BIOLOGY CURRICULUM JOURNEY

Together we belong, develop character and achieve excellence.

Curriculum overview

Our Biology curriculum develops pupils' understanding of living organisms and the interactions between organisms and their environment. It moves from the foundations of cells, organisation and health through increasingly demanding study of inheritance, ecosystems, homeostasis, energy transfer and the molecular basis of life. Across the curriculum, pupils learn to connect structure with function, explain biological processes using evidence, apply mathematical thinking and evaluate the impact of biology on health, society and the natural world.

BUILDING ON KEY STAGE 2 SCIENCE

Pupils arrive with foundations in:

- Living things: classification, habitats, food chains, life cycles, adaptation, variation, inheritance and evolution.
- Plants and animals: the requirements for life and growth, nutrition, skeletons and muscles, digestion, circulation and the impact of diet, exercise, drugs and lifestyle.
- Biological processes: reproduction in plants and animals, transport within plants and animals, and how organisms are suited to their environments.
- Working scientifically: planning enquiries, controlling variables, taking increasingly accurate measurements, recording data in tables and graphs, drawing conclusions, making predictions and using evidence to support or refute ideas.

How the curriculum builds from these foundations

Key Stage 3	Key Stage 4	Key Stage 5
Pupils move from observable features of organisms to cells, tissues, organs and systems. They deepen their understanding of digestion, gas exchange, reproduction, photosynthesis, respiration, ecosystems and inheritance, while using more precise scientific vocabulary and laboratory methods.	Pupils develop secure explanations at cellular and molecular level. They study cell biology, organisation, infection and response, bioenergetics, homeostasis, inheritance, variation, evolution and ecology, alongside increasingly rigorous practical, mathematical and evaluative work.	Pupils study biological molecules, cells, exchange, genetics, populations, evolution, ecosystems and energy transfer in greater depth. They integrate ideas across topics, analyse complex data and apply biological knowledge to unfamiliar contexts.

Each semester deliberately revisits and extends prior knowledge so that pupils make connections, address misconceptions and build a secure understanding of Biology over time.

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Year	Semester	Scheme of Learning	Powerful Knowledge / Threshold Concept links	Composites and their components	End Points	Word Revolution
7	1	Cell Biology	Animal, plant, specialised cells. – Fundamental principle of Biology – needed for all future concepts. Students will learn how organisms are made up of organ systems (link to KS2) organs (link to KS2) tissues and cells. To label and give the function of each part of the cell. To describe how specialised cells are adapted to suit their function.	**Composite- Describe the structure of plant and animal cells.** Component- Label a plant and animal cell. Component- State the function of each organelle. Component- Group cells, tissues, organs, organ systems. Component- Name and give the function of the major organs and organ systems.	End of topic test after Cell Biology- focussing on the composites and components. Other assessed points for Cell Biology- • Set up and use a microscope correctly. • Observe cellular structures under the microscope and draw diagrams of these structures. • Organ donations- describe the moral, economic and social factors influencing decision making.	Cell membrane, cell wall, chloroplast, cytoplasm, mitochondria, nucleus, vacuole, ribosome, tissue.
		Ecology	Food chains and webs – linked to KS2. Limited terminology needed for students, allows prior knowledge from KS2 to be used as a good starting point. Adaptations and predator-prey cycles- next logical step from KS2 content- linking food chains and webs to how organisms are adapted to catching their prey/not getting caught.	**Composite- Describe and explain the components of food chains and webs.** Component- Describe how organisms are adapted to catch prey/avoid predation. Component- Describe how and explain why food chains and webs can be disrupted. Component- Describe how build up of toxic material affects the food chain.	End of topic test after Ecology- focussing on the composites and components. Other assessed points for Ecology- • Analyse predator-prey cycles, predict population changes. • Describe how habitat destruction and extinction change the food web and limit food for other organisms.	Adaptation, predator, prey, primary consumer, producer, secondary consumer, tertiary consumer.
7	2	Infection & Response	COVID data project Purpose- to introduce the concept of pathogens- how they can enter the body/how they can harm the body and the defence mechanisms our body uses.	**Composite- Describe how a pathogen causes disease.** Component- State, using examples, how different diseases are transmitted. Component- Describe our bodies defence mechanisms.	No end of topic test for Infection & Response. There will be a literacy task and a data analysis task following a practical. These will focus on the composite and components. Other skills assessed include- • Reading website and newspaper articles to extract important information/data. • Suggest how the government could learn from COVID to prepare for another epidemic. • Analyse graphs to spot correlations.	Antibody, bacteria, communicable disease, pathogen, virus
		Organisation	Describe the process of reproduction in humans. Describe the development of the foetus. Linked to specialised cells (sperm and egg) taught in previous topic.	**Composite- State the structure and function of male and female reproductive systems.**		Fertilisation, zygote, menstrual cycle, ovulation, sperm, egg, foetus, embryo.

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			Start with life cycles- frog and butterfly (KS2 content) link to human life cycle. Focus on how the sperm is adapted to reach the egg. Links with KS4. Hinterland- Keeping healthy during pregnancy- focus on how drugs/smoking/alcohol can affect the foetus- opportunity for data analysis.	Component- Describe the process of fertilisation. Component- Describe the adaptations of the sperm and egg and explain how they increase the chances of fertilisation. Component- Describe the development of the foetus. Component- State the 4 stages of the menstrual cycle.	End of topic test after Organisation- focussing on the composites and components. Other assessed points for Organisation- • Data analysis- correlation/causation between smoking and miscarriage. • Describe how a female can change her lifestyle to keep healthy during pregnancy.	
8	**1**	Cell Biology	Revisit Y7 plant, animal and specialised cells- label and give function of. Introduce unicellular structures- bacteria- compare with plant and animal cells. Introduce diffusion (will have studied this in chemistry in year 7) Define diffusion and give examples of where diffusion occurs in the body. This concept is vital to cover before moving on to digestion and breathing- where diffusion underlies the whole method of exchange.	**Composite- Describe how specialised cells are adapted to suit their function.** Component- Label and state the function of an animal and plant cell. Component- Label and state the function of a bacterial cell. Component- Define diffusion and give examples of where diffusion occurs in the body. Component- Compare and contrast animal, plant and bacterial cells.	End of topic test after Cell Biology- focussing on the composites and components. Other assessed points for Cell Biology- 1. Give examples where diffusion takes place in animals, plants and bacteria.	Cell membrane, cell wall, chloroplast, cytoplasm, diffusion, mitochondria, nucleus, vacuole, ribosome.
		Organisation	Digestion- to label and give the function of organs in the digestive system- links to Y7 hierarchy. Hinterland- Balanced Diet- design a 3 course meal that covers all of the main food groups. Research deficiency diseases- kwashiorkor, night blindness, scurvy, rickets. Breathing- to describe the process of breathing and explain how the lungs are adapted for gas exchange. Hinterland- effects of smoking/vaping on the lungs and gas exchange. Respiration- follows on from	**Composite- Label and give the function of organs in the digestive system.** Component- To give the function, with examples of food, in the different food groups. Component- To describe the aspects of a balanced diet. Component- To describe the process of breathing and explain how the lungs are adapted for gas exchange.	End of topic test after Organisation- focussing on the composites and components. Other assessed points for Organisation- 1. Evaluate models of the digestive system. 2. Describe how named deficiency diseases affect the body.	Alveoli, amino acid, diffusion, enzyme, excretion, carbohydrase, lipase, protease. Aerobic Respiration, anaerobic respiration, chloroplast, mitochondria, oxygen debt,

