microorganisms</p> <p><i>White blood cells will be studied in Topic 5.3</i></p>	<p>1 and 2</p> <p>1 and 2</p> <p>1 and 2</p> <p>2</p>
<p>Describe the structure of the heart and how it functions</p> <p>Explain how the heart rate changes during exercise and under the influence of adrenaline</p> <p>Understand how factors may increase the risk of developing coronary heart disease</p> <p>Understand how the structure of arteries, veins and capillaries relate to their function</p> <p>Understand the general structure of the circulation system to include the blood vessels to and from the heart, the lungs, the liver and the kidneys</p>	<p>1 and 2</p>

4.4 Nerves and eyes

Content detail	IGCSE Exam. Paper
<p>Understand how organisms are able to respond to changes in their environment</p> <p>Understand that a coordinated response requires a stimulus, a receptor and an effector</p> <p>Describe how nervous and hormonal communication control responses and understand the differences between the two systems</p>	1 and 2
<p>Understand that the central nervous system consists of the brain and spinal cord and is linked to sense organs by nerves.</p> <p>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.</p> <p>Understand the role of neurotransmitters at synapses</p> <p>Describe the structure and functioning of a simple reflex arc illustrated by the withdrawal of a finger from a hot object</p>	1 and 2
<p>Describe the structure and function of the eye as a receptor</p> <p>Understand the function of the eye in focusing near and distant objects, and in responding to changes in light intensity.</p>	1 and 2

4.5 Coordination and homeostasis in humans

Content detail	IGCSE Exam. Paper
<p>Understand how organisms are able to respond to changes in their environment. <i>(Topic 4.4)</i></p>	1 and 2
<p>Understand that a coordinated response requires a stimulus, a receptor and an effector. <i>(Topic 4.4)</i></p>	1 and 2
<p>Describe how nervous and hormonal communication control responses and understand the differences between the two systems</p>	1 and 2
<p>Understand that homeostasis is the maintenance of a constant internal environment and that the control of body water content and body temperature are both examples of homeostasis.</p>	1 and 2
<p>Describe the role of the skin in temperature regulation, with reference to</p> <ul style="list-style-type: none"> • sweating, • vasoconstriction and • vasodilation. 	1 and 2
<p>Understand the sources, roles and effects of the following hormones:</p> <ul style="list-style-type: none"> • adrenaline, • insulin, • testosterone, • progesterone, • oestrogen. 	1 and 2
<p>Understand the sources, roles and effects of the following hormones:</p> <ul style="list-style-type: none"> • ADH, • FSH • LH 	2

4.6 Human excretion

Content detail	IGCSE Exam. Paper
<p>Know the excretory products of the lungs, kidneys and skin (organs of excretion)</p> <p>Understand how the kidney carries out its roles of excretion and of osmoregulation.</p> <p>Describe the structure of the urinary system, including the kidneys, ureters, bladder and urethra.</p>	<p>1 and 2</p> <p>2</p> <p>2</p>
<p>Describe the structure of a nephron, to include</p> <ul style="list-style-type: none"> • Bowman’s capsule and • glomerulus, • convoluted tubules, • loop of Henlé and • collecting duct <p>Describe ultrafiltration in the Bowman’s capsule and the composition of the glomerular filtrate</p> <p>Understand how water is reabsorbed into the blood from the collecting duct</p> <p>Understand why selective reabsorption of glucose occurs at the proximal convoluted tubule</p>	<p>2</p>
<p>Describe the role of ADH in regulating the water content of the blood</p> <p>Understand that urine contains water, urea and ions</p>	<p>2</p>

4.7 Coordination and response in plants

Content detail	Exam. Paper
Understand that plants respond to stimuli Describe the geotropic and phototropic responses of roots and stems Understand the role of auxin in the phototropic response of stems	1 and 2

