

# Science Curriculum Overview



**Cottingham**  
High School



THE CONSORTIUM  
ACADEMY TRUST

Shaping Positive Futures

## **Introduction**

This document outlines the curriculum and key considerations including:

- Aims and purpose
- Alignment with the whole school provision and curriculum intent
- A summary programme of study which includes sequencing of taught content

We use the National Curriculum as our statutory foundation and broadly share its principles and aims including:

- ‘To provide students with an introduction to the essential knowledge that they need to be educated citizens. To introduce students to the best that has been thought and said; and help engender an appreciation of human creativity and achievement’.
- To prepare students to be confident in themselves, to have a fulfilled and successful life beyond our school – one where they contribute positively to society.
- Our statutory curriculum is just one element in the education of every child. There is time and space in the school day and in each week, term and year to range beyond statutory specifications.
- Provision of a framework of core knowledge around which teachers can develop exciting and stimulating lessons to promote the development of students’ knowledge, understanding and skills as part of the wider school curriculum.
- The wider school curriculum includes an extensive range of opportunities and activities that are routinely available to students, are inclusive and reflect our diverse community.

## **Numeracy and literacy**

Teachers should take opportunities to develop students’ mathematical fluency, spoken language, reading, writing and vocabulary within their specific discipline and in line with the expectations laid out in our school curriculum statement.

## **Purpose of study**

‘A high-quality science education provides the foundations for understanding the world through the specific disciplines of biology, chemistry and physics. Science has changed our lives and is vital to the world’s future prosperity, and all pupils should be taught essential aspects of the knowledge, methods, processes and uses of science. Through building up a body of key foundational knowledge and concepts, pupils should be encouraged to recognise the power of rational explanation and develop a sense of excitement and curiosity about natural phenomena. They should be encouraged to understand how science can be used to explain what is occurring, predict how things will behave, and analyse causes.’ National Curriculum, DfE, 2015.

## **Curriculum Aims**

The Cottingham High School curriculum aims to ensure that all students:

- Develop scientific knowledge and conceptual understanding through the specific disciplines of biology, chemistry and physics and can manipulate and apply their knowledge of key concepts to unfamiliar scenarios.
- Develop resilience to tackle unknown and unseen challenges that present themselves throughout the duration of their studies and beyond.
- Are inquisitive learners who are curious about their place in the world. These learners develop into competent scientific enquirers who can ask questions about ideas and data.
- Master the key content delivered through the science curriculum, by being able to manipulate and apply their knowledge of key concepts to unfamiliar scenarios.
- Develop understanding of transferrable skills that can be applied cross-curricular and into everyday life - from application of maths skills to scientific literacy.
- Develop the skills needed to make educated, informed lifestyle choices to see the relevance, employability, and cultural importance of science, particularly in Hull and the East Riding.
- Become curious to find the “why” in different aspects of their life, inspiring the next generation of Scientists.

## **Building on prior learning**

Building on their learning from Key Stage 1, students should have secured the following knowledge by the end of their primary school science curriculum.

### Biology

- 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)
- Know the part that flowers play in the life cycle of flowering plants, including pollination, seed formation, and seed dispersal.
- Identify that humans and some other animals have skeletons and muscles for support, protection, and movement.
- Explore and use classification keys to help group, identify, and name a variety of living things in their local and wider environment.
- Describe the simple functions of the basic parts of the digestive system in humans.
- Identify the different types of teeth in humans and their simple functions.
- Construct and interpret a variety of food chains, identifying producers, predators, and prey.
- Describe the difference in the life cycles of a mammal, an amphibian, an insect, and a bird.
- Describe the life process of reproduction in some plants and animals.
- Describe the changes as humans develop into old age.
- Identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels, and blood.
- Describe the ways in which nutrients and water are transported within animals, including humans.
- Identify how animals and plants are adapted to suit their environment in different ways, and that adaptation may lead to evolution.