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		Bioenergetics	breathing topic- huge misconception- breathing and respiration are not the same. To state the equations for aerobic and anaerobic respiration. To explain how we get the reactants into our body (breathing/eating- links with topic above) and what we do with the products. To explain how our body changes during exercise to cope with increased energy demand. Photosynthesis- to describe the process of photosynthesis. To describe how the leaf is adapted to maximise the rate of photosynthesis and to explain why plants need to make their own glucose.	**Composite- State the equations for aerobic and anaerobic respiration and photosynthesis.** Component- Explain how our body is adapted to maximise the rate of respiration. Component- Explain how a plant is adapted to maximise the rate of photosynthesis.	3. Describe the effects of smoking/vaping on the lungs and gas exchange. End of topic test after Bioenergetics- focussing on the composites and components. Other assessed points for Bioenergetics- 4. Analyse graphs to describe how our heart and breathing rate change during exercise. 5. Plan and carry out an experiment to measure seed dispersal. 6. Design a greenhouse to produce a high yield of produce.	photosynthesis.
8	**2**	Homeostasis & Response	Reaction Speed Project- To plan and carry out an experiment to test individual reaction times. To explain how external factors affect reaction times. Linked to physics and levers – this looks at the skeleton and muscles. Not needed for KS4 but on the KS3 NC. Skills- planning an experiment, graph plotting, evaluating an experiment, data analysis of secondary sources. Literacy- comprehension- how fitness affects athlete's reaction time. Introduce the concept of DNA and its structure. Link back to cells.	**Composite- Describe how a nervous impulse is transmitted.** Component- Explain how external factors affect reaction times. Component- Plan and carry out an experiment to test individual reaction times.	No end of topic test for Homeostasis & Response. There will be a literacy task and a data analysis task following a practical. These will focus on the composite and components. Other skills assessed include- 1. Displaying results using appropriate tables and graphs. 2. Evaluating the experiment with a focus on how to improve reliability and repeatability. 3. Analysis of secondary sources. 4. explain how	Central Nervous System, effector, neurone, receptor, reflex DNA, Evolution, extinction, mutation, natural selection, species, variation.

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Year	Semester	Scheme of Learning	Powerful Knowledge / Threshold Concept links	Composites and their components	End Points	Word Revolution
		Variation, Evolution & Inheritance	Describe variation within species as a result of genetic changes and environmental changes. Describe the theory of natural selection. Explain how Darwin came up with his theory. Compare with Lamarck's theory. Hinterland- extinction and preserving species- look at how climate change and human destruction of habitats has led to the extinction of many species in recent year. Research the ways in which humans are trying to preserve endangered species.	**Composite- Explain why organisms show variation.** Component- Describe the theory of natural selection. Component- State the structure of DNA. Component- Give examples of environmental and genetic variation. Component- Describe the ways humans are trying to preserve endangered species.	drinking, drugs and tiredness affects driver's reaction time and stopping/braking distance. End of topic test after Variation, Evolution & Inheritance- focussing on the composites and components. Other assessed points for Variation, Evolution & Inheritance- 2. Display continuous and discontinuous data correctly. 3. Explain why people thought Darwin's theory of natural selection was incorrect.	
9	**1**	Cell Biology	Revisit Animal and Plant Cells. Label and give function of. Introduce Eukaryotes & Prokaryotes. State the differences between the two. Revisit specialised cells as a basis to introduce the term differentiation. Describe how stem cells can differentiate into any type of cell. Hinterland- evaluate using stem cells in a medical context. Microscopes Required Practical- revisit Y7 (setup and focus a microscope) then introduce magnification calculations. Cell Organisation- build on knowledge in year 7- cells-tissues-organs-organ systems. Describe how the 3 tissues inside the stomach allow the	**Composite- State the differences between eukaryotes and prokaryotes.** Component- Label a prokaryote and eukaryote. Component- State the function of each organelle in a prokaryote and eukaryote. Component- To define the term differentiation. Component- Describe how stem cells differentiate.	End of topic test after Cell Biology- focussing on the composites and components. Other assessed points for Cell Biology- Microscopy Required Practical- Describe how to set up a microscope, calculate magnification and convert units.	Cell membrane, cell wall, cellulose, chlorophyll, chloroplast, cytoplasm, differentiation, DNA, eukaryotic cell, mitochondria, nucleus, prokaryotic cell, vacuole, ribosome. Amino acid, capillary, carbohydrase, catalyst, diffusion, enzyme, lipase, protease,

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		Organisation	organ to carry out its function. Enzymes & Digestion- revisit Y8- label and function of digestive organs. Introduce enzymes as a molecule that speeds up the breakdown of food. Food Tests- Required Practical- skills- state the chemicals used and describe the procedure for food testing.	**Composite- Explain the role of enzymes in the digestive system.** Component- To label and give the functions of each digestive organ. Component- Describe how an organism is organised using examples.	End of topic test after Organisation- focussing on the composites and components. Other assessed points for Organisation- Required Practical- Food Tests- Follow a standard procedure, record observations.	Antibody, antigen, antitoxin, bacteria, communicable disease, non-communicable disease, pathogen, phagocytosis, protist, toxin, virus.
		Infection & Response	Revisit Y7- describe how pathogens spread disease. Describe how our body defends itself against disease. Communicable Disease split into 4 categories Viral & Fungal Disease, Protist & Bacterial Disease- state the symptoms and treatments of 8 diseases.	**Composite- Describe how our body defends itself against disease.** Component- Describe the methods pathogens spread disease. Component- State the symptoms and treatments of 8 diseases.	End of topic test after Infection & Response- focussing on the composites and components. Other assessed points for Infection & Response- 4. Data Handling- calculating population size and percentage of affected organisms.	Aerobic respiration, anaerobic respiration, metabolism, mitochondria, exothermic reaction
		Bioenergetics	Revisit Y8- Respiration- state the equation, describe the process and explain it's importance in the body. Introduce metabolism- state the definition for metabolism, describe how metabolism might be different in different people/animals.	**Composite- State the equation for aerobic and anaerobic respiration.** Component- Describe the process of aerobic respiration and explain why it is important. Component- Describe the process of anaerobic respiration in humans and in yeast and explain their importance. Component- State how humans use fermentation. Component- Define metabolism.	End of topic test after Bioenergetics- focussing on the composites and components. Other assessed points for Bioenergetics- 5. Skills- Plotting graphs, analysing data.	

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9	2	Homeostasis & Response	Nervous System- describe how a nerve cell is adapted to carry out its function (revisit specialised cells) Describe how a Reflex response is carried out. Reaction Time R.P- revisit Y8 project- carry out the investigation, suggest improvements/alternative methods to measure an individuals reaction time.	**Composite- Describe how a reflex action occurs.** Component- Describe how a nerve cell is adapted for its function.	End of topic test after Homeostasis & Response- focussing on the composites and components. Other assessed points for Homeostasis & Response- Evaluating methods- Reaction Time Required Practical Explain how caffeine, alcohol and sugar may change an individual's reaction time.	Central nervous system, co-ordination centre, effector, motor neurone, receptor, reflex, relay neurone, sensory neurone. Binomial system, DNA, evolution, extinction, family tree, fossil, fossil record, mutation, natural selection, species.
		Variation, Evolution & Inheritance	DNA & Variation- revisit Y8- state where DNA is found, describe how genetic and environmental factors fuel variation in species. Evolution & Selective Breeding- revisit Y8- Describe the stages of the theory of natural selection. Introduce the stages of variation/mutation, successful alleles, reproduction. Introduce Fossils & Classification as evidence for evolution. Describe the 3 ways in which fossils are made. Use pedigree charts to classify organisms and give their binomial names.	**Composite- Describe the stages of natural selection.** Component- describe how genetic and environmental factors affecting variation. Component- Describe how fossils are formed.	End of topic test after Variation, Evolution & Inheritance- focussing on the composites and components. Other assessed points for Variation, Evolution & Inheritance- Use pedigree charts to classify organisms.	Abiotic factor, adaptation, biotic factor, community, ecosystem, habitat.
		Ecology	Revisit- Adaptations & Food Chains from Y7. Describe how animals and plants are adapted to survive. Explain how adaptations help a species to survive. Introduce Competition- Describe how biotic and abiotic factors influence where an animal/plant will be most successful. Skills- interpret a food web and explain what would happen to other organisms if a certain species went extinct or had a population increase.	**Composite- Explain how adaptations in plants and animals increase their chances of survival.** Component- Define, and give examples of, biotic and abiotic factors. Component- Explain how biotic and abiotic factors affect the chances of an organism's survival.	End of topic test after Ecology- focussing on the composites and components. Other assessed points for Ecology- Interpret food webs. Suggest how populations would be affected if other organisms' populations changed in size.	

