International A level Biology (Pearson Edexcel)

Over two years (Year 12 and Year 13), students will sit 6 examined units.

Typical exam schedule
Year 12 (AS Year): Unit 1 = January, Unit 2&3 = May
Year 13 (A2 Year): Resits of previous units = Oct/Nov, Unit 4 = January, Unit 5&6 = June

Units 3 and 6 are practical units. Teaching for these is integrated into teaching of the other

Practical links

- There are videos of most practicals on Youtube.
- Royal Society of Biology: https://www.rsb.org.uk/images/SB/Practical_resources_supporting_the_new_Biology_A_levels_in_England_April_2015.pdf

Independent learning

- Students have access to various textbooks, practice questions, past papers and are directed to various websites
- Students are encouraged to engage in subject-relevant publications, such as “Nature” and “The Scientist.”
- https://bio.libretexts.org/
- http://ib.bioninja.com.au/

Year 12 (AS Year)

UNIT 1, Topic 1 – Molecules, Transport and Health
January exam

Wider reading

Topic 1

https://www.nhs.uk/conditions/heart-attack/

https://www.nhlbi.nih.gov/health/atherosclerosis/treatment

https://www.heart.org/en/around-the-aha/aha-names-biggest-advances-in-cardiovascular-research-for-2024

Topic 2

https://www.khanacademy.org/science/biology/dna-as-the-genetic-material/dna-replication/a/mode-of-dna-replication-meselson-stahl-experiment

https://byjus.com/biology/dna-replication-experiment/

https://www.nhlbi.nih.gov/health/cystic-fibrosis/treatment

Diagnosing Cystic Fibrosis: https://www.mdpi.com/2075-4418/14/7/763

Implications of genetic testing: https://www.ncbi.nlm.nih.gov/books/NBK236044/

https://www.nature.com/scitable/topicpage/ethics-of-genetic-testing-medical-insurance-and-651/

Teaching schedule

Term	Week	Specification reference	Content
1A	**1**	**1.1**	understand the importance of water as a solvent in transport, including its dipole nature
		1.2	(i) know the difference between monosaccharides, disaccharides and polysaccharides, including glycogen and starch (amylose and amylopectin) (ii) be able to relate the structures of monosaccharides, disaccharides and polysaccharides to their roles in providing and storing energy β-*glucose and cellulose are not required in this topic.*
		1.4	know how monosaccharides (glucose, fructose and galactose) join together to form disaccharides (maltose, sucrose and lactose) and polysaccharides (glycogen, amylose and amylopectin) through condensation reactions forming glycosidic bonds, and how these can be split through hydrolysis reactions
	2	**1.3**	**CORE PRACTICAL 1 + Practical skills introduction** **Introduce students to A level practical skills requirements** **Use a semi-quantitative method with Benedict's reagent to estimate the concentrations of reducing sugars and with iodine solution to estimate the concentrations of starch, using colour standards.**
		1.5	(i) know how a triglyceride is synthesised by the formation of ester bonds during condensation reactions between glycerol and three fatty acids (ii) know the differences between saturated and unsaturated lipids
		1.6	understand why many animals have a heart and circulation (mass transport to overcome the limitations of diffusion in meeting the requirements of organisms)
	3	**1.7**	understand how the structures of blood vessels (capillaries, arteries and veins) relate to their functions
		1.8	know the cardiac cycle (atrial systole, ventricular systole and cardiac diastole) and relate the structure and operation of the mammalian heart, including the major blood vessels, to its function *Details of myogenic stimulation are not needed at IAS.*