### Chemistry

- Compare and group together different kinds of rocks based on their appearance and simple physical properties.
- Describe in simple terms how fossils are formed when things that have lived are trapped within rock.
- Recognise that soils are made from rocks and organic matter.
- Compare and group materials together, according to whether they are solids, liquids or gases.
- Observe that some materials change state when they are heated or cooled.
- Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.
- Compare and group together everyday materials based on their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets.
- Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating.

## Physics

- Compare and group together a variety of everyday materials based on whether they are attracted to a magnet and identify some magnetic materials.
- Describe magnets as having two poles.
- Identify how sounds are made, associating it with vibration.
- Recognise that sounds get fainter as the distance from the sound source increases.
- Construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches, and buzzers.
- Use recognised symbols when representing a simple circuit in a diagram.
- Recognise some common conductors and insulators, and associate metal with being good conductors.
- Describe the movement of the Earth, and other planets, relative to the Sun in the solar system.
- Describe the movement of the Moon relative to the Earth.
- Identify the effects of air resistance, water resistance and friction, that act between moving surfaces.
- Recognising that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.
- Use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye.
- Explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes.
- Use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them.

## What can students do by the end of KS2?

Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary

- taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate
- recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs
- using test results to make predictions to set up further comparative and fair tests
- reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations
- identifying scientific evidence that has been used to support or refute ideas or arguments.

## What are the skills gaps?

- Forming hypotheses and predictions
- Recording and presenting data
- Planning experiments

## Curriculum Structure

In Science, there is not necessarily a clear line between Key Stage 3 and Key Stage 4. Science is a hierarchical subject. For example, students must understand states of matter before explaining distillation as a separation technique. As such, to succeed at GCSE, students need to have mastered (and then built upon) concepts that were first introduced in Key Stage 3, and even Key Stage 2.

To support the transition of learners from KS3 to KS4, year 9 transition units enables our learners to build confidence in more complex scientific ideas, over a longer period. For these units, we have chosen content from B1, C1 and P1 of the specification. We have also introduced a Science Communication Challenge which helps develop students speaking and listening skills, building toward their GCSE English presentations. Students will then transition to completing the GCSE Syllabus following the completion of these.

Subject Discipline	Substantive knowledge threads	Disciplinary knowledge threads
Biology	<ul style="list-style-type: none"> <li>• Cells and organisms</li> <li>• Organisation</li> <li>• Infection and response</li> <li>• Bioenergetics</li> <li>• Homeostasis and response</li> <li>• Inheritance, evolution and inheritance</li> <li>• Ecology</li> </ul>	<p><b>Disciplinary knowledge 1 - Scientific Attitudes and Ways of Thinking</b></p> <ul style="list-style-type: none"> <li>• Seeking objectivity</li> <li>• Development of methods and theories over time</li> <li>• Using a variety of models</li> <li>• The importance of peer review</li> </ul> <p><b>Disciplinary knowledge 2 - Scientific Enquiry</b></p> <ul style="list-style-type: none"> <li>• Planning for valid methods</li> <li>• Common techniques and apparatus</li> <li>• Planning valid methods which are safe</li> <li>• Making valid observations</li> </ul>
Chemistry	<ul style="list-style-type: none"> <li>• Particulate nature</li> <li>• Chemical reactions</li> <li>• Atomic structure and the periodic table</li> <li>• Rocks and materials</li> <li>• Energy changes</li> <li>• Quantitative chemistry</li> <li>• Organic chemistry</li> <li>• Chemical analysis</li> <li>• Atmosphere</li> </ul>	<p><b>Disciplinary knowledge 3 - Analytical and Evaluative Approaches</b></p> <ul style="list-style-type: none"> <li>• Presenting data</li> <li>• Analysing data</li> <li>• Interpreting data</li> <li>• Developing explanations</li> </ul> <p><b>Disciplinary knowledge 4 - Applications of Science and its Implications</b></p>

