



Biology Curriculum Overview Plan



Whole school curriculum intent

Develop a broad and balanced curriculum that enables students to learn, recall and apply knowledge and skills across different contexts, supported by a robust and consistent approach to assessment. This will lead to successful and resilient lifelong learners who can cope in a range of changing contexts.

Key stage 3/4 subject curriculum intent

- Science teaching at TQEA will develop a deep understanding of a range of scientific ideas in the subject disciplines of biology, chemistry and physics. Pupils will make connections between these subject areas and become aware of many of the big ideas underpinning scientific knowledge and understanding. To support this, the design of Knowledge Organisers has been carefully planned and aligned to the curriculum narrative. KOs are carefully embedded into the curriculum structure to ensure that this meets the need for improving literacy and provides opportunities for retrieval practice. This also ensures that new key language is introduced, explained and modelled when building on prior learning.
- Pupils will be able to decide on the appropriate type of scientific inquiry to undertake to answer their own questions and develop a deeper understanding of factors to be considered when collecting, recording, processing and evaluating data. They will develop their literacy, numeracy and ICT skills in a range of practical and theoretical contexts.
- We will enrich our curriculum by giving pupils opportunities to equip themselves with the tools needed to access their learning, for example, by research projects, visiting speakers and visits to local and national sites of scientific interest, both physically and virtually.
- Incorporate the 4 pillars of curriculum design ensuring that we produce students that can compete nationally and globally in any career: Personal Development and Empowerment; Subject Capital; Employability Capital; Social and Cultural Capital
- For some students, studying the sciences will provide the platform for more advanced studies, establishing the basis for a wide range of careers. For others, it will be their last formal study of subjects that provide the foundations for understanding the natural world and will enhance their lives in an increasingly technological society.
- Science is changing our lives and is vital to the world's future prosperity. The sciences will be taught in ways that ensure students have the knowledge to enable them to develop curiosity about the natural world and an appreciation of the relevance of science to their everyday lives.

Year Group		Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Year 7	Topic	Introduction to science	Cells, organisation and skeleton	Reproduction	Digestion	Ecosystems	
	Core knowledge from this topic	<ul style="list-style-type: none"> • Identify careers that involve science outside of the obvious (N) • How we stay safe in the lab (N) • How we draw scientific equipment (N) • How we use a Bunsen Burner (N) • How we use the scientific equipment in a practical (N) • Interpret graphs to describe what they show (N) • Recognise the scientific method (N): • Identify Variables • Design a valid experiment • Write a method • Analyse simple data • Draw simple bar charts • Evaluate an experiment (N) 	<ul style="list-style-type: none"> • What animal cells are and contain (N) • What plant cells are and what they contain (N) • Use a microscope to prepare and see cells (N) • What a specialised cell is (N) • What unicellular organisms are (N) • What cells, tissues and organs are (N) • How we move- the role of the skeleton • How muscles work (N) • What problems can occur in the body (N) 	<ul style="list-style-type: none"> • What the parts of the human reproductive system are (N) • What happens in fertilisation (N) • What happens in menstruation (N) • How a foetus develops • Factors that affect the growing foetus (N) • How we can affect fertility- increase and decrease (N) • The parts of the flowering plant (N) • How plants are fertilised (N) • How seeds are dispersed (N) 	<ul style="list-style-type: none"> • What makes up a healthy diet • What the effects are of an unbalanced diet (N) • What organs make up the digestive system • How enzymes work (N) 	<ul style="list-style-type: none"> • What food chains and webs are • How toxins affect food chains (N) • The importance of insects (N) • What predator-prey relationships are (N) • How we can measure biodiversity (N) 	



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<p>Links to the national curriculum</p>	<ul style="list-style-type: none"> ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience make predictions using scientific knowledge and understanding select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate use appropriate techniques, apparatus, and materials during fieldwork and laboratory work, paying attention to health and safety make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements apply mathematical concepts and calculate results present observations and data using appropriate methods, including tables and graphs interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions <p>•</p> <p>All these skills will then be ongoing through years 7-11.</p>	<ul style="list-style-type: none"> Cells as the fundamental unit of living organisms, including how to observe, interpret and record cell structure using a light microscope. The functions of the cell wall, cell membrane, cytoplasm, nucleus, vacuole, mitochondria and chloroplasts. The similarities and differences between plant and animal cells. The structural adaptations of some unicellular organisms. The hierarchical organisation of multicellular organisms: from cells to tissues to organs to systems to organisms. The structure and functions of the human skeleton. The interaction between skeleton and muscles. The function of muscles and examples of antagonistic muscles 	<ul style="list-style-type: none"> Reproduction in humans (as an example of a mammal), including the structure and function of the male and female reproductive systems, menstrual cycle, gametes, fertilisation, gestation and birth, to include the effect of maternal lifestyle on the foetus through the placenta. 	<ul style="list-style-type: none"> Content of a healthy human diet: carbohydrates, lipids (fats and oils), proteins, vitamins, minerals, dietary fibre and water, and why each is needed. Calculations of energy requirements in a healthy daily diet. The consequences of imbalances in the diet, including obesity, starvation and deficiency diseases. The tissues and organs of the human digestive system, including adaptations to function and how the digestive system digests food (enzymes simply as biological catalysts). 	<ul style="list-style-type: none"> The interdependence of organisms in an ecosystem, including food webs and insect pollinated crops. The importance of plant reproduction through insect pollination in human food security. How organisms affect, and are affected by, their environment, including the accumulation of toxic materials.
<p>Previous content that this topic builds upon</p>	<p>From KS2 NC:</p> <ul style="list-style-type: none"> asking relevant questions and using different types of scientific enquiries to answer them setting up simple practical enquiries, comparative and fair tests making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers gathering, recording, classifying and presenting data in a variety of ways to help in answering questions recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions 	<p>From KS1 NC:</p> <ul style="list-style-type: none"> describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals, including pets) identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense. explore and compare the differences between things that are living, dead, and things that have never been alive <p>From KS2 NC:</p> <ul style="list-style-type: none"> identify that humans and some other animals have skeletons and muscles for support, protection and movement. 	<p>From KS2 NC:</p> <ul style="list-style-type: none"> explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal. describe the life process of reproduction in some plants and animals. describe the changes as humans develop to old age. 	<p>From KS2 NC:</p> <ul style="list-style-type: none"> describe the simple functions of the basic parts of the digestive system in humans recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function describe the ways in which nutrients and water are transported within animals, including humans. <p>Simple functions and basic parts of the digestive system in humans.</p>	<p>From KS2 NC:</p> <ul style="list-style-type: none"> recognise that living things can be grouped in a variety of ways explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment recognise that environments can change and that this can sometimes pose dangers to living things. construct and interpret a variety of food chains, identifying producers, predators and prey. describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals give reasons for classifying plants and animals based on specific characteristics.