			RECOMMENDED ADDITIONAL PRACTICAL **Investigate the structure of a mammalian heart by dissection.**
		1.9	(i) understand the role of haemoglobin in the transport of oxygen and carbon dioxide
	4	**1.9**	(ii) understand the oxygen dissociation curve of haemoglobin, the Bohr effect and the significance of the oxygen affinity of fetal haemoglobin compared with adult haemoglobin
		1.10	understand the course of events that leads to atherosclerosis (endothelial dysfunction, inflammatory response, plaque formation, raised blood pressure)
		1.11	understand the blood clotting process (thromboplastin release, conversion of prothrombin to thrombin and fibrinogen to fibrin) and its role in cardiovascular disease (CVD)
		1.12	know how factors such as genetics, diet, age, gender, high blood pressure, smoking and inactivity increase the risk of cardiovascular disease (CVD)
		1.13	understand the link between dietary antioxidants and the risk of cardiovascular disease (CVD)
	5	**1.15**	be able to analyse and interpret quantitative data on illness and mortality rates to determine health risks, including distinguishing between correlation and causation and recognising conflicting evidence
		1.16	be able to evaluate the design of studies used to determine health risk factors, including sample selection and sample size used to collect data that is both valid and reliable
		1.17	understand why people's perception of risks are often different from the actual risks, including underestimating and overestimating the risks due to diet and other lifestyle factors in the development of heart disease
		1.18	(i) be able to analyse data on the possible significance for health of blood cholesterol levels and levels of high-density lipoproteins (HDLs) and low-density lipoproteins (LDLs) (ii) know the evidence for a causal relationship between blood cholesterol levels (total cholesterol and LDL cholesterol) and cardiovascular disease (CVD)
		1.19	understand how people use scientific knowledge about the effect of diet, including obesity indicators, such as body mass index and waist-to-hip ratio, exercise and smoking to reduce their risk of coronary heart disease
		1.20	know the benefits and risks of treatments for cardiovascular disease (CVD) (antihypertensives, statins, anticoagulants and platelet inhibitors)
	6	**1.14**	**CORE PRACTICAL 2** **Investigate the vitamin C content of food and drink.**

		Assessment/ revision	
	7	**Topic 2 start 2.2**	(i) know the structure and properties of cell membranes (ii) understand how models such as the fluid mosaic model of membrane structure are interpretations of data used to develop scientific explanations of the structure and properties of cell membranes
		2.4	understand what is meant by osmosis in terms of the movement of free water molecules through a partially permeable membrane, down a water potential gradient
		2.5	(i) understand what is meant by passive transport (diffusion, facilitated diffusion), active transport (including the role of ATP as an immediate source of energy), endocytosis and exocytosis (ii) understand the involvement of carrier and channel proteins in membrane transport

UNIT 1, Topic 2 – Membranes, Proteins, DNA and Gene Expression
January exam

Term	Week	Specification reference	Content
1B	**1**	**2.3**	**CORE PRACTICAL 3** **Investigate membrane properties including the effect of alcohol and temperature on membrane permeability.**
		2.1	(i) know the properties of gas exchange surfaces in living organisms (large surface area to volume ratio, thickness of surface and difference in concentration) (ii) understand how the rate of diffusion is dependent on these properties and can be calculated using Fick's Law of Diffusion (iii) understand how the structure of the mammalian lung is adapted for rapid gaseous exchange
		2.6	(i) know the basic structure of an amino acid *Structures of specific amino acids are not required.* (ii) understand the formation of polypeptides and proteins (amino acid monomers linked by condensation reactions to form peptide bonds)
	2	**2.6**	(iii) understand the significance of a protein's primary structure in determining its secondary structure, three-dimensional structure and properties (globular and fibrous proteins and the types of bonds involved in its three-dimensional structure) (iv) know the molecular structure of a globular protein and a fibrous protein and understand how their structures relate to their functions (including haemoglobin and collagen)
		2.7	(i) understand the mechanism of action and the specificity of enzymes in terms of their three-dimensional structure (ii) understand that enzymes are biological catalysts that reduce activation energy (iii) know that there are intracellular enzymes catalysing reactions inside cells and extracellular enzymes catalysing reactions outside cells