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10	1	Cell Biology	Introduce the concept of diffusion, osmosis and active transport based on students' prior knowledge that substances move into and out of cells. State the definition of each process. Compare each process and apply the theory to the lungs, small intestine, leaf, fish and insects. Osmosis Required Practical- identify the variables, carry out the practical using a method and evaluate the results. Apply the theory of osmosis to the results and explain why the potato lost or gained mass.	**Composite- Describe the processes of diffusion, osmosis and active transport.** Component- Compare and contrast each process. Component- Apply the processes to exchange of substances in the lungs, small intestine, leaf, fish and insects.	End of topic test after Cell Biology- focussing on the composites and components. Other assessed points for Cell Biology- Required Practical- Osmosis- Identifying variables. Follow a standard procedure. Evaluate the method and results.	Active transport, cell membrane, cytoplasm, diffusion, osmosis, partially permeable membrane, respiration.
		Organisation	The Lungs & Heart- revisit Y8 knowledge then introduce Blood Vessels, Blood and Cardiovascular Disease. Students need to state the function of the 4 components of blood, describe how the three blood vessels are adapted to suit their function and state the factors that increase the risk of CVD, the symptoms of CVD and how doctors treat CVD.	**Composite- Describe the differences between the 3 blood vessels.** Component- Describe the function of the 4 components of blood. Component- Describe the symptoms and treatment for Cardiovascular Disease.	End of topic test after Organisation- focussing on the composites and components. Other assessed points for Organisation- Data Analysis, correlation/causation- Risk factors for Non Communicable disease and Cancer.	Artery, capillary, cardiovascular disease (CVD) coronary artery, coronary heart disease (CHD) haemoglobin, obesity, plasma, platelet, statins, stent, valve, vein, white blood cell
		Infection & Response	Revisit Y9- Describing the symptoms and treatment for 8 diseases and defining the terms bacteria, virus, protist and fungus. Introduce vaccination- explain how vaccines work and lower the infection rates. Developing drugs- explain the 4 stages of drug development.	**Composite- Explain how vaccines lead to immunity.** Component- Describe the stages of drug development and why each stage is important.	End of topic test after Infection & Response- focussing on the composites and components. Other assessed points for Infection & Response- Compare primary and secondary responses. Evaluate the ethics behind drug development.	Antibody, clinical trial, double blind trial, optimum dose, peer review, placebo, toxicity, vaccination.
		Bioenergetics	Revisit Y7&8 Photosynthesis- equation, describe how plants get the raw materials and how they use the products. State the 5 uses of glucose. Explore the concept of Rate of Photosynthesis (/time) Interpret results from a graph. Revisit unit conversions- hours/mins/secs/ms Describe the ideal conditions for photosynthesis- link to farmers-		End of topic test after Bioenergetics- focussing on the composites and components.	Chlorophyll, chloroplasts, endothermic reaction, stoma, xylem

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			how do they maximise their yield? Photosynthesis R.P- follow a method, identify variables, risk assessment, interpret results and explain why the rate of photosynthesis increased. Modify the experiment so we can measure how other factors affect photosynthesis.	**Composite- State the photosynthesis equation.** Component- Describe how plants obtain the reactants for photosynthesis. Component- Describe the ideal conditions for photosynthesis. Component- State the uses of glucose. Component- Calculate rate of photosynthesis.	Other assessed points for Bioenergetics- Describe the standard procedure for the Photosynthesis Required Practical. Identify variables and produce a risk assessment for the Photosynthesis Required Practical. Explain how to modify the Photosynthesis Required Practical to measure other factors affecting photosynthesis. Converting Units.	
10	**2**	Homeostasis & Response	New- The Endocrine System. Label the glands on the body, describe the function of each gland- what hormone does it release? What is the job of that hormone? Revisit Y9 nervous system & compare with Hormones. Introduce Controlling Blood Glucose & Diabetes as a simple negative feedback loop. Describe how the body responds to an increase in blood glucose and a decrease in blood glucose. State the symptoms of diabetes and describe how it can be treated. Compare Type I & II.	**Composite- Label each gland in the endocrine system and give their function.** Component- Compare nerves and hormones. Component- Describe the action of insulin and glucagon. Component- State the symptoms of diabetes and describe treatments.	End of topic test after Homeostasis & Response- focussing on the composites and components. Other assessed points for Homeostasis & Response- Revisit Y9- Structure of Nerves	Diabetes, gland, glucagon, glycogen, hormone, insulin, optimum level,
		Variation, Evolution & Inheritance	Sexual & Asexual Reproduction. Describe how each one works and state the differences. X & Y Chromosomes- links with Y9 Inheritance- variation. Complete a punnett square to prove the chance of being male or female is 50:50.	**Composite- Describe the processes of sexual and asexual reproduction.** Component- Describe how sex is inherited.	End of topic test after Variation, Evolution & Inheritance- focussing on the composites and components. Other assessed points for Variation, Evolution & Inheritance- Complete punnett squares. Use Genetic Diagrams to identify who gets the Inherited Disorders.	Allele, asexual reproduction, chromosome, dominant allele, fertilisation, gamete, heterozygous, homozygous, meiosis, sex chromosomes, sexual reproduction.
		Ecology	New- Using Quadrats & Quadrats Required Practical. Describe how to use quadrats to estimate the population of a species. Revisit Y7- Environmental Change & Global Warming- a			Biodiversity, deforestation, distribution, global warming, quadrat, transect,

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			topic covered across all 3 strands of Science. State how humans are destroying habitats through deforestation. Describe how burning fossil fuels and peat big destruction causes global warming. Introduce The Water Cycle & The Carbon Cycle. Describe the stages of both of the cycles. 6 mark/extended answer practice.	**Composite- Describe and explain how to carry out random and systematic sampling.** Component- Describe how to use quadrats to estimate the population of a species. Component- Describe and explain how human activity impacts on the environment. Component- Describe the stages of the carbon and water cycle.	End of topic test after Ecology- focussing on the composites and components. Other assessed points for Ecology- Calculating mean/area/estimating numbers. Explain random sampling. Writing a method. Graph analysis. Identifying correlation.	
11	**1**	Cell Biology	Revisit- Y9 Eukaryote/Prokaryote, Microscopes Required Practical- skills- calculating magnification, converting units. Revisit Y10- Diffusion/Osmosis/Active Transport, Osmosis Required Practical- skills linking the movement of particles to the cell's activity. Stating variables, describing how to control variables. Calculating % change and plotting results on a graph. Describing how to modify/improve the practical. Introduce Stem Cells- builds on student's knowledge of differentiation and specialized cells. Introduce Chromosomes/Cell Cycle/Mitosis- explain how a cell replicates.	**Composite- Describe what happens in the 3 stages of the cell cycle.** Component- State the difference between embryonic and adult stem cells. Component- Describe how stem cells are used to treat disorders. Component- Explain how a cell replicates.	End of topic test after Cell Biology- focussing on the composites and components. Other assessed points for Cell Biology- Evaluate the moral/social implications of using stem cells. Calculate magnification. Convert units. Calculate percentage change. Revisit Y10- Osmosis Required Practical.	Asexual reproduction, binary fission, chromosome, differentiation, DNA, fertilisation, gamete, mitosis, stem cells.
		Organisation	Revisit Y9- Digestion & Enzymes, Enzymes Required Practical. To describe how an enzyme catalyses the breakdown of molecules. Skills- to follow a standard procedure. To modify the practical to investigate how pH, temperature and concentration	**Composite- State the factors affecting the rate of**	End of topic test after Organisation- focussing on the composites and components. Other assessed points for Organisation-	Amino acid, carbohydrase, catalyst, diffusion, enzyme, guard cell, lipase, phloem, photosynthesis, protease, stoma, translocation, transpiration stream, xylem.