Physics	<ul style="list-style-type: none"> <li>• Energy</li> <li>• Electricity</li> <li>• Particle model</li> <li>• Atomic structure</li> <li>• Forces</li> <li>• Waves</li> <li>• Magnetism and electromagnetism</li> <li>• Space</li> </ul>	<ul style="list-style-type: none"> <li>• Developing scientific knowledge through technology</li> <li>• Developing technology through scientific knowledge</li> <li>• Ethical, social, economic and political implications</li> </ul> <p><b>Disciplinary knowledge 5 – Protocols for Measurement</b></p> <ul style="list-style-type: none"> <li>• Units</li> <li>• Notation and conversions</li> <li>• Symbols and formulae</li> </ul>
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### Vocabulary

Having a rich, ambitious, broad vocabulary is vital for learners to succeed, both in school and throughout their lives. Tier 1 vocabulary is the simplest. These are the words we use in everyday conversation, such as “put”, “get”, “walk”, etc. Tier 2 vocabulary are challenging, ambitious words that don’t usually crop up in day-to-day conversation. These are the words that allow learners to access academic texts, such as high-level literature, newspaper articles and exam papers.

Tier 3 vocabulary is the subject-specific vocabulary of a particular discipline. These are words that are uncommon outside of the context of a specific subject, and enable learners to communicate effectively within the subject. At Cottingham High School, tier 3 vocabulary is explicitly taught across our school curriculum and is mapped within the schemes of learning.

### Assessment

Formative assessment is used throughout the year to check learners’ knowledge and understanding, using feedback techniques including exit tickets and end of topic quizzes. Summative assessment is calendared at end points within each academic year and is conducted more formally.

Year	Assessment Window	Topics to be assessed
7	Mid-Year – January	Cells and organisation, Particles, substances and mixtures, Fundamentals in Physics
	End of year - June	Biology - Cells and organisation, Organ systems Chemistry - Particles, substances and mixtures, Chemical Changes, Materials Physics - Fundamentals in Physics, Sound and Light
8	Mid-Year – January	Plants and their Processes, Earth and the Atmosphere, Heating and Cooling
	End of year - June	Biology - Plants and their Processes, Nutrition and Digestion, Interactions and Inter-dependence Chemistry - Earth and the Atmosphere, Acids and Alkalis Physics - Heating and Cooling, Forces and Work, Electricity 1
9	Mid-Year - December	Biology – Transporting Substances Chemistry – Separating Mixtures Physics – Energy Resources
	End of year - June	Biology - Cells and Transport, Organisation (Part) Chemistry - Atomic Structure and the Periodic Table

		Physics – Energy *The Y9 topics from Sept – December form part of the GCSE topics named in the end of year assessment.
10	Mid-Year - January	Tbc.
	June PPE	Biology – Cells and Transport, Organisation, Infection and Response, Bioenergetics Chemistry – Atomic Structure and the Periodic Table, Bonding and Properties, Quantitative Chemistry, Chemical Changes, Energy Changes Physics – Energy, Electricity, Particle Model, Atomic Structure
11	October PPE	Biology – Cells and Transport, Organisation, Infection and Response, Bioenergetics Chemistry – Atomic Structure and the Periodic Table, Bonding and Properties, Quantitative Chemistry, Chemical Changes, Energy Changes Physics – Energy, Electricity, Particle Model, Atomic Structure
	February PPE	Biology – Homeostasis and Response, Inheritance, Variation and Evolution, Ecology Chemistry – Rates of Reaction, Organic Chemistry, Chemical Analysis, Earth’s Atmosphere, Using Resources Physics – Forces and Motion, Waves, Magnetism, (Space – Triple only)