		2.8	**CORE PRACTICAL 4** **Investigate the effect of temperature, pH, enzyme concentration and substrate concentration on the initial rate of enzyme-catalysed reactions.**
	3	**2.9**	(i) know the basic structure of mononucleotides (deoxyribose or ribose linked to a phosphate and a base, including thymine, uracil, adenine, cytosine or guanine) and the structures of DNA and RNA (polynucleotides composed of mononucleotides linked by condensation reactions to form phosphodiester bonds) (ii) know how complementary base pairing and the hydrogen bonding between two complementary strands are involved in the formation of the DNA double helix
		2.10	(i) understand the process of DNA replication, including the role of DNA polymerase (ii) understand how Meselson and Stahl's classic experiment provided new data that supported the accepted theory of replication of DNA and refuted competing theories
		2.11	understand the nature of the genetic code (triplet code, non-overlapping and degenerate)
		2.12	know that a gene is a sequence of bases on a DNA molecule that codes for a sequence of amino acids in a polypeptide chain
		2.15	(i) understand what is meant by the terms *gene, allele, genotype, phenotype, recessive, dominant, codominance, homozygote* and *heterozygote* (ii) understand patterns of inheritance, including the interpretation of genetic pedigree diagrams, in the context of monohybrid inheritance
	4	**2.15**	(iii) understand sex linkage on the X chromosome, including red-green colour blindness in humans
		2.13	(i) understand the process of protein synthesis (transcription and translation), including the role of RNA polymerase, translation, messenger RNA, transfer RNA, ribosomes and the role of start and stop codons (ii) understand the roles of the DNA template (antisense) strand in transcription, codons on messenger RNA and anticodons on transfer RNA
		2.14	(i) understand how errors in DNA replication can give rise to mutations (substitution, insertion and deletion of bases) (ii) know that some mutations will give rise to cancer or genetic disorders, but that many mutations will have no observable effect
		2.16	understand how the expression of a gene mutation in people with cystic fibrosis impairs the functioning of the gaseous exchange, digestive and reproductive systems

	5	**2.17**	(i) understand the uses of genetic screening, including the identification of carriers, pre-implantation genetic diagnosis (PGD) and prenatal testing, including amniocentesis and chorionic villus sampling (ii) understand the implications of prenatal genetic screening
		2.18	be able to identify and discuss the ethical and social issues relating to genetic screening from a range of ethical viewpoints, including religious, moral and social implications
	6	**Assessment/ revision**	Mock exams for January Unit 1
	7	**Assessment/ revision**	

Unit 2 wider reading

Topic 3

https://www.news-medical.net/life-sciences/History-of-the-Electron-Microscope.aspx

International Society for Stem Cell Research: https://www.isscr.org/

https://stemcellres.biomedcentral.com/articles/10.1186/s13287-019-1165-5

https://www.nature.com/subjects/epigenetics

https://www.the-scientist.com/tag/epigenetics

Topic 4

Plant-Derived Antimicrobials: https://www.mdpi.com/2079-6382/13/8/746, https://pmc.ncbi.nlm.nih.gov/articles/PMC8541629/

https://www.sciencepharma.com/blog/changing-face-of-clinical-trials-history/

https://bepartofresearch.nihr.ac.uk/articles/history-healthcare-research/

History of Hardy-Weinberg principle: https://www.historyofinformation.com/detail.php?id=3834

Teaching schedule

UNIT 2, Topic 3 – Cell Structure, Reproduction and Development
May/June exam

Term	Week	Specification reference	Content
2A	**1**	**3.1**	know that all living organisms are made of cells, sharing some common features
		3.2	understand how the cells of multicellular organisms are organised into tissues, tissues into organs, and organs into organ systems
		3.3	(i) know the ultrastructure of eukaryotic cells, including nucleus, nucleolus, ribosomes, rough and smooth endoplasmic reticulum, mitochondria, centrioles, lysosomes and Golgi apparatus (ii) understand the function of the organelles listed in (i)
		3.4	understand the role of the rough endoplasmic reticulum (rER) and the Golgi apparatus in protein transport within cells, including their role in the formation of extracellular enzymes
		3.5	(i) know the ultrastructure of prokaryotic cells, including cell wall, capsule, plasmid, flagellum, pili, ribosomes and circular DNA (ii) understand the function of the structures listed in (i)
		3.6	be able to recognise the organelles in **3.3** from electron microscope (EM) images
	2	**3.7**	(i) know how magnification and resolution can be achieved using light and electron microscopy (ii) understand the importance of staining specimens in microscopy
		3.8	**CORE PRACTICAL 5** **(i) use a light microscope to make observations and labelled drawings of suitable animal cells** **(ii) use a graticule with a microscope to make measurements and understand the concept of scale**