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	<ul style="list-style-type: none"> identifying differences, similarities or changes related to simple scientific ideas and processes using straightforward scientific evidence to answer questions or to support their findings 				How animals obtain their food from plants and other animals. Simple food chains and naming difference sources of food.
Key vocabulary	variables, independent, dependent, control, fair test, measurements, valid, repeatable, mean average, calculate, prediction, hypothesis, valid, metod, results, table, graph, bar chart, axes, label, units, equipment, beaker, test-tube, boiling tube, Bunsen burner, spatula, conical flask, funnel, filter, evaporating bowl, measuring cylinder, stirring rod, gauze, tripod, diagram, conclusion, evaluation, reproducible, the scientific method	Cell, tissue, organ, organ system, organism, nucleus, cytoplasm, mitochondria, ribosomes, cell membrane, cell wall, vacuole, chloroplasts, skeleton, muscles, antagonistic, joints, ligaments, tendons, microscope, specialised cell, unicellular, multicellular, femur, clavicle, scapula, humerus, cranium, rib cage, pelvis, ulna, radius, tibia, fibula, sternum.	Foetus, reproduction, menstrual cycle, gametes, fertilisation, gestation, birth, maternal, placenta, penis, vagina, sperm, egg, ejaculation, bladder, glands, sperm duct, urethra, testis, foreskin, scrotum, oviduct, ovary, uterus, cervix, ovulation, menstruation	Diet, balanced, nutrients, digestion, carbohydrates, protein, lipids, minerals, vitamins, dietary fibre, water, Biuret's, Benedicts, ethanol, emulsification, obesity, energy, deficiencies, iron, iodine, vitamin, mouth, oesophagus, liver, gall bladder, pancreas, small intestine, appendix, stomach, salivary glands, large intestines, rectum, anus, scurvy, rickets, goitre, anemia, enzymes, amylase, protease, lipase, starch, amino acids, fatty acids, bacteria.	Organisms, producer, primary consumer, secondary consumer, tertiary consumer, apex predator, energy, food chain, food web, predator, prey, herbivore, carnivore, omnivore, ecosystem, toxins, accumulate, bioaccumulate, insects, pollination, environment, populations, biodiversity, quadrat, sampling, monoculture, artificial pollination.
Development of cultural capital	<p>€ https://www.khanacademy.org/science/high-school-biology/hs-biology-foundations/hs-biology-and-the-scientific-method/a/the-science-of-biology The scientific method worksheet</p> <p>€</p> <p>Practical Opportunities:</p> <p>€ Investigating the resolution of different pieces of measuring equipment.</p>	<p>€ Understanding how the human body works in more depth and appreciating the biology that makes humans equal.</p> <p>€ Problems with the human body and how they affect others</p> <p>FOCUS CAREER: CELLULAR BIOLOGIST</p> <p>Practical Opportunities:</p> <p>€ Preparing onion cell and cheek cell slides</p> <p>€ Use of the microscope</p> <p>€ Dissection of a chicken leg to show muscles, tendons etc</p> <p>€ use of human organ model and skeleton</p>	<p>€ Understanding how lifestyle choices can impact on a foetus.</p> <p>€ Start to understand the purpose of using contraception and how fertilisation occurs. This links to PSHE taught in year 8.</p> <p>FOCUS CAREER: IVF TECHNICIAN</p> <p>Practical Opportunities:</p> <p>€ Dissection of a flower and labelling the parts</p>	<p>€ Understand the importance of a balanced diet and a healthy relationship with food.</p> <p>€ Understand the consequences of severe imbalances in diets.</p> <p>€ Appreciate that a lot of different diets can be healthy.</p> <p>FOCUS CAREER: DIETICIAN</p> <p>Practical Opportunities:</p> <p>€ Food tests- fats, proteins, glucose and starch</p> <p>€ Energy in different foods</p>	<p>€ Understand what is meant by world food security and appreciate that not all people have access to all foods.</p> <p>€ Understand the effects of toxins entering the food chain.</p> <p>€ Appreciate the working world by practicing using quadrats and measuring biodiversity; learning transferable skills.</p> <p>FOCUS CAREER: ECOLOGIST</p> <p>Practical Opportunities:</p> <p>€ Sampling techniques- use of quadrats/ pooters/ field guides outside etc</p>
Key Practical/ maths/ graph skills	<p>€ Record data into tables</p> <p>€ Introduce idea of control variables</p> <p>€ Making simple predictions</p>	<p>€ Follow a simple method</p> <p>€ Annotate a picture method.</p> <p>€ Scientists use models to represent complex ideas.</p>	<p>€ Follow a simple method</p> <p>€ Annotate a picture method.</p>	<p>€ Making a simple prediction.</p> <p>€ Recording data into tables.</p> <p>€ Write a simple conclusion and describe trends in data.</p> <p>€ Describe some sources of error in experiments.</p> <p>€ Suggest improvements to experiments.</p> <p>€ Identify control variables, then independent variable and dependent variables.</p> <p>€ Design and draw own results tables.</p> <p>€ Define anomaly and identify in data. Comment on accuracy and reliability of results.</p> <p>€ Bar chart for energy in foods.</p>	<p>€ Recording data into tables.</p> <p>€ Write a simple conclusion and describe trends in data.</p> <p>€ Describe some sources of error in experiments.</p> <p>€ Suggest improvements to experiments.</p> <p>€ Identify control variables, then independent variable and dependent variables.</p> <p>€ Design and draw own results tables.</p> <p>€ Define anomaly and identify in data. Comment on accuracy and reliability of results.</p> <p>€ Write a clear and logical method.</p> <p>€ Calculate percentage abundance.</p>