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			affects rate of enzyme action. Revisit Y10- Heart, Health & Disease. Skills- data handling- describe and explain graphs displaying info regarding health statistics over a number of years. To define correlation and causation and give the differences between the two. Introduce Plant Cell Organisation- parts of a plant (covered in Y8) should be revisited along with how a leaf is adapted for photosynthesis. Transpiration & Translocation and Rate of Transpiration- describe how water and sugars are transported around the plant. Explain how the xylem and phloem are adapted for this transport. Skills- data handling/calculating the rate of transpiration.	**transpiration.** Component- State the differences between transpiration and translocation. Component- Describe the function of the components of the leaf. Component- Describe how a leaf is adapted for photosynthesis.	How to measure rate of transpiration using a potometer. Revisit Year 9- Enzymes Required Practical- Link the practical to the lock and key theory and factors affecting enzyme action. Describe a method to investigate how concentration, temperature or pH affects enzyme action. Revisit Year 10- describe and explain graphs displaying info regarding health statistics over a number of years. Revisit Year 10- To define correlation and causation and give the differences between the two.	Antibiotic, antibiotic resistance, antibody, antigen, antitoxin, pathogen, phagocytosis, vector.
		Infection & Response	Revisit Y9- Communicable Disease, Preventing Disease- name the 8 diseases, state the symptoms and treatment. Revisit Y10- Fighting Disease & Vaccination, Developing Drugs- Describe how our white blood cells respond to infection, explain how vaccinations build up immunity and describe the stages of drug development.	**Composite- Describe how white blood cells respond to infection.** Component- Explain how vaccinations build up immunity. Component- Describe the stages of drug development.	End of topic test after Infection & Response- focussing on the composites and components. Other assessed points for Infection & Response- Revisit Y9- name the 8 diseases, state the symptoms and treatment. Revisit Y10- Describe how our white blood cells respond to infection	Aerobic respiration, anaerobic respiration, chlorophyll, chloroplast, fermentation, limiting factor, translocation, transpiration.
		Bioenergetics	Revisit Y9- Respiration- state the equation, explain the changes that occur during exercise. Skills- calculate rate of respiration. Recap Y10- Photosynthesis Required Practical- state the equation, describe how the raw materials needed for photosynthesis are transported (links with Y11 organisation) Explain limiting factors graphs. Skills- follow a standard procedure, calculate the rate of photosynthesis, evaluate the procedure, identify how the practical could be improved and		End of topic test after Bioenergetics- focussing on the composites and components. Other assessed points for Bioenergetics-	

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			describe how you could modify the procedure to investigate how CO2 concentration and temperature affect the rate of photosynthesis.	**Composite- State the equation for aerobic and anaerobic respiration and photosynthesis.** Component- Explain how limiting factors affect the rate of photosynthesis.	Calculate rate of respiration/photosynthesis. Describe and explain the changes that occur during exercise. Required Practical- Photosynthesis- Follow a standard procedure. Evaluate a method. Revisit Y10- describe how the raw materials needed for photosynthesis are transported. Revisit Y10- Explain limiting factors graphs.	
11	**2**	Homeostasis & Response	Revisit Y9- Nervous System, Reaction Time Required Practical. To describe how electrical impulses are generated and lead to a response to a stimulus. Skills- Explain how the practical could be modified/improved to investigate how caffeine, alcohol, drugs affect reaction times. Revisit Y10- Endocrine System, Blood Glucose & Diabetes. Label and give the function of each gland and the hormone it secretes. Describe the negative feedback loop of glucoregulation. Describe how diabetic people are treated and apply this to the negative feedback loop. Higher only- Introduce Puberty & The Menstrual Cycle now hormone knowledge is embedded. Explain how oestrogen, progesterone, LH and FSH work to release an egg. Controlling Fertility- link hormones to contraception. Evaluate each method of contraception. Adrenaline & Thyroxine- build up complexity of negative feedback loop. Describe how adrenaline and thyroxine secretion affect body processes. Revisit Y9- DNA- label the different components, state that DNA makes up a gene, which makes up a chromosome, 23 pairs of chromosomes are found in the nucleus of each human	**Composite- Explain how hormones regulate blood glucose.** Component- Explain how hormones work in the menstrual cycle. Component- Describe how barrier and chemical contraceptives work. Component-Describe how adrenaline and thyroxine affect body processes.	End of topic test after Homeostasis and Response- focussing on the composites and components. Other assessed points for Homeostasis and Response- Explain how the Required Practical- Reaction Times could be modified to increase accuracy/precision. Evaluate contraceptive devices. Revisit Y9- describe how electrical impulses are generated and lead to a response to a stimulus. Revisit Y10- Label and give the function of each gland and the hormone it secretes. Revisit Y10- Describe the negative feedback loop of glucoregulation.	Contraceptive, fertility, hormone, IVF, menstrual cycle, negative feedback, glucagon, glycogen, insulin. Allele, asexual reproduction, sexual reproduction,

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		Variation, Evolution & Inheritance	body cell. Revisit Y10- Sexual & Asexual Reproduction. State sperm and egg cells are haploid (23 chromosomes) Describe the process of fertilisation. Introduce Meiosis- describe how sexual reproduction promotes variation. State the differences between sexual and asexual reproduction. Revisit Y10- Genetic Diagrams- complete punnett squares to identify the chances of inheriting a disorder. Revisit Y9- Variation & Evolution- Describe environmental and genetic variation in individuals. Introduce Genetic Engineering building on knowledge using genetic diagrams, variation and evolution.	**Composite-Label a DNA molecule.** Components- State the differences between sexual and asexual reproduction. Components- Explain how variation occurs in organisms using the theory of natural selection. Components- Describe how genetic engineering works as a method for creating useful substances.	End of topic test after Variation, Evolution and Inheritance- focussing on the composites and components. Other assessed points for Variation, Evolution and Inheritance- Using punnett squares to work out the chance of inheriting given alleles Revisit Y9- DNA- label the different components. Revisit Y10- Describe the process of fertilisation. Revisit Y10- Explain how variation occurs in organisms using the theory of natural selection.	chromosome, cystic fibrosis, DNA, dominant allele. fertilisation, gamete, gene, genetic engineering, genome, genotype, heterozygous, homozygous, inherited disorder, phenotype, polydactyly. recessive allele,
		Ecology	Revisit Y9- Competition & Adaptations. Describe and explain how organisms are adapted to successfully compete. Revisit Y10- Quadrat Required Practical- Describe how to carry out random and systematic sampling. Calculate the population of organisms in an area. Cycles- describe the water and carbon cycles- Practice extended questions. Introduce Biodiversity (covered in Y7/9), Waste Management, Deforestation & Land Use, Maintaining Ecosystems & Biodiversity.	**Composite- To explain how human interference with the ecosystem causes changes to biodiversity**. Component- Describe the water	End of topic test after Ecology- focussing on the composites and components. Other assessed points for Ecology- Data analysis Problem solving questions. Revisit Y9- Describe and explain how organisms are adapted to successfully compete. Revisit Y10- Quadrat Required Practical- Describe how to carry	Biodiversity, biomass, community, deforestation, distribution, global warming, interdependence, quadrat, stable community, transect.