4.8 Reproduction

Content detail	IGCSE Exam. Paper
<p>Understand the differences between sexual and asexual reproduction</p> <p>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.</p>	1 and 2
<p>Describe the structures of an insect-pollinated and a wind-pollinated flower and explain how each is adapted for pollination</p> <p>Understand that the growth of the pollen tube followed by fertilisation leads to seed and fruit formation</p> <p>Understand how germinating seeds utilise food reserves until the seedling can carry out photosynthesis</p> <p>Understand that plants can reproduce asexually by natural methods (illustrated by runners) and by artificial methods (illustrated by cuttings).</p> <p>Practical task:</p> <p><i>Investigate the conditions needed for seed germination.</i></p>	1 and 2
<p>Understand how the structure of the male and female reproductive systems are adapted for their functions</p> <p>Understand the roles of oestrogen and progesterone in the menstrual cycle</p> <p>Understand the roles of FSH and LH in the menstrual cycle</p> <p>Describe the role of the placenta in the nutrition of the developing embryo</p> <p>Understand how the developing embryo is protected by amniotic fluid.</p> <p>Understand the roles of oestrogen and testosterone in the development of secondary sexual characteristics.</p>	<p>1 and 2</p> <p>1 and 2</p> <p>2</p> <p>1 and 2</p> <p>1 and 2</p> <p>1 and 2</p>

5.1 Food production

Content detail	IGCSE Exam. Paper
<p>Describe how glasshouses and polythene tunnels can be used to increase the yield of certain crops</p> <p>Understand the effects on crop yield of increased carbon dioxide and increased temperature in glasshouses</p> <p>Understand the use of fertiliser to increase crop yield</p> <p>Understand the reasons for pest control and the advantages and disadvantages of using pesticides and biological control with crop plants</p>	1 and 2
<p>Understand the methods used to farm large numbers of fish to provide a source of protein, including</p> <ul style="list-style-type: none"> • maintaining water quality, • controlling intraspecific and interspecific predation, • controlling disease, • removing waste products, • controlling the quality and frequency of feeding • selective breeding. <p style="text-align: center;"><i>Selective breeding is studied further in Topic 5.7</i></p>	2

5.3 Microorganisms

Content detail	IGCSE Exam. Paper
<p>Describe the common features shown by prokaryotic organisms such as bacteria</p> <p>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.</p> <p>Examples include <i>Lactobacillus bulgaricus</i>, a rod-shaped bacterium used in the production of yoghurt from milk, and <i>Pneumococcus</i>, a spherical bacterium that acts as the pathogen causing pneumonia.</p> <p>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.</p> <p>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.</p> <p>Reminder from topic 3.1</p> <p>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 <i>Mucor</i>, which has the typical fungal hyphal structure, and yeast, which is single-celled.</p> <p>Protoctists: these are microscopic single-celled organisms. Some, like <i>Amoeba</i>, that live in pond water, have features like an animal cell, while others, like <i>Chlorella</i>, have chloroplasts and are more like plants. A pathogenic example is <i>Plasmodium</i>, responsible for causing malaria.</p> <p style="text-align: right;">(continued)</p>	<p>1 and 2</p>

<p>Understand the role of yeast in the production of food including bread</p> <p>Understand the role of bacteria (<i>Lactobacillus</i>) in the production of yoghurt</p> <p>Interpret and label a diagram 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</p> <p><i>Practical task:</i></p> <p><i>Investigate the role of anaerobic respiration by yeast in different conditions</i></p>	<p>1 and 2</p>
<p>Understand the term 'pathogen' and know that pathogens may be fungi, bacteria, protoctists or viruses.</p> <p>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.</p> <p>Understand how vaccination results in the manufacture of memory cells, which enables future antibody production to the pathogen to occur sooner, faster and in greater quantity.</p>	<p>1 and 2</p> <p>1 and 2</p> <p>2</p>

5.4 Inheritance

Content detail	IGCSE Exam. Paper
Understand that the nucleus of a cell contains chromosomes on which genes are located	1 and 2
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	1 and 2
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)	2
Understand that an RNA molecule is single stranded and contains uracil (U) instead of thymine (T)	2
Describe the stages of protein synthesis including transcription and translation, including the role of mRNA, ribosomes, tRNA, codons and anticodons	2
Understand how genes exist in alternative forms called alleles which give rise to differences in inherited characteristics	1 and 2
<p>Understand the meaning of the terms:</p> <ul style="list-style-type: none"> • dominant, • recessive, • homozygous, • heterozygous, • phenotype, • genotype, • codominance <p>Understand that most phenotypic features are the result of polygenic inheritance rather than single genes</p> <p>Describe patterns of monohybrid inheritance using a genetic diagram</p> <p>Understand how to interpret family pedigrees</p> <p>Predict probabilities of outcomes from monohybrid crosses</p> <p style="text-align: right;">(continued)</p>	<p>1 and 2</p> <p>2</p> <p>1 and 2</p> <p>1 and 2</p> <p>1 and 2</p> <p>1 and 2</p>