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Development of reading	Scientific method information sheet comprehension task	https://www.stem.org.uk/system/files/elibrary-resources/legacy_files_migrated/27930-StemCells%20debate-kit.pdf Stem cell debate kit. Students use the information given to form opinions. Advise using a whole lesson.	https://www.tes.com/teaching-resource/ivf-6400406 IVF debate. Process of IVF, success rates and risks. Read the fact sheets and highlight as instructed. Then debate which families should be allowed access	https://www.success-stream.co.uk/what-is-an-unbalanced-diet/ Articles about the effects of unbalanced diets. NEEDS EDITING!	DDT build-up comprehension task word document The importance of bees and what happens when bee populations drop. Extracts from <i>Silent Spring</i> .
Concepts –what will students be able to do at the end of the topic	<ul style="list-style-type: none"> Identify careers that involve science Describe how we stay safe in the lab Draw scientific equipment Learn how to use a Bunsen Burner Use the scientific equipment in a practical Interpret graphs to describe what they show Use the scientific method to Identify Variables Design a valid experiment Write a method Analyse simple data Draw simple bar charts Evaluate an experiment 	<ul style="list-style-type: none"> Describe the differences between a general plant and animal cell. Name some specialised cells and describe their adaptations and functions. Identify parts of a microscope and be able to use a microscope to identify cells. Describe the difference between unicellular and multicellular organisms. Describe the difference between cells, tissues and organs. Describe the difference between joints, tendons and ligaments. Describe how muscles work in antagonistic pairs. Name and locate some bones in the human skeleton. 	<ul style="list-style-type: none"> Describe the structure and functions of parts of the female and male reproductive systems. Describe the process of menstruation and causes of low fertility. Describe the role of the mother in supporting and protecting the developing foetus. Describe the effects of difference factors on a developing foetus. Critique claims linked with the effects of smoking in pregnancy. 	<ul style="list-style-type: none"> Describe the components of a healthy diet. Examine the importance of each component of a healthy diet. Compare energy requirements of different healthy diets. Describe positive tests for fats, starch, glucose, protein. Describe physical effects of eating too much/too little. Identify causes and effects of some deficiencies in the diet. Identify organs in the human digestive system. Describe the process of digestion. Describe the roles of organs in the digestive system. Describe the importance of enzymes and gut bacteria in digestion. Explain how the structure of each organ is adapted to its function. 	<ul style="list-style-type: none"> Describe how food webs are made up of a number of food chains. Make predictions about factors affecting plant and animal populations. Analyse and evaluate changes in food webs. Describe and explain how toxins enter, pass along and accumulate in food chains. Evaluate the advantages and disadvantages of using pesticides. Describe the impact of low pollination on fruit production. Explain why artificial pollination is used for some crops. Evaluate the risks of monoculture on world food security. Describe ways in which organisms affect their environment. Explain why prey populations affect predator populations. Evaluate a model of predator-prey populations and explain the importance of predators. Describe methods that can be used to measure populations.

Year Group	Topic	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Year 8	Core knowledge from this topic	Breathing and respiration		Photosynthesis		Genetics	
		<ul style="list-style-type: none"> How we breathe How we measure breathing (N) What gas exchange is (N) What respiration is (N) How respiration affects sport (N) Difference between aerobic and anaerobic respiration (N) The effects of disease and lifestyle on the lungs (N) 		<ul style="list-style-type: none"> What photosynthesis is (N) The structure of the leaf and how leaves are adapted for photosynthesis (N) The function of the vein and the process of transpiration (N) The importance of minerals (N) Factors that can affect photosynthesis (N) 		<ul style="list-style-type: none"> What variation is (N) What causes variation. (N) The advantages of variation. (N) What natural selection is. (N) What biodiversity is. (N) Causes of extinction. (N) What DNA is. (N) What chromosomes are. (N) What heredity is and how it can be predicted. (N) 	
	Links to the national curriculum	<ul style="list-style-type: none"> The structure and functions of the gas exchange system in humans, including adaptations to function. 		<ul style="list-style-type: none"> Plants making carbohydrates in their leaves by photosynthesis and gaining mineral nutrients and water from the soil via their roots. The reactants in, and products of, photosynthesis, and a word summary for photosynthesis. 		<ul style="list-style-type: none"> Heredity as the process by which genetic information is transmitted from one generation to the next. A simple model of chromosomes, genes and DNA in heredity. 	