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				and carbon cycles. Component- Describe how waste management, deforestation and land use affect habitats.	out random and systematic sampling. Calculate the population of organisms in an area.	
12	**1**	1. Biological Molecules	Revisit GCSE Carbohydrates, Lipids, Proteins- what they are broken down into. Enzymes- how they speed up chemical reactions. Introduce structure of Biological Molecules and Hydrolysis/Condensation Reactions.	**<u>1. Biological Molecules</u>** Composite- Describe the structure of biological molecules and explain the importance of their roles within loving organisms. Component- Describe condensation and hydrolysis. Component- Describe the structure of monosaccharides and how to test for them. Component- Explain how monosaccharides are linked together to form disaccharides. Component- Describe the test for non-reducing sugars and starch. Component- Explain how the structure of starch, glycogen and cellulose relate to their functions. Component- Describe the structure of a phospholipid and how it relates to its function. Component- Describe the test for a lipid. Component- Explain how amino acids are linked to form polypeptides. Component- Explain how polypeptides are arranged to form secondary, tertiary and quaternary structures. Component- Describe the test for proteins. Composite- Describe the structure of enzymes and explain their role in catalysing chemical reactions. Component- Explain the lock and key model of enzyme action. Component- Explain how temperature, pH and concentration affect the rate of reaction. Component- Explain how competitive and non-competitive inhibitors affect the active site.	End of topic test after Biological Molecules- focussing on the composites and components. Other assessed points for Biological Molecules- Explain the formation of ions. Interpret the results of qualitative tests for reducing sugars, non-reducing sugars, starch, protein and emulsion tests. Explain how fibrous and globular proteins are adapted for their specific roles in the body. Use chromatography, with known standard solutions, to separate a mixture of monosaccharides and identify their components. Produce a dilution series of glucose solution and use colorimetric techniques to produce a calibration curve. Plan and carry out investigations into the effect of temperature, pH or concentration on enzyme action. Explain how inhibitors control metabolic pathways. End of topic test after Nucleic	ATP, Amino Acid, Benedict's Test, Biuret Test, Cellulose, Condensation Reaction, DNA, Dipeptide, Disaccharide, DNA Helicase, DNA Polymerase, Enzyme, Glycogen, Glycosidic Bond, Heat Capacity, Hydrolysis, Induced-Fit Model, Iodine Test, Lactose, Latent Heat, Lipid Emulsion Test, Maltose, Metabolite, Monomers, Monosaccharide, Phospholipid, Polymers, Polypeptide, Polysaccharide, Primary Structure, Quaternary Structure, RNA, Secondary Structure, Semi Conservative Replication, Solvent, Starch, Sucrose, Tertiary Structure, Triglyceride. Active immunity, Active Transport, Agglutination, Antibody, Antigen, Binary Fission, Cell Cycle, Cell-Surface Membrane, Cell Vacuole, Cell Wall, Chloroplast, Clonal Expansion, Co-transport, Cytokinesis, Facilitated Diffusion, Flagella, Fluid-Mosaic Model, Ggolgi Apparatus, Helper T-Cell, Herd Immunity, HIV, Lysosomes, Magnification, Mitochondrion, Mitosis, Monoclonal Antibodies, Nucleus, Osmosis, Passive Immunity, Phagocytosis, Plasmids, Primary Immune Response, Resolution, Ribosomes, Rough Endoplasmic Reticulum, Secondary Immune Response, Smooth Endoplasmic Reticulum, Vaccine
			Revisit GCSE- Structure of DNA. Introduce DNA replication using prior knowledge of enzymes and			

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		2. Cells	DNA structure. Explain how enzymes catalyse the hydrolysis reactions of molecules. Describe inhibition of enzymes and the factors affecting enzyme action. Revisit GCSE- Microscopy/Calculating Magnification/Unit Conversions. Evaluate the use of light and electron microscopes. Introduce ultracentrifugation and differences between TEM and SEM. Revisit GCSE- Label and function of cells, prokaryote and eukaryote comparisons. Introduce new cell organelles- R.E.R, golgi body, vesicles, lysosomes. Apply knowledge of sub-cellular features in explaining adaptations of eukaryotic cells. Revisit GCSE- Process of mitosis. Introduce the stages of mitosis. Revisit GCSE- Describe the processes of diffusion/osmosis/active transport. Apply these principles to different processes in organisms. Explain how molecules are transported across cell membranes. Introduce Co-transport as an additional transport mechanism.	**2. Nucleic Acids** Composite- Describe the structure of nucleic acids and explain their role in living organisms. Component- Describe the structure of RNA and DNA. Component- Explain the semi-conservative method of DNA replication. Composite- Describe the role of ATP in biological processes. Composite- Describe the properties of water and inorganic ions and explain their importance in living organisms. **3. Cell Structure** Composite- Describe the function of each organelle and explain how we can observe cells under a microscope. Component- Explain the principles of magnification and resolution. Component- Explain how ultracentrifugation works. Component- Explain the differences between TEM and SEM. Component- Explain how to calibrate an eye piece graticule. Component- Describe the structure of organelles in plants and animals. Component- Describe the advantages of cellular differentiation. Component- Describe the structure of prokaryotic cells. Composite- Explain the process of mitosis in replicating cells. Component- Describe what mitosis is. Component- Explain the importance of mitosis. Component- Describe the three stages of the cell cycle. Component- Describe how cancer and its treatment relate to the cell cycle.	Acids- focussing on the composites and components. Other assessed points for Nucleic Acids- Describe how the carbon atoms in a pentose molecule are numbered. Evaluate the work of scientists in validating the Watson–Crick model of DNA replication. End of topic test after Cell Structure- focussing on the composites and components. Other assessed points for Cell Structure- Calculate actual sizes of specimens from drawings and photographs. Convert Units Use iodine in potassium iodide solution to identify starch grains in plant cells. Calculation of mitotic index. End of topic test after Transport Across Cell Membranes-	

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			Revisit GCSE- Immune system- defence mechanisms, phagocytosis, white blood cells, vaccination. Introduce action of T + B Lymphocytes and HIV. Describe the process of cell-mediated and humoral immunity. Describe the replication of HIV and the ELISA test. Explain the appearance of cells in each stage of mitosis. Explain the adaptations of specialised cells in relation to the rate of transport across their internal and external membranes.	**4. Transport Across Cell Membranes** Composite- Describe how cell membranes are adapted for the transport of molecules and explain the methods of transport. Component- Describe the structure of the cell-surface membrane. Component- Explain the process of diffusion, osmosis and active transport. Component- Explain what affects the rate of diffusion. Component- Explain how water potential affects water movement. Component- Explain how glucose is absorbed in the ileum through the process of co-transport. **5. Cell Recognition and the Immune System** Composite- Describe and explain the role of cells in the immune system. Component- Describe the main defence mechanisms of the body. Component- Explain the process of phagocytosis. Component- Explain the role of T cells in cell-mediated immunity. Component- Explain the role of B cells in humoral immunity. Component- Explain how monoclonal antibodies are used to target specific substances and cells. Component- Describe the features of an effective vaccination programme. Component- Describe the structure of HIV and explain how it causes AIDS.	focussing on the composites and components. Other assessed points for Transport Across Cell Membranes- Determine the water potential of plant tissues using the intercept of a graph. Explain how Oral Rehydration Therapy treats diarrhoeal diseases. End of topic test after Cell Recognition and the Immune System- focussing on the composites and components. Other assessed points for Cell Recognition and the Immune System- Discuss ethical issues associated with the use of vaccines and monoclonal antibodies Evaluate methodology, evidence and data relating to the use of vaccines and monoclonal antibodies.	
12	**2**	3. Organisms Exchange Substances with Thier Environment	Revisit GCSE- Describe the process of gas exchange in mammals and plants.	**6. Exchange** Composite- Explain the mechanisms of gas exchange in	End of topic test after Exchange- focussing on the composites and components. Other assessed	Alveoli, Amylase, Antiporter, Aorta, Arteriole, Artery, Atrium, Bile Salts, Bronchi, Bronchioles,