## Curriculum Sequencing

### Year 7

Autumn term	Biology	Chemistry	Physics
Substantive Knowledge	<p><b><u>Cells and organisation</u></b></p> <ul style="list-style-type: none"> <li>Organisms</li> <li>Introduction to the microscope</li> <li>Proficiency with the microscope</li> <li>Levels of organisation</li> <li>Animal cell structures and functions</li> <li>Plant cell structures and functions</li> <li>Preparing a slide to observe cells</li> <li>Comparing cell structure</li> <li>Needs of cells</li> <li>Factors affecting diffusion</li> </ul>	<p><b><u>Particles, substances and mixtures</u></b></p> <ul style="list-style-type: none"> <li>The particle model and states of matter</li> <li>Changes of state</li> <li>Using a Bunsen burner</li> <li>Melting and boiling points</li> <li>Diffusion</li> <li>Gas pressure</li> <li>Pure substances and mixtures</li> <li>The particle model and solutions</li> <li>Conservation of mass in solutions</li> <li>Saturation and solubility</li> <li>Temperature and solubility</li> <li>Filtration, evaporation and crystallisation</li> <li>Purifying rock salt</li> <li>Distillation</li> <li>Chromatography</li> <li>Interpreting chromatograms</li> </ul>	<p><b><u>Fundamentals in Physics</u></b></p> <ul style="list-style-type: none"> <li>Forces cause change</li> <li>Modelling and measuring forces</li> <li>Balanced and unbalanced forces</li> <li>Resultant forces</li> <li>Forces that deform objects</li> <li>Friction force</li> <li>Investigating friction and lubricants</li> <li>Interpreting the friction and lubricants enquiry</li> <li>Energy stores</li> <li>Energy pathways</li> <li>Analysing energy transfers</li> </ul>

<b>Disciplinary Knowledge 1</b> Scientific Attitudes and Ways of thinking	Develop models that can represent reality, but do not show everything at once. Plan with help a scientific method where measuring is not always possible.	How scientific models can be devised to explain observations The importance of planning a systematic enquiry using a scientific method, manipulating variables.	Examples of models which are mathematical and representational. How to follow a hypothesis testing, variable manipulation method.
<b>Disciplinary Knowledge 2</b> Scientific Enquiry	Classify results as observations: qualitative or quantitative, as measurements; consider if the data is 'good enough'.	What is meant by 'quantity' and how to measure certain quantities; plan the collection of data and carry it out.	Compare observations and measurements, and data; plan for repeatability and reproducibility.
<b>Disciplinary Knowledge 3</b> Analytical and Evaluative Approaches	Use qualitative data to describe patterns in the data collected using the data that supports this analysis.	Use given tables to record observations; the purpose of tables and what should be included: title, heading, units.	How to qualitatively compare energy using end-point analysis. Extract data from tables.
<b>Disciplinary Knowledge 4</b> Applications of Science	How scientific advances have enabled STEM workers to develop processes, instrumentation leading to scientific researchers being able to work differently. For example, new materials for use in research, new tools and machines, making mass production possible, thus more accessible, cheaper materials, new products, made more efficiently, new medicines or medical techniques e.g., using echoes to observe foetuses in the womb, clean water to more people.		
<b>Disciplinary Knowledge 5</b> Protocols for Measurement		What a 'unit' is and why they are important. Use words (and 'symbols') for units correctly. Use words (and 'symbols') for units correctly.	The units for length, time, mass, temperature, and force. The units for loudness and frequency.
<b>Spring Term</b>	<b>Biology</b>	<b>Chemistry</b>	<b>Physics</b>
Substantive knowledge	<b><u>Organ systems</u></b> <ul style="list-style-type: none"> <li>• Unicellular organisms</li> <li>• Multicellular organisms</li> <li>• Gas exchange system</li> <li>• Inhaled and exhaled air</li> <li>• Digestive system</li> <li>• Circulatory system</li> <li>• Skeletal system</li> <li>• Joints and movement</li> <li>• Muscles and movement</li> <li>• Investigating muscle strength</li> </ul>	<b><u>Chemical Changes</u></b> <ul style="list-style-type: none"> <li>• Atoms and elements</li> <li>• Element properties</li> <li>• Investigating elements</li> <li>• Compounds</li> <li>• Chemical formulae</li> <li>• Naming compounds</li> <li>• Chemical reactions</li> <li>• Chemical reactions as rearrangement of atoms</li> <li>• Types of chemical reaction – oxidation</li> <li>• Types of chemical reaction – thermal decomposition</li> </ul>	<b><u>Sound and Light</u></b> <ul style="list-style-type: none"> <li>• Observing sound</li> <li>• Transmission of sound</li> <li>• Distance and absorption of sound</li> <li>• Sound reflection and scattering</li> <li>• Speed of sound</li> <li>• Sound and hearing</li> <li>• Observing light</li> <li>• Transmission of light</li> <li>• Reflection of light</li> <li>• Coloured light</li> <li>• Coloured objects</li> <li>• Reflected images</li> </ul>