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	<ul style="list-style-type: none"> The mechanism of breathing to move air in and out of the lungs, including simple measurements of lung volume. The impact of exercise, asthma and smoking on the human gas exchange system. Aerobic and anaerobic respiration in living organisms. A word summary for aerobic respiration. The process of anaerobic respiration in humans and microorganisms, including fermentation, and a word summary for anaerobic respiration. The differences between aerobic and anaerobic respiration in terms of the reactants, the products formed and the implications for the organism. The effects of recreational drugs (including substance misuse) on behaviour, health and life processes. 	<ul style="list-style-type: none"> The dependence of almost all life on Earth on the ability of photosynthetic organisms, such as plants and algae, to use sunlight in photosynthesis to build organic molecules that are an essential energy store and to maintain levels of oxygen and carbon dioxide in the atmosphere. The adaptations of leaves for photosynthesis. 	<ul style="list-style-type: none"> The variation between species and between individuals of the same species means some organisms compete more successfully, which can drive natural selection. Changes in the environment may leave individuals within a species, and some entire species, less well adapted to compete successfully and reproduce, which in turn may lead to extinction. The importance of maintaining biodiversity and the use of gene banks to preserve hereditary material.
Previous content that this topic builds upon	<p>From KS2 NC:</p> <ul style="list-style-type: none"> identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function <p>From Previous KS3</p> <ul style="list-style-type: none"> Function of mitochondria MRS GREN as the 7 life processes <p>Knowledge that the lungs are involved in breathing. Awareness of diseases such as asthma.</p>	<p>From KS2 NC:</p> <ul style="list-style-type: none"> identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow) and how they vary from plant to plant investigate the way in which water is transported within plants <p>From Previous KS3</p> <ul style="list-style-type: none"> Structure of plant cells. Structure and function of specialised cells such as root hair cells and palisade cells. Function of chloroplasts. Ecosystems - plants as producers. 	<p>From KS2 NC:</p> <ul style="list-style-type: none"> recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution. <p>From Previous KS3</p> <ul style="list-style-type: none"> Reproduction - genes and gametes.
Key vocabulary	Breathing, respiration, trachea, lungs, diaphragm, ribs, intercostal muscles, pressure, volume, bronchi, bronchioles, alveoli, aerobic, anaerobic, fermentation, gas exchange, glucose, carbon dioxide, oxygen, microbes, cells, reactants, products.	Photosynthesis, chloroplasts, chlorophyll, leaf, carbon dioxide, water, oxygen, glucose, starch, energy, sunlight, transpiration, minerals, evaporate, xylem, phloem, roots, light intensity, cell, deficiency.	Natural selection, genes, heredity, DNA, species, chromosomes, extinction, variation, genetic, environmental, biodiversity, gene banks, offspring, adaptations, continuous, discontinuous, inherited, nucleus, environment, gametes.
Development of cultural capital	<ul style="list-style-type: none"> Understanding that human are all the same - reduce discrimination and encourage equality. Increase sensitivity and awareness of lung diseases <p>Practical Opportunities:</p> <ul style="list-style-type: none"> Measuring peak flow and lung capacity Measuring pulse rate Comparison of aerobic and anaerobic respiration using weights <ul style="list-style-type: none"> FOCUS CAREER: SPORTS SCIENTIST 	<ul style="list-style-type: none"> Appreciation for the natural world. Understand the importance of plants. <p>FOCUS CAREER: BOTANIST</p> <p>Practical Opportunities:</p> <ul style="list-style-type: none"> How light affects photosynthesis Phototropism in plants (potato in a shoebox maze HWK?) Celery and the being with food dye Growing seedlings 	<ul style="list-style-type: none"> A wider understanding of variation amongst the humans and an appreciation of the advantages of variation. Students can explain why it is good that everybody is different. <p>Practical Opportunities:</p> <ul style="list-style-type: none"> Recording differences between people in the class <p>FOCUS CAREER: GENE THERAPIST</p>
Key Practical/ maths/ graph skills	<ul style="list-style-type: none"> Bar chart for type of exercise versus heart rate. Write a clear and logical method. Define anomaly and identify them in data. Design and draw own results table. 	<ul style="list-style-type: none"> Write a clear and logical method. Define anomaly and identify them in data. Design and draw own results table Make a hypothesis. Explain why particular equipment has been selected. Comment on resolution and precision. Explain why it is important to keep control variables constant Scatter graph for number of oxygen bubbles vs distance of the light source. 	<ul style="list-style-type: none"> Bar chart for discontinuous variation. Scatter graph for continuous variation.
Development of reading	https://www.usms.org/fitness-and-training/articles-and-videos/articles/5-reasons-why-swimming-is-great-for-lung-health swimming good for health	Minerals in plants - taking information on factsheet and putting into a table to summarise. Looking at how greenhouses can increase the rate of photosynthesis.	Royal family example of haemophilia.