Year	Semester	Scheme of Learning	Powerful Knowledge / Threshold Concept links	Composites and their components	End Points	Word Revolution
			Introduce gas exchange in fish and insects (apply same principles from GCSE) Revisit GCSE- Digestive System- description of roles of major organs, role of enzymes, lock and key mechanism. Introduce concept of hydrolysis- breaking bonds between polymers. Introduce co-transport and absorption of fatty acids. Revisit GCSE- Structure of lungs and adaptations of alveoli. Introduce role of haemoglobin/O2 dissociation curves and cardiac cycle. Explain how oxygen molecules are loaded and unloaded in the body.	a variety of organisms. Component- Explain how surfaces are specially adapted to facilitate exchange. Component- Describe how single-celled organisms exchange gases. Component- Explain how insects exchange gases. Component- Explain how countercurrent flow increases the rate of gas exchange in fish. Component- Describe how plants exchange gases. Component- Explain how plants and insects limit water loss in their gas exchange mechanisms. Component- Explain the functions of the human gas exchange surface. Component- Explain the processes of inspiration and expiration. Component- Explain how gases are exchanged in the alveoli of humans. Composite- Explain how the human digestive system is adapted to maximise the rate of absorption of molecules. Component- Describe the structure and function of the major organs of the digestive system. Component- Explain the roles of enzymes in digestion of carbohydrates, lipids and proteins. Component- Explain how the ileum is adapted for the absorption of molecules. Component- Explain how monosaccharides, amino acids and triglycerides are absorbed. **<u>7. Mass Transport</u>** Composite- Explain how oxygen is transported around the body. Component- Describe the	points for Exchange- Use agar blocks containing indicator to determine the effect of surface area to volume ratio and concentration gradient on the diffusion of an acid or alkali. Calculate the surface area to volume ratios of these cells. Dissect mammalian lungs, the gas exchange system of a bony fish or of an insect. Use an optical microscope to examine prepared mounts of gas exchange surfaces of a mammal, fish and insect, or temporary mounts of gills. Analyse graphs to explain spiracle movements. Examine vertical sections through a dicotyledonous leaf. Explain the adaptations of xerophytes. Use manometers and simple respirometers to measure volumes of air involved in gas exchange. Calculate pulmonary ventilation rate (PVR) and Cardiac Output (CO) Explain the difference between correlations and causal relationships. Interpret information relating to the effects of lung disease on gas exchange and/or ventilation Interpret data relating to the effects of pollution and smoking on the incidence of lung disease. Design and carry out investigations into the effect of a pH or bile salts on the rate of reaction catalysed by a digestive enzyme. Explain why some people are lactose intolerant. End of topic test after Mass Transport- focussing on the composites and components. Other assessed points for Mass Transport- Analyse oxygen dissociation curves. Design and carry out an investigation into the effect of a named variable on human pulse	Capillary, Coronary Artery, Co-transport, Diaphragm, Endopeptidase, Exopeptidase, Gill filaments, Gill lamellae, Haemoglobin, Lipase, Membrane-bound dipeptidases, membrane-bound disaccharidases, micelles, phloem, positive cooperativity, renal, spiracles, spongy mesophyll, stomata, symporter, Bohr effect, tissue fluid, trachea, tracheae, tracheoles, vein, venule, xerophyte, xylem.

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			Describe how heart rate is increased and decreased through the cardiac cycle. Revisit GCSE- describe how substances in plants are transported by the xylem and phloem. Introduce investigations into transport in plants. Describe how radioactive tracers are used to detect transport and explain how ringing and tracer experiments give evidence of translocation.	structure and function of haemoglobins. Component- Explain what is meant by loading and unloading of oxygen. Component- Describe the nature of an oxygen dissociation curve. Component- Explain the effect of carbon dioxide on the dissociation curve. Composite- Explain the adaptations of the mammalian circulatory system to maximise transport. Component- Describe the features of the transport system in large organisms. Component- Describe the appearance of the heart and its associated blood vessels. Component- Describe the stages of the cardiac cycle. Component- Explain how the structure of blood vessels is related to their function.	rate. Analyse and interpret data associated with specific risk factors and the incidence of cardiovascular disease. Evaluate conflicting evidence associated with risk factors affecting cardiovascular disease. Interpret electrocardiograms. Recognise correlations and causal relationships. Plan and carry out investigations to measure water uptake using a potometer. Explain how specialised plant cells are adapted to maximise water transport in the plant. Interpret evidence from tracer and ringing experiments and to evaluate the evidence for and against the mass flow hypothesis.	Adaptation, allele, anticodon, artificial classification, Binomial system, biodiversity, cellular proteome, chromatid, chromosome, classification, codon, conservation, courtship, crossing over, degenerate, deletion, directional selection, exon, fertilisation, gene, gene mutation, genetic code, genetic diversity, genome, histones, homologous chromosome, independent segregation, Index of diversity, intron, locus, meiosis, mRNA, mitosis, mutagenic agent, natural selection, non-coding sequence, non-disjunction, non-overlapping, phylogenetic classification, phylogeny, random sampling, recombination, ribosomes, RNA polymerase, species, species diversity, species richness, splicing, stabilising selection, substitution, taxon, transcription, tRNA, translation, triplet, variation.
		4. Genetic Information, Variation and Relationships between Organisms	Revisit GCSE- Key terminology and function- DNA/Chromosomes/genes/ allele. Describe the structure of DNA and RNA. Introduce Protein Synthesis. Describe transcription and translation. Revisit GCSE- Variation and natural selection. Stages of natural selection. Introduce mutations and selection.	Composite- To explain the adaptations of plant tissue to maximise the transport of water and organic substances. Component- Explain how water moves up the xylem and through the leaf. Component- Describe the mass flow mechanism for the transport of organic substances in the phloem. Component- Describe the use of ringing and tracer experiments to investigate transport in plants. **8. DNA, Genes and Protein Synthesis** Composite- Explain the role of DNA and genes in the process of protein synthesis. Component- Explain how genes code for polypeptides. Component- Describe the structure of a chromosome. Component- Describe the structure of RNA, mRNA and	End of topic test after DNA, Genes and Protein Synthesis- focussing on the composites and components. Other assessed points for DNA, Genes and Protein Synthesis- Interpret data relating to similarities and differences in the base sequences of DNA and in the amino acid sequences of proteins to suggest relationships between different organisms within a species. Compare DNA, mRNA and tRNA. Interpret data from experimental work investigating the role of nucleic acids. End of topic test after Genetic Diversity and Adaptation- focussing on the composites and components. Other assessed points for Genetic Diversity and Adaptation-	

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				tRNA. Component- Describe the process of transcription. Component- Describe the process of translation. **9. Genetic Diversity and Adaptation** Composite- Explain how genetic diversity and adaptations occur in organisms. Component- Describe gene mutations. Component- Describe the process of meiosis. Component- Describe what factors influence genetic diversity. Component- Explain what stabilising and directional selection are.	Explain hybridisation in wheat. Examine meiosis in prepared slides of suitable plant or animal tissue. Calculate the possible number of different combinations of chromosomes following meiosis. Complete diagrams showing the chromosome content of cells after the first and second meiotic division. Explain the different outcomes of mitosis and meiosis. Explain how random fertilisation of haploid gametes further increases genetic variation within a species. Interpret data relating to the effect of selection in producing change within populations. End of topic test after Biodiversity- focussing on the composites and components. Other assessed points for Biodiversity- Explain the difficulties of defining species. Use a logarithmic scale when dealing with data relating to large numbers of bacteria in a culture. Calculate an index of diversity and interpret the significance of the calculated value of the index. Relate the base sequence of nucleic acids to the amino acid sequence of polypeptides. Design appropriate methods to ensure random sampling. Carry out random sampling within a single population. Use random samples to investigate the effect of position on the growth of leaves. Calculate the mean values of data they have collected or have been given. Calculate, and interpret the values of, the standard deviations of their mean values.	
			Revisit GCSE- Biodiversity. Introduce- Diversity index calculations and investigating diversity.	**10. Biodiversity** Composite- Explain the importance of biodiversity within species. Component- Explain the principles of classification. Component- Explain how courtship is a precursor to mating. Component- Explain how a diversity index is used as a measure of species diversity. Component- Describe the impact of agriculture on species diversity.		