		3.9	(i) know that a locus is the location of genes on a chromosome (ii) understand the linkage of genes on a chromosome
	3	**3.14**	understand the role of mitosis and the cell cycle in producing genetically identical daughter cells for growth and asexual reproduction
		3.16	be able to calculate mitotic indices
		3.15	**CORE PRACTICAL 6** **Prepare and stain a root tip squash to observe the stages of mitosis.**
		3.10	understand the role of meiosis in ensuring genetic variation through the production of non-identical gametes as a consequence of independent assortment of chromosomes in metaphase I and crossing over of alleles between chromatids in prophase I *Names of the stages of prophase are not required.*
	4	**3.11**	understand how mammalian gametes are specialised for their functions (including the acrosome in sperm and the zona pellucida in the egg cell)
		3.12	know the process of fertilisation in mammals, including the acrosome reaction, the cortical reaction and the fusion of nuclei
		3.13	know the process of fertilisation in flowering plants, starting with the growth of a pollen tube and ending with the fusion of nuclei
		3.17	(i) understand what is meant by the terms *stem cell*, *pluripotent* and *totipotent*, *morula* and *blastocyst* (ii) be able to discuss the ways in which society uses scientific knowledge to make decisions about the use of stem cells in medical therapies
	5	**3.18**	understand how cells become specialised through differential gene expression, producing active mRNA, leading to the synthesis of proteins which, in turn, control cell processes or determine cell structure in animals and plants
		3.19	understand how one gene can give rise to more than one protein through post-transcriptional changes to messenger RNA (mRNA)

		3.20	(i) understand how phenotype is the result of an interaction between genotype and the environment (ii) know how epigenetic modification, including DNA methylation and histone modification, can alter the activation of certain genes (iii) understand how epigenetic modifications can be passed on following cell division
		3.21	understand how some phenotypes are affected by multiple alleles for the same gene, or by polygenic inheritance, as well as the environment, and how polygenic inheritance can give rise to phenotypes that show continuous variation
	6	**Assessment/ Revision**	
	7	**4.1**	(i) know the structure and ultrastructure of plant cells including cell wall, chloroplast, amyloplast, vacuole, tonoplast, plasmodesmata, pits and middle lamella and be able to compare it with animal cells (ii) understand the function of the structures listed in (i)
		4.2	be able to recognise the organelles in **4.1** from electron microscope (EM) images
		4.3	understand the structure and function of the polysaccharides starch and cellulose, including the role of hydrogen bonds between the β-glucose molecules in the formation of cellulose microfibrils
		4.4	understand how the arrangement of cellulose microfibrils and secondary thickening in plant cell walls contributes to the physical properties of xylem vessels and sclerenchyma fibres in plant fibres that can be exploited by humans
		4.5	know the similarities and differences between the structures of, the position in the stem, and the function of sclerenchyma fibres (support), xylem vessels (support and transport of water and mineral ions) and phloem (translocation of organic solutes)

UNIT 2, Topic 4 – Plant Structure and Function, Biodiversity and Conservation
May/June exam

Term	Week	Specification reference	Content
2B	**1**	**4.6**	**CORE PRACTICAL 7** **Use a light microscope to:** **(i) make observations, draw and label plan diagrams of transverse sections of roots, stems and leaves** **(ii) make observations, draw and label cells of plant tissues** **(iii)identify sclerenchyma fibres, phloem, sieve tubes and xylem vessels and their location.**
		4.7	understand how the uses of plant fibres and starch may contribute to sustainability, including plant-based products to replace oil-based plastics
		4.8	understand the importance of water and inorganic ions (nitrate, calcium ions and magnesium ions) to plants
		4.9	**CORE PRACTICAL 8 (demo/video)** **Determine the tensile strength of plant fibres.**
	2	**4.11**	know that substances derived from plants can have antimicrobial and other therapeutic properties
		4.10	understand the conditions required for bacterial growth
		4.13	understand the development of drug testing from historic to contemporary protocols, including William Withering's digitalis soup, double blind trials, placebo and three-phased testing

Term	Week	Specification reference	Content
		4.12	**CORE PRACTICAL 9** **Investigate the antimicrobial properties of plants, including aseptic techniques for the safe handling of bacteria.**
	3	**4.14**	(i) understand that classification is a means of organising the variety of life based on relationships between organisms using differences and similarities in phenotypes and in genotypes, and is built around the species concept (ii) understand the process and importance of critical evaluation of new data by the scientific community leading to new taxonomic groupings, based on molecular evidence, including the three-domain system (Archaea, Bacteria and Eukarya)
		4.15	know that, over time, the variety of life has become extensive but is now being threatened by human activity
		4.16	understand what is meant by the terms *biodiversity* and *endemism*
		4.17	know how biodiversity can be measured within a habitat using species richness, and within a species using genetic diversity by calculating the heterozygosity index: $\text{heterozygosity index} = \frac{\text{number of heterozygotes}}{\text{number of individuals in the population}}$
	4	**4.18**	understand how biodiversity can be compared in different habitats using the formula to calculate an index of diversity (D): $D = \Sigma \frac{n(n-1)}{N(N-1)}$
		4.19	understand the concept of niche and be able to discuss examples of adaptations of organisms to their environment (behavioural, anatomical and physiological)