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		<p>Bio KS3- Respiration Lung Diseases factsheet- Different lung diseases, in particular, asthma.</p> <ul style="list-style-type: none"> Describe the mechanism of breathing. Explain how pressure changes help us breathe. Describe lung volume and how to measure it. Describe features of the human gas exchange system and explain how features enable gases to be exchanged. Distinguish between respiration and breathing. Recall the equations for respiration and explain the importance of respiration. Describe anaerobic respiration and explain why some sports involve anaerobic respiration. Explain what oxygen debt is. Recall the equation for fermentation and describe some applications of fermentation. Describe and explain some effects of disease and lifestyle on the breathing system. 	<ul style="list-style-type: none"> State the equation for photosynthesis. Describe a method to show that chlorophyll is essential for photosynthesis. Relate the size of the leaf to the availability of light. Relate the function of the leaf to its structure and the types of cell. Evaluate the structures of a cell related to its function. Define transpiration. Identify and explain how water and minerals move through a plant. Evaluate the cell structures that allow movement of water and minerals through a plant. Identify the minerals essential to healthy plant growth. Explain the effects of a deficiency in essential minerals. Identify the factors that can affect photosynthesis. Predict results of investigations. Interpret secondary data about photosynthesis. 	<ul style="list-style-type: none"> Describe what is meant by variation in a species. Explain the difference between continuous and discontinuous variations. Identify whether a feature is inherited or determined by the environment. Understand that offspring from the same parents may show variation. Describe the importance of variation. Explain how variation may help a species survive. Describe how variation causes competition for resources and drives natural selection. Describe what is meant by biodiversity and explain its importance. Identify changes that can cause a species to become extinct. Identify where chromosomes are and that they carry inherited genetic information. Describe structure of DNA. Identify that a fertilised egg contains a full set of chromosomes. Explain how some genetic disorders arise. Identify inherited characteristics and explain how inherited differences arise. Describe how identical twins arise and analyse data about their features. Use a model to represent inheritance of a trait. Predict the likelihood of offspring inheriting specific traits.
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Year Group		Autumn Term 1	Autumn Term 2	Spring Term 1	Spring Term 2	Summer Term 1	Summer Term 2
Year 9	Topic	Cells and Microscopy	Plant Structure	Photosynthesis	Enzymes and Digestion	Respiration	Cell Transport
	Core knowledge from this topic	<ul style="list-style-type: none"> Identify eukaryotic and prokaryotic cells Describe subcellular structures Describe and explain specialised cells Types of stem cell and differentiation (N) Types of microscopes (N) Applying the magnification equation (N) Preparing, observing and drawing cells from microscope slides and producing a scale bar (RP) (N) 	<ul style="list-style-type: none"> Structure of a leaf and adaptations Main transport systems of the plant. Structural differences between xylem and phloem. (N) Transpiration in leaves and using a potometer. (N) The effects of environmental factors on the rate of transpiration. (N) 	<ul style="list-style-type: none"> Why plants carry out photosynthesis. The reactants and products, construction of word and balanced symbol equation. Uses of glucose in plants and investigating light as a limiting factor of photosynthesis (RP) Applying inverse square law. (N) Manipulating factors of photosynthesis. (N) 	<ul style="list-style-type: none"> Organs of the digestive system and their functions. The role of digestive enzymes, testing foods for particular food groups (RP) Structure and Function of enzymes. Investigating the effect of pH on enzyme activity at a constant temperature (RP). (N) The role of bile. (N) Adaptations of the small intestine. (N) 	<ul style="list-style-type: none"> Aerobic respiration reactants, products, word and balanced symbol equations. Anaerobic respiration reactants, products, word and balanced symbol equations. Comparing aerobic and anaerobic respiration in animals and plants/fungi. Oxygen debt and fermentation. (N) Physical effects of exercise on the body. (N) Metabolism including anabolic and catabolic reactions. (N) 	<ul style="list-style-type: none"> Diffusion and factors that affect the rate of diffusion. Location of diffusion surfaces in the body. (N) Active transport and locations in organisms (N) Osmosis in root hair cells, Investigating osmosis in plant tissues (RP) (N)
	Links to the national curriculum	4.1.1.1 Eukaryotes and Prokaryotes, 4.1.1.2 Animal and Plant Cells, 4.1.1.3 Cell Specialisation, 4.1.1.4 Cell differentiation, 4.1.1.5 Microscopy, 4.1.2.3 Stem cells, 4.1.1.6 Culturing Microorganisms	4.2.3.1 Plant Tissues, 4.2.3.2 Plant organs	4.4.1.1 Photosynthetic reactions, 4.4.1.2 Rate of photosynthesis, 4.4.1.3 Uses of glucose	4.2.1 Principles of organisation, 4.2.2.1 Human Digestive system,	4.4.2.1 Aerobic and anaerobic respiration, 4.2.2.2 Response to exercise, 4.2.2.3 Metabolism	4.1.3.1 Diffusion, 4.1.3.2 Osmosis, 4.1.3.3 Active Transport
	Previous content that this topic builds upon	Year 7 Cells, organisation	Year 7 Cells, organisation	Year 8 Photosynthesis	Year 7 Digestion	Year 8 Breathing and Respiration	KS3 topic of Cells.
	Key vocabulary	Eukaryote, prokaryote, nucleus, cell membrane, cytoplasm, ribosome, mitochondria, chloroplast, cell wall, vacuole, specialised, differentiated, undifferentiated, stem cell, meristem, embryonic, adult stem cell	Transpiration, transpiration stream, evaporation, diffusion, xylem, phloem, translocation, stomata, guard cell, palisade layer, spongy layer, epidermis, waxy cuticle, vascular bundle, potometer, light intensity, temperature, wind, humidity	Carbon dioxide, water, oxygen, glucose, light, chlorophyll, starch, cellulose, lipids, proteins, limiting factor, rate	Enzyme, active site, specific, substrate, product, optimum, denatured, pH, temperature, saturated, carbohydrates, amylase, protease, lipases	Aerobic respiration, anaerobic respiration, glucose (reducing sugars), oxygen, energy (ATP), lactic acid, fermentation, oxygen debt, metabolism, heart rate, blood flow, cardiac output	High concentration, low concentration, passive, semi-permeable, hypertonic, hypotonic, isotonic, concentration gradient, energy, mitochondria, temperature, distance
	Development of cultural capital	Using stem cells to treat/cure medical conditions in today's society. Practical Opportunities:	Practical Opportunities: use of microscope to see stomata	Practical Opportunities: RP	Practical Opportunities: RP	Practical Opportunities: Lung capacity bags Spirometer to measure peak flow	Practical Opportunities: RP