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				Component- Explain how base sequences of DNA and mRNA are used to compare genetic diversity within species. Component- Describe how variation is measured.		
13	**1**	7. Genetics, Populations, Evolution and Ecosystems	Revisit GCSE- inheritance- monohybrid and punnett squares. Introduce dihybrid then move onto sex linkage, co-dominance, autosomal and epistasis.	**17. Inherited Change** Composite- Describe and explain the processes of inheritance. Component- Explain the nature of multiple alleles. Component- Explain monohybrid and dihybrid inheritance. Component- Explain how codominance affects the inheritance of characteristics. Component- Explain how sex is determined genetically. Component- Describe autosomal linkage. Component- Explain what is meant by epistasis. Component- Calculate values for chi-squared.	End of topic test after Inherited Change- focussing on the composites and components. Other assessed points for Inherited Change- Investigate genetic ratios using crosses of Drosophila. Use information to represent phenotypic ratios in monohybrid and dihybrid crosses. Show understanding of the probability associated with inheritance. Explain the work of Gregor Mendel. Analyse Pedigree Charts the explain the transmission of disease. Use the X 2 test to investigate the significance of differences between expected and observed phenotypic ratios. Collect data about the frequency of observable phenotypes within a single population.	Abiotic, allele, allele frequency, allopatric speciation, autosomal linkage, autosome, belt transect, biodiversity, biotic, carrying capacity, chi-squared, climax community, codominant, community, conservation, dihybrid inheritance, diploid, directional selection, disruptive selection, dominant, ecosystem, epistasis, evolution, gene, gene pool, genetic drift, genotype, habitat, Hardy-Weinberg principle, heterozygous, homozygous, interspecific competition, intraspecific competition, locus, mark-release-recapture, monhybrid, multiple alleles, natural selection, niche, phenotype, pioneer species, population, predator, prey, quadrat, random sampling, recessive, selection pressures, sex linkage, speciation, species, stabilising selection, succession, sustainable, sympatric speciation, systematic sampling, variation.
			Revisit GCSE- Natural Selection and Evolution- theories and basic model. Introduce theories of isolation and speciation.	**18. Populations and Evolution** Composite- Describe and explain changes in population allele frequencies. Component- Use the Hardy-Weinberg principle to calculate allele, genotype and phenotype frequencies. Component- Describe variation due to genetic and environmental influences. Component- Explain the role of variation in natural selection. Component- Describe the three main types of selection. Component- Explain how new species are formed.	End of topic test after Populations and Evolution- focussing on the composites and components. Other assessed points for Populations and Evolution- Calculate allele, genotype and phenotype frequencies from appropriate data using the Hardy–Weinberg equation. Analyse genetic variation graphs to explain how it leads to natural selection. Use turbidity measurements to investigate the growth rate of a broth culture of microorganisms. Use a logarithmic scale in representing the growth of a population of microorganisms. Explain why individuals within a population of a species may show a wide range of variation in phenotype. Explain why genetic drift is	Acetylcholine, action potential, actin, actinomyosin bridge, adenylate cyclase, adrenaline, afferent arteriole, all-or-nothing,

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					important only in small populations. Explain how natural selection and isolation may result in change in the allele and phenotype frequency and lead to the formation of a new species. Explain how evolutionary change over a long period of time has resulted in a great diversity of species.	anisotropic bands, Antagonistic muscles, ADH, ascending limb, AVN, autonomic nervous system, auxins, axon, bundle of His, cell body, chemoreceptor, cholinesterase, cholinergic synapse, collecting duct, cone cells, control mechanism, coordinator, cyclic AMP, dendrites, dendrons, depolarisation, descending limb, diabetes, distal convoluted tubule, effector, efferent arteriole, excitatory synapse, fovea, generator potential, glomerular filtrate, glomerulus, glucagon, gluconeogenesis, gylcogenesis, glycogenolysis, gravitropism, homeostasis, hormones, hyperpolarisation, hypothalamus, H-Zone, IAA, inhibitory synapse, insulin, intermediate neurone, iodopsin, islets of Langerhans, Isotropic bands, kinesis, loop of Henle, medulla oblongata, motor neurone, myelin sheath, myofibrils, myogenic, myosin, negative feedback, nephron, neuromuscular junction, neurones, neurotransmitter, nodes of Ranvier, optic nerve, osmoreceptors, osmoregulation, Pacinian corpuscle, parasympathetic, peripheral nervous system, phosphocreatine, phototropism, polarisation, positive feedback, posterior pituitary gland, postsynaptic neurone, pressure receptors, presynaptic neurone, protein kinase, proximal convoluted tubule, Purkyne tissue, receptor, reflex, refractory period, Bowman's capsule, repolarisation, resting potential, retina, rhodopsin, rod cells, saltatory conduction, sarcomere, sarcoplasm, Schwann cells, second messenger model, sensory neurone, SAN, sodium-potassium pump, spatial summation, stimulus, stretch-mediated sodium channel, summation, sympathetic, synaptic cleft, synaptic vesicles, taxis, temporal summation, threshold value, transducer cells, tropism, tropomyosin, unidirectionality, visual acuity,
			Revisit GCSE- Variation, competition, predation, sampling techniques (nothing new at A-Level) Introduce concept of succession and conservation methods (links with GCSE Ecology)	**19. Populations in Ecosystems** Composite- Explain how energy within ecosystems is transferred and recycled. Component- Describe the factors that determine the size of a population. Component- Summarise the factors that different species compete for. Component- Explain how predator-prey relationship affects the population size of the predator and prey. Component- Explain how a transect is used. Component- Explain how the mark-release-recapture method measures abundance of species. Component- Describe changes that occur in a variety of species that occupy an area over time. Component- Explain how managing succession can conserve habitats.	End of topic test after Populations in Ecosystems- focussing on the composites and components. Other assessed points for Populations in Ecosystems- Plot population growth curves. Analyse population pyramids and Demographic Transition Models to explain changes in populations. Analyse Predator-Prey graphs. Collect data about the frequency of observable phenotypes within a single population. Devise an investigation to mimic the effects of random sampling on allele frequencies in a population. Investigate the distribution of organisms in a named habitat using randomly placed frame quadrats, or a belt transect. Use the mark-release-recapture method to investigate the abundance of a motile species. Use given data to calculate the size of a population estimated using the mark-release-recapture method. Evaluate evidence and data concerning issues relating to the conservation of species and habitats and consider conflicting evidence.	
		6. Organisms Respond to Changes in Their Environment	Revisit GCSE- Plant Tropisms. Introduce concept of IAA affecting growth. Introduce Texis and Kinesis (NEW TO STUDENTS) Revisit GCSE- Reflex Arc		End of topic test after Response to Stimuli- focussing on the composites and components. Other assessed points for Response to Stimuli- Design and carry out investigations into the effects of indoleacetic acid on root growth	

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			(Nothing new at A-Level) Revisit GCSE- Nervous system- components/explanation of reflex arc/synapses. Introduce concepts of action potential rather than nervous impulse. Introduce the mechanism of resting and action potential. Introduce muscles, sliding filament theory (NEW TO STUDENTS) Revisit GCSE- Homeostasis- simple blood glucose negative feedback cycle. Add detail to this. Revisit GCSE- Diabetes- differences between Type I and II and how they are controlled. Introduce osmoregulation and anatomy/role of kidney (NEW TO STUDENTS)	**14. Response to Stimuli** Composite- Describe and explain how organisms are able to respond to stimuli. Component- Describe taxes, kineses and tropisms. Component- Explain phototropism and gravitropism in flowering plants. Component- Explain how a simple reflex arc works. Component- Describe the structure of a Pacinian corpuscle and explain how it works. Component- Explain the role of chemoreceptors and baroreceptors in controlling heart rate. **15. Nervous Co-ordination and Muscles** Composite- Explain the role of the nervous system in responding to changes in the environment. Component- Describe the structure of a myelinated motor neurone. Component- Explain how a resting potential is established in a neurone. Component- Explain how an action potential is initiated in a neurone. Component- Describe the factors that affect the speed of conductance of an action potential. Component- Describe the structure of a synapse. Composite- Explain the role of skeletal muscle in responding to changes in the environment. Component- Describe the ultrastructure of a myofibril. Component- Explain how the sliding filament mechanism causes a muscle to contract. **16. Homeostasis** Composite- Explain how	in seedlings. Analyse experimental data to explain tropic response. Design and carry out an investigation into the effect of a named variable on human pulse rate. Use values of heart rate (R) and stroke volume (V) to calculate cardiac output (CO), using the formula CO = R × V End of topic test after Nervous Co-ordination and Muscles- focussing on the composites and components. Other assessed points for Nervous Co-ordination and Muscles- Measure the membrane potential and duration of an action potential using graphical data. Examine prepared slides of skeletal muscle using an optical microscope. Investigate the effect of repeated muscular contraction on the rate of muscle fatigue in human volunteers. Use information provided to predict and explain the effects of specific drugs on a synapse. End of topic test after Homeostasis- focussing on the composites and components. Other assessed points for Homeostasis- Compare thermoregulation in ectotherms and endotherms. Interpret information relating to examples of negative and positive feedback. Analyse graphs to describe the effects of diabetes on substance concentrations in the blood. Evaluate the positions of health advisers and the food industry in	z-line.