Term	Week	Specification reference	Content
		4.20	(i) understand how the Hardy-Weinberg equation can be used to see whether a change in allele frequency is occurring in a population over time (ii) understand that changes in allele frequency can come about as a result of mutation and natural selection (iii) understand that reproductive isolation can lead to accumulation of different genetic information in populations, potentially leading to the formation of new species
		4.21	be able to evaluate the methods used by zoos and seed banks in the conservation of endangered species and their genetic diversity, including scientific research, captive breeding programmes, reintroduction programmes and education
	5	**Assessment/ Revision**	MOCKS for Unit 2&3
	6	**Assessment/ Revision**	
	7	**Assessment/ Revision**	

Year 12-13 (A2 Year)

Unit 4 wider reading

Topic 5

https://10insightsclimate.science/

https://www.sciencedaily.com/news/earth_climate/climate/

https://www.nature.com/subjects/climate-change

https://www.newscientist.com/article/dn17453-timeline-the-evolution-of-life/

Topic 6

https://www.nature.com/subjects/virology

https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Introductory_Biology_(CK-12)/07%3A_Prokaryotes_and_Viruses/7.08%3A_Virus_Structures

https://virologyresearchservices.com/2022/05/22/enveloped-vs-non-enveloped-viruses/

https://www.woah.org/en/disease/mammalian-tuberculosis/

https://iris.who.int/bitstream/handle/10665/205187/B0007.pdf?

Teaching schedule

UNIT 4, Topic 5 – Energy Flow, Ecosystems and the Environment
January exam

Term	Week	Specification reference	Content
3B	**1**	**5.1**	understand the overall reaction of photosynthesis as requiring energy from light to split apart the strong bonds in water molecules, storing the hydrogen in a fuel (glucose) by combining it with carbon dioxide and releasing oxygen into the atmosphere
		5.2	understand how photophosphorylation of ADP requires energy and that hydrolysis of ATP provides an immediate supply of energy for biological processes
		5.3	understand the light-dependent reactions of photosynthesis, including how light energy is trapped by exciting electrons in chlorophyll and the role of these electrons in generating ATP, reducing NADP in cyclic and non-cyclic photophosphorylation and producing oxygen through photolysis of water
		5.4	(i) understand the light-independent reactions as reduction of carbon dioxide using the products of the light-dependent reactions (carbon fixation in the Calvin cycle, the role of GP, GALP, RuBP and RUBISCO) (ii) know that the products are simple sugars that are used by plants, animals and other organisms in respiration and the synthesis of new biological molecules (polysaccharides, amino acids, proteins, lipids and nucleic acids)
		5.5	understand the structure of chloroplasts in relation to their role in photosynthesis
	2	**5.6**	understand what is meant by the terms *absorption spectrum* and *action spectrum*
		5.7	understand that chloroplast pigments can be separated using chromatography and the pigments identified using Rf values

Term	Week	Specification reference	Content
		5.8	**CORE PRACTICAL 10** **Investigate the effects of light intensity, light wavelength, temperature and availability of carbon dioxide on the rate of photosynthesis using a suitable aquatic plant.**
	3	**5.9**	(i) understand the relationship between gross primary productivity (GPP), net primary productivity (NPP) and plant respiration (R) (ii) be able to calculate net primary productivity
		5.10	know how to calculate the efficiency of biomass and energy transfers between trophic levels
		5.11	understand what is meant by the terms *population*, *community*, *habitat* and *ecosystem*
		5.12	understand that the numbers and distribution of organisms in a habitat are controlled by biotic and abiotic factors
		5.13	understand how the concept of niche accounts for the distribution and abundance of organisms in a habitat
	4	**5.23**	understand how evolution (a change in allele frequency) can come about through gene mutation and natural selection
		5.24	understand how isolation reduces gene flow between populations, leading to allopatric or sympatric speciation
		5.15	understand the stages of succession from colonisation to the formation of a climax community
	5	**Off timetable expected**	