		<ul style="list-style-type: none"> <li>• Representing reactions with chemical equations</li> <li>• Combustion reactions</li> <li>• Investigating conservation of mass</li> <li>• Exothermic and endothermic reactions</li> </ul>	<ul style="list-style-type: none"> <li>• Refraction of light</li> <li>• Focussing</li> <li>• Seeing</li> </ul>
<b>Disciplinary Knowledge 1</b> Scientific Attitudes and Ways of thinking	Models representing systems and flow of materials in and out of systems are explored. Develop an understanding of planning a hypothesis testing, non-manipulative scientific method.	Models are developed further with representational flow diagrams, of pictorial and before and after diagrams. Make a prediction and ensure the planned method will collect data that could confirm the hypothesis.	Several models more models build students' range. The process to decide how a scientific method is selected (apparatus and techniques).
<b>Disciplinary Knowledge 2</b> Scientific Enquiry	Observations can be primary or secondary data; how using both can improve the quality of data.	Collect data with regard to resolution and systematic error.	The importance of collecting over a range, with systematic and appropriate intervals between data points.
<b>Disciplinary Knowledge 3</b> Analytical and Evaluative Approaches	Read data from given line graphs and bar charts, using it to identify and describe trends in collected data.	How to decide which headings, numbers of rows and columns to prepare in data tables. Identify and exclude anomalies from data.	Further prepare tables and collect data systematically.
<b>Disciplinary Knowledge 4</b> Applications of Science	How technology advances have enabled scientific researchers to use more uniform devices e.g. lenses, and to make measurements of quantities that were too small, too large, too distant, or too difficult to resolve before. How technology advances have enabled the use of measuring instruments rather than make subjective observations e.g. digital thermometer, and to automate calculations using computers, which are less prone to mistakes and quicker.		
<b>Disciplinary Knowledge 5</b> Protocols for Measurement		Use mathematical formulae to complete calculations.	Formulae: total magnification = eyepiece x objective The use of scaling prefixes. To use the 'milli', 'kilo' and 'centi' prefixes with confidence.
<b>Summer Term</b>	<b>Biology</b>	<b>Chemistry</b>	<b>Physics</b>
Substantive Knowledge	<u><b>Life Cycles</b></u> <ul style="list-style-type: none"> <li>• Heredity</li> <li>• The genome</li> <li>• Variation</li> <li>• Discontinuous and continuous variation</li> <li>• Presenting data on variation</li> <li>• Growth and development</li> <li>• Adolescence and puberty in humans</li> </ul>	<u><b>Materials</b></u> <ul style="list-style-type: none"> <li>• Ceramics</li> <li>• Polymers</li> <li>• Polymer properties and uses</li> <li>• Testing polymers</li> <li>• Problems with polymers</li> <li>• Composite materials</li> <li>• Selecting composite materials</li> </ul>	