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		<p>RP</p> <ul style="list-style-type: none"> Preparing onion cell and cheek cell slides Use of the microscope <p>RP</p> <ul style="list-style-type: none"> Aseptic techniques with T <p>FOCUS CAREER: MICROBIOLOGIST, BIOTECHNOLOGIST</p>	<p>use of microscope to see cross sections of the leaf</p> <p>celery in dyed water- graphing from distance travelled up stem/ qualitative from the colour of the leaves</p> <p>FOCUS CAREER: BOTANIST, HORTICULTURAL MANAGER, IRRIGATION ENGINEER</p>	<ul style="list-style-type: none"> effect of light on photosynthesis <p>testing a leaf for starch/</p> <p>FOCUS CAREER: BOTANIST, HORTICULTURAL MANAGER</p>	<ul style="list-style-type: none"> Food tests- starch, fats, proteins and sugars pH and enzyme activity modelling the human gut <p>FOCUS CAREER: NUTRITIONIST, DIETITIAN, FOOD SCIENTIST</p>	<ul style="list-style-type: none"> Use of oximeters to measure blood oxygen levels and pulse rate Get students to measure pulse rate and breathing rate before exercise. 20 fast star jumps, measure again (could use oximeters again) lifting weights with breaks/ no breaks to compare aerobic/ anaerobic <p>FOCUS CAREER: EXERCISE PHYSIOLOGIST, PHYSICAL THERAPIST</p>	<ul style="list-style-type: none"> Osmosis and sugar concentration <p>diffusion of acid into agar</p> <p>FOCUS CAREER: CELLULAR SCIENTIST</p>
	Key Practical/ maths/ graph skills	<ul style="list-style-type: none"> Write a clear and logical method. Write an applied method. 	<ul style="list-style-type: none"> Calculate percentage of open vs closed stomata. Make a hypothesis. 	<ul style="list-style-type: none"> Explain why it is important to keep control variables constant. Make a hypothesis. Explain why particular equipment has been chosen. Comment on reproducibility and repeatability. Suggest how valid results can be obtained. 	<ul style="list-style-type: none"> Make a hypothesis. Comment on validity of results and identify types of errors. 	<ul style="list-style-type: none"> Suggest how valid results can be obtained. Calculate uncertainty. Comment on validity of results. Identify different types of error. 	
	Development of reading					<ul style="list-style-type: none"> George Floyd 'I can't breathe' Covid and O2 levels Oxygen enhancing drugs in sport Haemochromatosis 	<ul style="list-style-type: none"> Describe what diffusion is and how different factors affect the rate of diffusion. To describe what osmosis is and how it affects plant and animal cells and follow up with an investigation into the effect of a range of saline conditions on the mass of plant tissue (RP). <p>To describe what active transport is and why areas where it occurs require carrier proteins and increased numbers of mitochondria.</p>
	Concepts –what will students be able to do at the end of the topic	<ul style="list-style-type: none"> Identify animal, plant and bacterial cells recognise and describe organelles compare light and electron microscopes use magnification equation to validate magnification, actual and image size, what stem cells are, medical uses of stem cells, specialised cells and how they are adapted and link structure to function. 	<ul style="list-style-type: none"> Describe the role of stomata and guard cells define transpiration, factors that affect transpiration, explain the role of xylem and phloem analysing structure of the leaf organ, 	<ul style="list-style-type: none"> Define what photosynthesis is, construct word and symbol equation describe and explain limiting factors how plants use glucose investigating rate of reaction of photosynthesis (RP) 	<ul style="list-style-type: none"> Describe the role of the digestive system and functions of the organs. Conduct food tests (RP) and know why food tests give qualitative results. Know the structure and function of an enzyme and link the link and key theory to specificity at the active site. Know the sources of digestive enzymes (carbohydrases, proteases and lipases) and what substrates they act on. To investigate the action of enzyme in range of different pH values linking to rate of reaction (RP). 	<ul style="list-style-type: none"> Describe why all living organisms carry out respiration state the reactants and products of both aerobic and anaerobic and be able to write word and symbol equations for both reactions. To link the effect of exercise on the rate of respiration and what metabolism is and examples of metabolic reactions in the body. 	<ul style="list-style-type: none">