Year 13 (A2 Year)

UNIT 4, Topic 5- Energy Flow, Ecosystems and the Environment, continued + Topic 6 -Microbiology, Immunity and Forensics
January exam

Teaching schedule

Term	Week	Specification reference	Content
1A	**1**	**5.16**	understand the different types of evidence for climate change and its causes, including records of carbon dioxide levels, temperature records, pollen in peat bogs and dendrochronology, recognising correlations and causal relationships
		5.17	understand the causes of anthropogenic climate change, including the role of greenhouse gases in the greenhouse effect
	2	**5.18**	understand how knowledge of the carbon cycle can be applied to methods to reduce atmospheric levels of carbon dioxide
		5.19	(i) understand that data can be extrapolated to make predictions and that these are used in models of future climate change (ii) understand that models for climate change have limitations
		5.20	understand the effects of climate change (changing rainfall patterns and changes in seasonal cycles) on plants and animals (distribution of species, development and lifecycles)
		5.25	understand the way in which scientific conclusions about controversial issues, such as what actions should be taken to reduce climate change, or the degree to which humans are affecting climate change, can sometimes depend on who is reaching the conclusions

Term	Week	Specification reference	Content
	3	5.22	**CORE PRACTICAL 12** **Investigate the effects of temperature on the development of organisms (such as seedling growth rate or brine shrimp hatch rates), taking into account the ethical use of organisms.**
		5.26	understand how reforestation and the use of sustainable resources, including biofuels, are examples of the effective management of the conflict between human needs and conservation
		5.21	understand the effect of temperature on the rate of enzyme activity and its impact on plants, animals and microorganisms, to include Q_{10}
	4	6.1	understand the principles and techniques involved in culturing microorganisms, using aseptic technique
		6.2	understand the different methods of measuring the growth of microorganisms, as illustrated by cell counts, dilution plating, mass and optical methods (turbidity)
		6.3	understand the different phases of a bacterial growth curve (lag phase, exponential phase, stationary phase and death phase) and be able to calculate exponential growth rate constants
		6.4	**CORE PRACTICAL 13** **Investigate the rate of growth of microorganisms in a liquid culture, taking into account the safe and ethical use of organisms.**
	5	6.7	(i) know the major routes pathogens may take when entering the body (ii) understand the role of barriers in protecting the body from infection, including skin, stomach acid, and gut and skin flora
		6.5	(i) be able to compare the structure of bacteria and viruses (nucleic acid, capsid structure and envelope) with reference to Ebola virus, tobacco mosaic virus (TMV), human immunodeficiency virus (HIV) and lambda phage (λ phage) (ii) understand what is meant by the terms *lytic* and *latency*
		6.6	understand how *Mycobacterium tuberculosis* and human immunodeficiency virus (HIV) infect human cells, causing symptoms that may result in death

Term	Week	Specification reference	Content
		6.8	understand the non-specific responses of the body to infection, including inflammation, lysozyme action, interferon and phagocytosis
	6	**Assessment/ Revision**	Students may have resits for other units in the October exam sitting.
	7	**Assessment/ Revision**	Students may have resits for other units in the October exam sitting.

UNIT 4 , Topic 6 – Microbiology, Immunity and Forensics, continued
January exam

Term	Week	Specification reference	Content
1B	**1**	**6.9**	understand the roles of antigens and antibodies in the body's immune response including the involvement of plasma cells, macrophages and antigen-presenting cells
		6.10	understand the differences between the roles of B cells (B memory and B effector cells), and T cells (T helper, T killer and T memory cells) in the host's immune response
	2	**6.11**	understand how individuals may develop immunity (natural, artificial, active and passive)
		6.12	understand how the theory of an 'evolutionary race' between pathogens and their hosts is supported by evasion mechanisms shown by pathogens
		6.13	understand the difference between bacteriostatic and bactericidal antibiotics
		6.15	know how an understanding of the contributory causes of hospital-acquired infections has led to codes of practice regarding antibiotic prescription and hospital practice that relate to infection prevention and control
	3	**6.14**	**CORE PRACTICAL 14** **Investigate the effect of different antibiotics on bacteria.**
		6.16	know the role of microorganisms in the decomposition of organic matter and the recycling of carbon
		6.17	know how DNA can be amplified using the polymerase chain reaction (PCR)
	4	**6.18**	know how gel electrophoresis can be used to separate DNA fragments of different length

Term	Week	Specification reference	Content
		6.19	understand how DNA profiling is used for identification and determining genetic relationships between organisms (plants and animals)
		6.20	understand how to determine the time of death of a mammal by examining the extent of decomposition, stage of succession, forensic entomology, body temperature and degree of muscle contraction
	5	**Assessment/ revision**	Preparation for Unit 4 January exam.
	6	**Assessment/ revision**	Preparation for Unit 4 January exam.
	7	**Assessment/ revision**	Preparation for Unit 4 January exam.