	<ul style="list-style-type: none"> <li>Sexual reproduction in humans</li> <li>Male and female reproductive systems</li> <li>Fertilisation and embryo formation</li> <li>Menstrual cycle and contraception</li> <li>Pregnancy and foetal development</li> <li>Birth</li> <li>Flowers and pollination</li> <li>Fertilisation and germination</li> <li>Seed dispersal</li> <li>Asexual reproduction</li> </ul>	<ul style="list-style-type: none"> <li>Investigating composite materials</li> </ul>	
<b>Disciplinary Knowledge 1</b> Scientific Attitudes and Ways of thinking	Plan a scientific method for: range, intervals, resolution, systematic error and random error.	To consider how the same concept can be represented by different scientific models. Plan a scientific method for: range, intervals, resolution, systematic error and random error.	
<b>Disciplinary Knowledge 2</b> Scientific Enquiry	Collect data with regard to managing random error.	Review data throughout its collection: if values are within estimates; if the data is likely to be trustworthy.	
<b>Disciplinary Knowledge 3</b> Analytical and Evaluative Approaches	Read data from given line graphs and bar charts, using it to identify and describe trends in collected data.	Construct bar charts from their data given guidance, using data that has been processed for random error.	
<b>Disciplinary Knowledge 4</b> Applications of Science	The scientific and technological developments that have increased the human population and some possible implications of it.	The implications of using raw materials in increasing amounts; using new raw materials from across the world; the impacts of polymers on society.	

## Year 8

Autumn term	Biology	Chemistry	Physics
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Substantive Knowledge	<p><b><u>Plants and their Processes</u></b></p> <ul style="list-style-type: none"> <li>Plants as Organisms</li> <li>Photosynthesis</li> <li>Testing for Starch</li> <li>Plant Growth Theories</li> <li>Leaf Adaptations</li> <li>Gas Exchange and Stomata</li> <li>Plant Roots</li> <li>Transport Vessels in Plants</li> <li>Transpiration</li> <li>Measuring the Rate of Photosynthesis</li> <li>Plants and the Atmosphere</li> <li>Plants as Producers and the Role of Pollinators</li> </ul>	<p><b><u>Earth and the Atmosphere</u></b></p> <ul style="list-style-type: none"> <li>Structure of the Earth</li> <li>Continental Drift</li> <li>Igneous Rocks</li> <li>Weathering and Erosion</li> <li>Sedimentary Rocks</li> <li>Metamorphic Rocks and the Rock Cycle</li> <li>Fossil Formation</li> <li>Fossil Fuels</li> <li>Extraction and Use of Fossil Fuels</li> <li>Earth's Atmosphere</li> <li>Greenhouse Effect and Global Warming</li> </ul>	<p><b><u>Heating and Cooling</u></b></p> <ul style="list-style-type: none"> <li>Temperature</li> <li>Changing Temperature</li> <li>Energy Transfer and Temperature</li> <li>Investigating Heating and Cooling</li> <li>Heating Graphs</li> <li>Cooling</li> <li>Thermal Conduction</li> <li>Measuring Thermal Conductivity</li> <li>What Affects Temperature Change</li> <li>Investigating Materials' Capacity to Store Energy</li> <li>Internal Energy</li> <li>Density Changes</li> <li>Thermal Convection</li> <li>Thermal Radiation</li> <li>Designing Systems</li> </ul> <p><b><u>Forces and Motion</u></b></p> <ul style="list-style-type: none"> <li>Revisiting Forces and Motion</li> <li>Investigating Speed</li> <li>Calculating Speed</li> <li>Relative Motion</li> <li>Speed and Distance-Time Graphs</li> <li>Changing Motion</li> <li>Drag and Streamlining</li> <li>Frictional Forces and Motion</li> <li>Falling</li> </ul>
<b>Disciplinary Knowledge 1</b> Scientific Attitudes and Ways of thinking	Describe an example of how scientific theory has developed over time, e.g. our changing understanding of photosynthesis	After data collection, scientific thinkers propose a scientific theory; it is based on a body of facts and is repeatedly confirmed by observation.	Measurement error – systemic and random Range of types of scientific method; they can be broadly categorised as to whether they test a hypothesis and if they manipulate variables, Examples of some scientific models.
<b>Disciplinary Knowledge 2</b>	When planning to test a hypothesis, a prediction can be made and the data to collect planned for,	Scientific thinkers seek to understand the limitations and strengths of models they use to explain a concept. Some models are yet tentative	Develop a line of enquiry and clarify research questions the investigation seeks to answer.