<p>Understand how the sex of a person is controlled by one pair of chromosomes, XX in a female and XY in a male</p>	1 and 2
<p>Describe the determination of the sex of offspring at fertilisation, using a genetic diagram</p>	1 and 2
<p>Understand how random fertilisation produces genetic variation of offspring</p>	1 and 2
<p>Know that in human cells the diploid number of chromosomes is 46 and the haploid number is 23</p>	1 and 2
<p>Understand that variation within a species can be</p> <ul style="list-style-type: none"> • genetic, • environmental, or • a combination of both. 	1 and 2
<p>Understand how a change in DNA can affect the phenotype by altering the sequence of amino acids in a protein</p>	2
<p>Understand how most genetic mutations have no effect on the phenotype, some have a small effect and rarely do they have a significant effect</p>	2
<p>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)</p>	2
<p>Explain Darwin's theory of evolution by natural selection</p>	1 and 2
<p>Understand how resistance to antibiotics can increase in bacterial populations, and appreciate how such an increase can lead to infections being difficult to control</p>	1 and 2

5.5 Cell division

Content detail	IGCSE Exam. Paper
<p>Understand how division of a diploid cell by mitosis produces two cells which contain identical sets of chromosomes</p> <p>Understand that mitosis occurs during</p> <ul style="list-style-type: none"> • growth, • repair, • cloning and • asexual reproduction <p>Understand how division of a cell by meiosis</p> <ul style="list-style-type: none"> • produces four cells, • each with half the number of chromosomes, and • this results in the formation of genetically different haploid gametes. <p>Understand how random fertilisation produces genetic variation of offspring (Topic 5.4)</p> <p>Know that in human cells the diploid number of chromosomes is 46 and the haploid (Topic 5.4) number is 23</p>	<p>1 and 2</p>

5.6 Cloning and stem cells

Content detail	IGCSE Exam. Paper
<p>Describe the process of micropropagation (tissue culture) in which explants are grown in vitro</p> <p>Understand how micropropagation can be used to produce commercial quantities of identical plants (clones) with desirable characteristics</p> <p>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</p> <p>Understand how cloned transgenic animals can be used to produce human proteins</p> <p>Explain the importance of cell differentiation in the development of specialised cells</p> <p>Understand the advantages and disadvantages of using stem cells in medicine</p>	<p>2</p>

5.7 Selective breeding

Content detail	IGCSE Exam. Paper
<p>Understand how selective breeding can develop plants with desired characteristics</p>	<p>1 and 2</p>
<p>Understand how selective breeding can develop animals with desired characteristics</p>	<p>1 and 2</p>

5.8 Genetic modification

Content detail	IGCSE Exam. Paper
<p>Understand how restriction enzymes to cut DNA at specific sites and ligase enzymes to join pieces of DNA together</p> <p>Understand how plasmids and viruses can act as vectors, which take up pieces of DNA, then insert this recombinant DNA into other cells</p> <p>Understand how large amounts of human insulin can be manufactured from genetically modified bacteria that are grown in a fermenter</p> <p>Understand how genetically modified plants can be used to improve food production</p> <p>Understand that the term 'transgenic' means the transfer of genetic material from one species to a different species</p>	<p>1 and 2</p>

5.9 Human influences on the environment

Content detail	IGCSE Exam. Paper
<p>Understand the biological consequences of pollution of air by sulphur dioxide and by carbon monoxide</p> <p>Understand that the following are all greenhouse gases:</p> <ul style="list-style-type: none"> • water vapour, • carbon dioxide, • nitrous oxide, • methane, • CFCs <p>Understand how human activities contribute to greenhouse gases</p> <p>Understand how an increase in greenhouse gases results in an enhanced greenhouse effect and that this may lead to global warming and its consequences</p>	1 and 2
<p>Understand the biological consequences of pollution of water by sewage</p> <p>Understand the biological consequences of eutrophication caused by leached minerals from fertilizer</p> <p>Understand the effects of deforestation, including</p> <ul style="list-style-type: none"> • leaching, • soil erosion, • disturbance of evapotranspiration and the carbon cycle, • the balance in atmospheric gases 	<p>1 and 2</p> <p>1 and 2</p> <p>2</p>