UNIT 5, Topic 7 – Respiration, Muscles and the Internal Environment
June exam

Unit 5 wider reading

Topic 7

https://www.nature.com/subjects/transcription-factors#:~:text=Latest%20Research%20and%20Reviews&text=Transcription%20factor%20(TF)%20condensation%20may,dictate%20the%20resultant%20condensate%20morphology.

https://www.savemyexams.com/a-level/biology/ocr/17/revision-notes/5-communication-homeostasis-and-energy/5-2-excretion/5-2-9-kidney-failure/

Topic 8

https://www.nhs.uk/conditions/parkinsons-disease/treatment/

https://www.healthline.com/health/ms/parkinsons-vs-ms

https://www.radiologymasterclass.co.uk/tutorials/mri/mri_system

https://www.genome.gov/genetics-glossary/Bioinformatics#:~:text=Bioinformatics%2C%20as%20related%20to%20genetics,or%20annotations%20about%20those%20sequences.

Teaching schedule

Term	Week	Specification reference	Content
2A	**1**	**7.1**	(i) understand the overall reaction of aerobic respiration as splitting of the respiratory substrate to release carbon dioxide as a waste product and reuniting hydrogen with atmospheric oxygen with the release of large amounts of energy (ii) understand that respiration is a stepped process, with each step controlled and catalysed by a specific intracellular enzyme *Names of specific enzymes are not required.*
		7.2	understand the roles of glycolysis in aerobic and anaerobic respiration, including the phosphorylation of hexoses, the production of ATP by substrate level phosphorylation, reduced coenzyme, pyruvate and lactate *Details of intermediate stages and compounds are not required.*
		7.3	understand the role of the link reaction and the Krebs cycle in the complete oxidation of glucose and formation of carbon dioxide (CO_2) by decarboxylation, ATP by substrate level phosphorylation, reduced NAD and reduced FAD by dehydrogenation (names of other compounds are not required) and that these steps take place in mitochondria, unlike glycolysis which occurs in the cytoplasm
		7.4	understand how ATP is synthesised by oxidative phosphorylation associated with the electron transport chain in mitochondria, including the role of chemiosmosis and ATP synthase
	2	**7.5**	understand what happens to lactate after a period of anaerobic respiration in animals
		7.6	understand what is meant by the term *respiratory quotient* (*RQ*)
		7.7	**CORE PRACTICAL 15** **Use an artificial hydrogen carrier (redox indicator) to investigate respiration in yeast.**

Term	Week	Specification reference	Content
		7.8	**CORE PRACTICAL 16** **Use a simple respirometer to determine the rate of respiration and RQ of a suitable material (such as germinating seeds or small invertebrates).**
	3	**7.9**	know the way in which muscles, tendons, the skeleton and ligaments interact to enable movement, including antagonistic muscle pairs, extensors and flexors
		7.10	(i) know the structure of a mammalian skeletal muscle fibre (ii) understand the structural and physiological differences between fast and slow twitch muscle fibres
		7.11	understand the process of contraction of skeletal muscle in terms of the sliding filament theory, including the role of actin, myosin, troponin, tropomyosin, calcium ions (Ca^{2+}), ATP and ATPase
	4	**7.12**	(i) know the myogenic nature of cardiac muscle (ii) understand how the normal electrical activity of the heart coordinates the heartbeat, including the roles of the sinoatrial node (SAN), the atrioventricular node (AVN), the bundle of His and the Purkyne fibres (iii) understand how the use of electrocardiograms (ECGs) can aid in the diagnosis of abnormal heart rhythms
		7.13	(i) be able to calculate cardiac output (ii) understand how variations in ventilation and cardiac output enable rapid delivery of oxygen to tissues and the removal of carbon dioxide from them, including how the heart rate and ventilation rate are controlled and the roles of the cardiovascular control centre and the ventilation centre in the medulla oblongata
		7.14	understand the role of adrenaline in the fight or flight response
	5	**7.15**	**CORE PRACTICAL 17** **Investigate the effects of exercise on tidal volume, breathing rate, respiratory minute ventilation, and oxygen consumption using data from spirometer traces.**