Scientific Enquiry	so that if the prediction is supported, so will the hypothesis. The risks associated with using chemicals may include harm from ingestion, breathing in or contact with eyes or skin of hazardous substances, or fire and its related potential harm.	and may likely change in the future; all models are limited in their ability to explain all aspects of reality.	Plan aspects of a method (including apparatus, techniques and the data to be collected) to answer a research question. Using datalogging. Identify the likelihood of systematic error and account for it
<b>Disciplinary Knowledge 3</b> Analytical and Evaluative Approaches	Processing data in tables by finding frequency. Students should be able to make accurate qualitative observations e.g., biological specimens. Students should be able to suggest a different method or extension to datasets related to limitations in their data.	Interpret pie charts.	Identifying the most appropriate chart or graph depending on the type of data and the line of enquiry. Make a conclusion, where appropriate, , plus: the conclusion describes any simple quantitative relationship if there is one.
<b>Disciplinary Knowledge 4</b> Applications of Science	Students should be able to give examples of how the development of technology has increased the body of scientific knowledge.	Students should be able to describe the societal and environmental implications of scientific applications.	STEM workers generally use physical, mathematical or computational models to test the effect of changes to materials or design and modify them. They consider how to optimise a solution within defined constraints such as cost.
<b>Disciplinary Knowledge 5</b> Protocols for Measurement			Unit of temperature - the kelvin (K). Derive units from the base quantities, normally expressed as products of powers of the base units as listed for Year 7, with some units having special names
<b>Spring Term</b>	<b>Biology</b>	<b>Chemistry</b>	<b>Physics</b>
Substantive knowledge	<b><u>Interactions and Inter-dependence</u></b> <ul style="list-style-type: none"> <li>• Food Chains (Biomass and Transfer)</li> <li>• Predator-Prey Relationships</li> <li>• Food Webs</li> <li>• Bioaccumulation</li> <li>• Decay and the Importance of Microorganisms</li> <li>• Carbon Cycle</li> <li>• Classification</li> <li>• Competition</li> <li>• Adaptations</li> <li>• Natural Selection</li> <li>• Evolution and Extinction</li> </ul>		<b><u>Electricity 1</u></b> <ul style="list-style-type: none"> <li>• Circuits</li> <li>• Current in Series Circuits</li> <li>• Potential Difference</li> <li>• Investigating Potential Difference</li> <li>• Power and Energy</li> <li>• Electrical Power</li> <li>• Impact of Using Domestic Electricity</li> <li>• Efficiency of Electrical Appliances</li> </ul> <b><u>Forces and Work</u></b> <ul style="list-style-type: none"> <li>• Forces and Their Effects</li> <li>• Work Done</li> <li>• Moments and Balance</li> </ul>