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				homeostasis and the role of hormonal co-ordination control and organisms internal environment. Component- Explain what negative feedback is. Component- Explain the roles of the pancreas and liver in regulating blood glucose. Component- Explain how Type I and Type II diabetes can be controlled. Component- Describe the structure of the nephron. Component- Describe the role of the nephron in osmoregulation. Component- Explain how water potential of the blood is regulated.	relation to the increased incidence of type II diabetes.	
13	**2**	5. Energy Transfer in and Between Organisms	Revisit GCSE- Photosynthesis- equation/description/location Introduce the stages and reactions. Revisit GCSE- Respiration- equation/description/location Introduce the stages and reactions. Revisit GCSE- Food chains/energy transfer/nutrient cycles.	**<u>11. Photosynthesis</u>** Composite- Describe the main stages of photosynthesis. Component- Explain how the plant leaf is adapted to carry out photosynthesis. Component- Explain the processes of oxidation and reduction. Component- Explain how chloroplasts are adapted to carry out the light dependent reaction. Component- Describe the roles of ATP and NADPH in the light independent reaction. **12. Respiration** Composite- Describe the main stages of respiration. Component- Describe the main stages of glycolysis and its products. Component- Describe the nature of hydrogen carrier molecules and explain their role in the Krebs cycle. Component- Explain how ATP is synthesised during oxidative phosphorylation. Component- Explain how energy is released by anaerobic respiration.	End of topic test after photosynthesis- focussing on the composite and components. Other assessed points for photosynthesis- Devise and carry out experiments to investigate the effect of named environmental variables on the rate of photosynthesis. Use graphs to explain how limiting factors affect the rate of photosynthesis. How to use a photosynthometer to measure and calculate rates of photosynthesis. Explain how Calvin's lollipop experiment helped to work out the light-independent reaction. End of topic test after respiration- focussing on the composite and components. Other assessed points for respiration- Devise and carry out experiments to investigate how coenzymes work in respiration. Investigate where respiratory pathways take place in cells. End of topic test after Energy and Ecosystems- focussing on the composite and components. Other assessed points for	Acetyl Coenzyme A, ATP, aerobic, ammonification, anaerobic, antioxidant, artificial fertilisers, ATP synthase, biomass, calorimetry, chemiosmotic theory, chloropyll, coenzymes, Calvin cycle, carrier molecule, community, consumer, denitrification, dentrifying bacteria, ecological niche, ecosystem, electron acceptor, electron carrier molecules, electron transfer chain, eutrophication, FAD, glycerate 3-phosphate, glycolysis, GPP, habitat, intercropping, Krebs cycle, leaching, light-dependent reaction, light-independent reaction, limiting factor, link reaction, mycorrhizae, NAD, NADP, NPP, nitrification, nitrifying bacteria, nitrogen fixation, oxidation, oxidative phosphorylation, photoionisation, photolysis, primary productivity, producers, pyruvate, reduction, RuBP, rubisco, saprobionts, substrate-level phosphorylation, TP, trophic level Acetylation, addition, benign, cancer, cellular proteome, cDNA, complete proteome, deletion, differentiation, DNA hybridisation, DNA ligase, DNA polymerase, DNA probe, DNA sequencing, duplication, epigenetics, frameshift

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Year	Semester	Scheme of Learning	Powerful Knowledge / Threshold Concept links	Composites and their components	End Points	Word Revolution
			Add extra detail to nitrogen/carbon and water cycle and introduce effect fertilisers have on these cycles.	**13. Energy and Ecosystems** Composite- Explain how energy is transferred between the organisms in the ecosystem. Component- Explain how energy is lost along the food chain. Component- Describe the features of the nitrogen cycle. Component- Describe the features of the phosphorous cycle. Component- Explain why fertilisers are needed in agricultural systems. Component- Describe the main environmental effects of using nitrogen containing fertilisers.	Energy and Ecosystems- Calculate gross primary production and derive the appropriate units. Carry out investigations to find the dry mass of plant samples or the energy released by samples of plant biomass. Calculate the net productivity of producers or consumers from given data, the efficiency of energy transfers within ecosystems. Calculate percentage yields. Devise investigations into the effect of named minerals on plant growth.	mutation, gel electrophoresis, gene machine, gene mutation, gene therapy, GMO, genetic counselling, genetic fingerprinting, genetic screening, genome, hypermethylation, hypomethylation, iPS cells, inversion, in vitro, in vivo, malignant, marker genes, metastasis, methylation, multipotent cells, mutagenic agent, mutation, non-coding DNA, oestrogen, oncogenes, pluripotent, PCR, primers, promoter, proto-oncogenes, recognition sequences, recombinant DNA, Restriction endonucleases, reverse transcriptase, RNAi, silent mutation, stem cells, sticky ends, substitution, terminator, thermocycler, totipotent, transformation, tumour suppresor genes, transcriptional factors, transgenic, translocation of bases, unipotent cells, VNTR's, vector, WGS sequencing.
		8. The Control of Gene Expression	Revisit GCSE- Uses of stem cells and their ethical implications. Link this to Gene mutations and totipotency.	**20. Gene Expression** Composite- Explain how the	End of topic test after Gene Expression- focussing on the components and composites. Other assessed points for Gene Expression- Explain how mutagenic agents damage the body. Evaluate the use of stem cells in treating human disorders. Devise and carry out	

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			Revisit GCSE- Cancer- how tumours are formed and their adverse effects on the human body. Link this to gene expression mechanism. Revisit GCSE- Cloning methods. Link this to PCR/Genetic Screening/Genetic Fingerprinting.	different types of gene mutation result in different amino acid sequences in polypeptides. Composite- Explain how cells lose their totipotency and become specialised. Component- Describe cell differentiation and cell specialisation. Component- Describe the origins and types of stem cells. Composite- Explain how oestrogen affects gene transcription. Composite- Describe the nature of the epigenome. Component- Explain the effects of decreased acetylation of histones. Component- Explain the effects of increased methylation of DNA. Composite- Distinguish between benign and malignant tumours. Component- Explain the role of oncogenes and tumour suppressor genes in the development of tumours. Composite- Outline the importance of genome sequencing projects. Component- Describe the nature of the proteome. **<u>21. DNA Technology</u>** Composite- Describe the applications of recombinant DNA technology. Component- Explain how complementary DNA is made using reverse transcriptase. Component- Explain how a DNA fragment can be inserted into a vector. Component- Describe the polymerase chain reaction. Component- Describe what DNA probes are and explain how they work.	investigations to produce tissue cultures of explants of cauliflower. Relate the nature of a gene mutation to its effect on the encoded polypeptide. Use data to evaluate the risk factors of cancer. End of topic test after DNA Technology- focussing on the composites and components. Other assessed points for gene expression. Investigate the specificity of restriction enzymes using extracted DNA and electrophoresis. Use gel electrophoresis to produce ‘fingerprints’ of food dyes. Interpret information relating to the use of recombinant DNA technology. Evaluate the ethical, financial and social issues associated with the use and ownership of recombinant DNA technology. Evaluate information relating to screening individuals for genetically determined conditions and drug responses.	

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				Component- Describe what genetic fingerprinting is.		