Term	Week	Specification reference	Content
		7.16	(i) understand what is meant by the terms *negative feedback* and *positive feedback control* (ii) understand the principle of negative feedback in maintaining systems within narrow limits
		7.17	understand what is meant by the term *homeostasis* and its importance in maintaining the body in a state of dynamic equilibrium during exercise, including the role of the hypothalamus in thermoregulation
		7.18	know the gross and microscopic structure of the mammalian kidney
	6	**7.19**	understand how urea is produced in the liver from excess amino acids (*details of the ornithine cycle are not required*) and how it is removed from the bloodstream by ultrafiltration
		7.20	understand how solutes are selectively reabsorbed in the proximal tubule and how the loop of Henle acts as a countercurrent multiplier to increase the reabsorption of water
	7	**7.21**	understand how the pituitary gland and osmoreceptors in the hypothalamus, combined with the action of antidiuretic hormone (ADH), bring about negative feedback control of mammalian plasma concentration and blood volume
		7.22	understand how genes can be switched on and off by DNA transcription factors, including the role of peptide hormones acting extracellularly and steroid hormones acting intracellularly

UNIT 5, Topic 8 – Coordination, Response and Gene Technology

Term	Week	Specification reference	Content
2B	**1**	**8.1**	know the structure and function of sensory, relay and motor neurones, including Schwann cells and myelination
		8.2	understand how the nervous system of organisms can cause effectors to respond to a stimulus
		8.3	know the structure and function of a spinal reflex arc, including grey matter and white matter of the spinal cord
		8.4	understand how a nerve impulse (action potential) is conducted along an axon, including changes in membrane permeability to sodium and potassium ions
		8.5	understand the role of myelination in saltatory conduction
		8.6	(i) know the structure and function of synapses in nerve impulse transmission, including the role of neurotransmitters and acetylcholine (ii) understand how the pupil dilates and contracts
	2	**8.7**	understand how the effects of drugs can be caused by their influence on nerve impulse transmission, illustrated by nicotine, lidocaine and cobra venom alpha toxin, the use of L-DOPA in the treatment of Parkinson's disease and the action of MDMA (ecstasy)
		8.8	understand how the nervous systems of organisms can detect stimuli with reference to rods in the retina of mammals, the roles of rhodopsin, opsin, retinal, sodium ions, cation channels and hyperpolarisation of rod cells in forming action potentials in the optic neurones
		8.9	understand what is meant by the term *habituation*
	4	**8.10**	know that the mammalian nervous system consists of the central and peripheral nervous systems

Term	Week	Specification reference	Content
		8.11	understand how phytochrome, auxin (IAA) and gibberellins bring about responses in plants, including their effects on transcription
		8.12	**CORE PRACTICAL 18** **Investigate the production of amylase in germinating cereal grains.**
	5	**8.13**	understand how coordination in animals is brought about through nervous and hormonal control
		8.14	know the location and main functions of the cerebral hemispheres, hypothalamus, pituitary gland, cerebellum and medulla oblongata of the human brain
		8.15	understand how magnetic resonance imaging (MRI), functional magnetic resonance imaging (fMRI), positron emission tomography (PET) and computed tomography (CT) are used in medical diagnosis and the investigation of brain structure and function
		8.16	understand how imbalances in certain naturally-occurring brain chemicals can contribute to ill health, including dopamine in Parkinson's disease and serotonin in depression, and to the development of new drugs
	6	**8.17**	know how drugs can be produced using genetically modified organisms (plants, animals and microorganisms)
		8.18	understand how recombinant DNA can be produced, including the roles of restriction endonucleases and DNA ligase
		8.19	understand how recombinant DNA can be inserted into other cells
	7	**8.20**	know how microarrays can be used to identify active genes
		8.21	understand what is meant by the term *bioinformatics*
		8.22	understand the risks and benefits associated with the use of genetically modified organisms

Term	Week	Specification reference	Content
3A	**1-7**		**Preparation for May/June exams**