Year Group	Autumn Term 1	Autumn Term 2	Spring Term 1	Spring Term 2	Summer Term 2
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Year 10	Topic	Cardiovascular	Immune system	Genetics	Biodiversity	Evolution	Ecology
	Core knowledge from this topic	<ul style="list-style-type: none"> Structure of the human heart, including key adaptations (N) Journey of the blood through the heart, types of blood vessels and how they are adapted to their function (N) components of blood including adaptation of red blood cells (N) Structure of lungs, gas exchange and adaptations of alveoli. 	<ul style="list-style-type: none"> What are communicable and non-communicable diseases (N) Definition of a pathogen and named examples(N) Non-specific and specific body defences Vaccination Development of drugs. (N) Culturing microorganisms including using aseptic techniques (T) Calculating colony size using area of a circle (T) Producing monoclonal antibodies and their uses (T) Detecting and identifying plant diseases, plant defences (physical and chemical). (T) Describing aseptic techniques and why they are used. Culturing microorganisms using aseptic techniques to investigate the effect of different antimicrobial substances. (BIO ONLY RP) Calculate zone of inhibition to conclude effect of different antimicrobial substances. 	<ul style="list-style-type: none"> Difference between sexual and asexual reproduction (N) Link between chromosomes, genes and DNA (N) Cell cycle and mitosis (N) Meiosis and how it compares to mitosis (N) Stem cells and their uses, Genetic engineering and its advantages and disadvantages. (N) Understanding genetics using Mendel's pea experiments. Construction of a timeline to show how developments in technology are linked to advances in the field of genetics. Describe what cloning is and the techniques that can be used (embryo transplantation and nuclear fusion. Comparing sexual and asexual reproduction. 	<ul style="list-style-type: none"> What is biodiversity (N) Management of waste as a result of human activity (N) Land use and deforestation and the effects, global warming and the effects (N) Maintaining and monitoring biodiversity. (N) 	<ul style="list-style-type: none"> What variation is The causes of variation and the differences between continuous and discontinuous variation including which charts are used to present data Selective breeding and its advantages and disadvantages, Evolution by natural selections, Evidence to support evolution. (N) Fossil formation and extinction. (N) Classification of living organisms using Linnaean system and comparison to Woese 3 domain system. (N) Darwin's Theory of Evolution compared to the work of Alfred Wallace and Lamarck. 	<ul style="list-style-type: none"> Communities and interdependence. (N) Biotic and abiotic factors. (N) Adaptations including functional, structural and behavioural adaptations. (N) Sampling of a population (estimating populations and transect line). (N) Food chains and energy transfer. (N) Cycles in nature. (N)
	Links to the national curriculum (if applicable)	4.2.2.2 The heart and blood vessels, 4.2.2.3 Blood, 4.2.2.4 Heart Disease	4.3.1.1 Communicable diseases, 4.3.1.2 Viral diseases, 4.3.1.3 Bacterial diseases, 4.3.1.4 Fungal diseases, 4.3.1.5 Protist diseases, 4.3.1.6 Human Defence system, 4.3.1.7 Vaccination, 4.3.1.8 Antibiotics and painkillers, 4.3.1.9 Discovery and development of drugs, 4.2.2.6 Effect of lifestyle on non-communicable diseases 4.1.1.6 Culturing microorganisms, 4.3.2.1 Producing monoclonal antibodies, 4.3.2.2. Uses of monoclonal antibodies, 4.3.3.1 Detection and Identification of Plant Diseases, 4.3.3.2 Plant Defence Responses,	<ul style="list-style-type: none"> 4.6.1.1 Sexual and Asexual reproduction, 4.1.2.1 Chromosomes, 4.1.2.2 Mitosis, 4.6.1.2 Meiosis, 4.6.1.4 DNA and the genome, 4.6.1.6 Genetic Inheritance, 4.6.1.7 Inherited Disorders, 4.6.1.8 Sex Determination, 4.6.2.4 Genetic Engineering 	<ul style="list-style-type: none"> 4.7.3.1 Biodiversity, 4.7.3.2 Waste Management, 4.7.3.3 Land use, 4.7.3.4 Deforestation, 4.7.3.5 Global Warming, 4.7.3.6 Biofuels 	4.6.2.1 Variation, 4.6.2.2 Evolution, 4.6.2.3 Selective Breeding, 4.6.3.4 Evidence for Evolution, 4.6.3.5 Fossils, 4.6.3.6 Extinction, 4.6.3.7 Resistant Bacteria	4.7.1.1 Communities, 4.7.1.2 Abiotic factors, 4.7.1.3 Biotic factors, 4.7.1.4 Adaptations, 4.7.2.1 Organisation of an ecosystem, 4.7.2.2 How materials are cycled
	Previous content that this topic builds upon	KS3 topic of cells and KS4 specialised cells.		KS3 topic of Genetics.	KS3 topic of ecosystems.	KS3 topic of Genetics.	KS3 topic of ecosystems.
	Key vocabulary	Circulatory system, atria, ventricles, vein, capillary, artery, pulmonary, red blood cells, white blood cells, platelets, plasma, double circulatory system, Sino Atrial Node, myogenic, oxygenated, deoxygenated	Pathogen, virus, bacterium, protist, fungi, communicable, non-communicable, air borne, foodborne, vector, transmission, vaccination, primary response, secondary response, clinical trials, placebo, double blind trial	Sexual reproduction asexual reproduction, meiosis, mitosis, DNA, gene, chromosome, gamete, haploid, diploid, allele, heterozygous, homozygous, genotype, phenotype, cystic fibrosis, polydactyly, mutation, genetic engineering	Pollution, Global Warming, Greenhouse effect, recycling, conservation, endangered, bioaccumulation	Variation, inherited, environmental, natural selection, selective breeding, , fossils, extinction, fossil record. Isolation, geographical, behavioural, structural	Ecosystem, community, interdependence, abiotic factors, biotic factors, adaptations, producer, primary consumer, secondary consumer, predator, quadrat, sampling, water cycle, carbon cycle



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			Monoclonal antibodies, Hybridoma, Nitrate deficiency, Magnesium deficiency, Physical, Chemical, Mechanical	Nucleotide, Tissue culture, Cuttings, Embryo transplants, Adult cell cloning, Speciation			
Development of cultural capital	<p>Practical Opportunities: heart dissection</p> <p>FOCUS CAREER: CARDIOLOGIST,</p>	<p>Practical Opportunities: RP</p> <ul style="list-style-type: none"> TRIPLE: culturing bacteria, zones of inhibition <p>FOCUS CAREER: MEDICAL SALES REPRESENTATIVE, CLINICAL SCIENTIST, PATHOLOGIST, PHARMACIST, DOCTOR, VET, RADIOGRAPHER</p>	<p>Practical Opportunities: ≠ Constructing DNA molecules to see the double helix/ base pairing</p> <p>FOCUS CAREER: GENETICIST</p>	<p>FOCUS CAREER: ENVIRONMENTAL CONSULTANT, AGRONOMIST, COUNTRYSIDE RANGER</p>	<p>Practical Opportunities: ≠ Recording differences between people in the class</p> <p>FOCUS CAREER: PALEONTOLOGIST</p>	<p>Practical Opportunities: RP</p> <ul style="list-style-type: none"> Sampling- Random Sampling- Transect <p>FOCUS CAREER: ECOLOGIST, ORNITHOLOGIST</p>	
Development of reading						On the Origin of Species by means of Natural Selection: Charles Darwin	
Concepts –what will students be able to do at the end of the topic	<ul style="list-style-type: none"> To know the gross structures of the heart including the blood vessels that bring blood to and take blood away from the heart. To know the journey of blood through the heart using the acronym 'VAVA'. Describe the components of blood and their functions. To explain the difference between oxygenated and deoxygenated blood. To know where gas exchange occurs in humans, plants and fish, and know how alveoli are adapted for efficient gas exchange. Describe what Coronary Heart Disease is, causes and evaluate available treatments. 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Describe the difference between sexual and asexual reproduction. To state that cells divide by mitosis and meiosis and understand the difference between the two processes. Describe the genetic contents of a cell's nucleus, where genes are located and what an allele is. To know the possible allele combinations in an individual and use this to predict probabilities of offspring genotypes and phenotypes using a punnett square. To analyse cystic fibrosis and polydactyly, including symptoms, effects and causes how embryos through IVF treatment can undergo embryo screening. 	<ul style="list-style-type: none"> To describe what biodiversity is, How human activity is threatening it and programmes to try to maintain it. Examine the effects of pollution, land use and deforestation on biodiversity. To explain what global warming is and link to species becoming endangered. 	<ul style="list-style-type: none"> To define what variation is, know the causes of variation and know which chart to use to present continuous and discontinuous data. Describe what selective breeding is, the process it is carried out by and compare the advantages and disadvantages. To name the scientist who came up with the theory of evolution by Natural Selection and describe the process How the fossil record supporting his ideas and the limitations of the record. How fossils are formed and how species become extinct. 	<ul style="list-style-type: none"> 	

Year Group		Autumn Term 1	Autumn Term 2	Spring Term 1	Spring Term 2	Summer Term 1	Summer Term 2
Year 11	Topic		Homeostasis	Nervous System	Biodiversity 2 (TRIPLE ONLY)		
	Core knowledge from this topic		<ul style="list-style-type: none"> What the endocrine system is and the main endocrine glands and hormones they secrete (N). Regulation of blood glucose by insulin (and glucagon HT) (N). Comparing type I and Type II diabetes and using Benedicts reagent to test model urine samples for glucose (N). Menstrual cycle stages. How FSH, LH, Oestrogen and Progesterone regulate the menstrual cycle (N). Process of IVF. How menstrual hormones can be used to increase fertility. (N). 	<ul style="list-style-type: none"> State what homeostasis in living organisms is. (N) Functions of the nervous systems and conscious and reflex actions. Recall general structure of a neurone. The neurones (structure and adaptation) involved in the nervous system. (N) Synapses and factors that affect synaptic activity. (N) Investigating reaction time (RP) (N) The gross structures of the brain including how brain activity can be studied and the limitations of these tests. (T) The gross structure of the eye and accommodation of the lens to focus on near and far objects. (T) 	<ul style="list-style-type: none"> Decomposition and factors that affect the rate of decay. Impact of environmental change on a species. Describe the term trophic level. Construct pyramids of number and biomass and calculate efficiency of biomass transfer between trophic levels. Food Security and factors that affect it. Sustainable farming techniques. Biotechnology and GM foods. 		



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			<ul style="list-style-type: none"> The role of negative feedback in the body with reference to adrenaline and thyroxine (HIGHER TIER) (N). Control of body temperature by negative feedback and including vasodilation and vasoconstriction. (T) Maintaining water balance focussing on the kidney and the role of ADH. (T) Maintaining nitrogen balance via production and excretion of urea. (T) Plant hormones including geotropism and phototropism. (T) 				
Links to the national curriculum (if applicable)	NA	4.5.1 Homeostasis, 4.5.2.1 Structure and Function of Nervous system, 4.5.3.1 Human Endocrine System, 4.5.3.2 Control of blood glucose concentration, 4.5.3.4 Hormones in human reproduction, 4.5.3.5 Contraception 4.5.3.6 Hormones to treat infertility (HT only), 4.5.3.7 Negative feedback 4.5.2.4 Control of body temperature, 4.5.3.3. Maintaining water and nitrogen balance, 4.5.4.1 Control and coordination of plant hormones, 4.5.4.2 Uses of plant hormones	4.5.2.2 The brain, 4.5.2.3 The eye, 4.6.1.3 Advantages and disadvantages of sexual and asexual reproduction, 4.6.1.5 DNA structure and protein synthesis, 4.6.2.5 Cloning, 4.6.3.1 Theory of Evolution, 4.6.3.2 Speciation, 4.6.3.3 Understanding of genetics,	4.7.2.3 Decomposition, 4.7.2.4 Impact of Environmental change, 4.7.4.1 Trophic levels, 4.7.4.2 Pyramids of biomass, 4.7.4.3 Transfer of biomass, 4.7.5.1 Factors affecting food security, 4.7.5.2 Farming Techniques, 4.7.5.3 Farming Techniques, 4.7.5.4 Role of biotechnology	NA	NA	
Previous content that this topic builds upon		KS3 topic of cells, organisation and systems.		KS3 topic of pathogen and disease, genetics and ecosystems.			
Key vocabulary		Endocrine system, insulin, glucagon, type I diabetes, Type II diabetes, oestrogen, Progesterone, Follice Stimulating Hormone (FSH), Lutenising hormone (LH), In Vitro Fertilisation	Homeostasis, stimulus, receptor, coordination centre, effector, response, reflex action, Motor neurone, sensory neurone, relay neurone Cerebral cortex, Medulla, Cerebellum, MRI, Accommodation, Myopia, Hyperopia, Vasodilation, Vasoconstriction, Deamination, Selective reabsorption, ADH, Thyroxine	Decomposers, pyramid of biomass, food security, mycoprotein			
Development of cultural capital		<p>Practical Opportunities:</p> <ul style="list-style-type: none"> Use of diabetes testing kits to test 'samples' <p>FOCUS CAREER: EMBRYOLOGIST</p>	<p>Practical Opportunities:</p> <p>RP</p> <ul style="list-style-type: none"> Investigating Reaction time using a ruler/ computer programs <p>FOCUS CAREER: OPTOMETRIST, NEUROLOGICAL SURGEON</p>				
Development of reading							
Concepts –what will students be able to do at the end of the topic			To know what homeostasis means. Describe the main structures of the nervous system. State what the endocrine system is and describe the main endocrine glands and the hormones they release. Describe how the menstrual cycle is regulated by hormones. To describe how IVF works and examine advantages and disadvantages.	<p>Name the gross structures of the brain, how brain activity can be sampled and the limitations of these methods. State the gross structures of the eye and explain their functions and how the ciliary muscles and suspensory ligaments alter the shape of the lens to allow focus on near and far objects (accommodation). Describe what myopia and hyperopia is and how these can be corrected using concave and convex lenses.</p> <p>State the methods of cloning, describe how plants can be cloned and compare cloning by cuttings and tissue culture in plants.</p>			



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					<p>To explain what speciation is and the factors that lead to its occurrence. How Alfred Wallace devised the theory and collaborated with Charles Darwin on the theory of evolution by Natural Selection.</p> <p>Explain the role of decomposers in ecosystems, what pyramids of numbers and biomass show and calculating efficiency between trophic levels. Examining food security and the impacts on society and what mycoprotein is and how it is being utilised in the wider world.</p>		
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