			<ul style="list-style-type: none"> <li>• Simple Machines</li> <li>• Hidden Forces</li> <li>• Hooke's Law</li> <li>• Pressure</li> <li>• Applied Pressure</li> </ul>
<b>Disciplinary Knowledge 1</b> Scientific Attitudes and Ways of thinking	Scientific thinkers seek evidence to support their explanations. Students should be able to identify procedures that are likely to be valid (i.e. produce evidence). Students should be able to identify how scientific claims can be judged for their validity.		Precise measurements have very little spread about the mean value; precision indicates only the extent of random error. Students should be able to decide whether measurement results are precise.
<b>Disciplinary Knowledge 2</b> Scientific Enquiry	Students should be able to assess if collected data is within expected boundaries. Students should be able to estimate the potential bias of a measuring instrument, e.g. how far the measured value is from the true value, using resolution or secondary data		Students should be able to identify equipment listed and skilfully use them. Students should be able to set up simple series circuits. Collected data can be described, for example repeatability and reproducibility and its precision and resolution
<b>Disciplinary Knowledge 3</b> Analytical and Evaluative Approaches	Students should be able to comment on the validity of conclusions.		Interpreted data that is ready for peer review includes that of all collected and processed data. The impact of random error and how to reduce it.
<b>Disciplinary Knowledge 4</b> Applications of Science	The implications for the application of science include, for example, demand for space); fertilisers and pesticides		The implications for the application of science include, for example new raw materials required for modern solutions; energy demands.
<b>Disciplinary Knowledge 5</b> Protocols for Measurement			Electric current - ampere (A) Potential difference - volt (V) Power – watt (W) Electric charge – coulomb (C) Electric resistance – ohm ( $\Omega$ ) Electrical energy consumption or production – kilowatt-hour (kWh) Moment – newton metre (Nm)
<b>Summer Term</b>	<b>Biology</b>	<b>Chemistry</b>	<b>Physics</b>

Substantive Knowledge	<p><b><u>Nutrition and Digestion</u></b></p> <ul style="list-style-type: none"> <li>• Healthy Diet</li> <li>• Consequences of Poor Diet</li> <li>• Chemistry of Food: Carbohydrates</li> <li>• Chemistry of Food: Proteins</li> <li>• Chemistry of Food: Lipids</li> <li>• Energy in Food</li> <li>• Releasing Energy from Food</li> <li>• Enzymes and the Digestive System</li> <li>• Enzymes and Chemical Digestion</li> <li>• Absorption and Transport of Nutrients</li> <li>• Factors Affecting Enzyme Action</li> <li>• Investigating Temperature and Enzyme Action</li> <li>• Making Digestion Efficient</li> </ul>	<p><b><u>Acids and Alkalis</u></b></p> <ul style="list-style-type: none"> <li>• Acids and Bases</li> <li>• Simple Indicators</li> <li>• pH Scale and Indicator Solution</li> <li>• Investigating Acids and Alkalis</li> <li>• Acid Rain</li> <li>• Reactions of Acids with Metals 1</li> <li>• Reactions of Acids with Metals 2</li> <li>• Reactions of Acids with Alkalis</li> <li>• Antacid Investigation 1</li> <li>• Antacid Investigation 2</li> <li>• Metal Oxides and Non-Metal Oxides</li> </ul>	<p><b><u>Space 1</u></b></p> <ul style="list-style-type: none"> <li>• Observations from Our Position on Earth</li> <li>• Solar System</li> <li>• Gravity</li> <li>• Calculating Weight</li> <li>• Day and Night</li> <li>• Years</li> <li>• Seasons</li> <li>• Stars and Galaxies</li> <li>• The Universe</li> <li>• Exploring Space</li> </ul>
<b>Disciplinary Knowledge 1</b> Scientific Attitudes and Ways of thinking	<p>New scientific claims (results or explanations) that are to be published must be reviewed by other expert scientists.</p> <p>Research often impacts peoples' everyday lives and, if not founded on evidence, could have negative consequences.</p>		<p>Students should be able to describe an example of how scientific theory has developed over time, e.g. transitioning from geocentric to heliocentric models in astronomy.</p>
<b>Disciplinary Knowledge 2</b> Scientific Enquiry	<p>Students should be able to use guidance to identify hazards and carry out an appropriate risk assessment.</p> <p>The risks associated with using biological matter including potential allergic reactions or harm from the ingestion of contaminated food.</p>	<p>Testing with indicators and pH indicator scales</p> <p>Students should be able to identify hazards and their associated risks and control measures for chemical substances, with guidance.</p> <p>Students should be able to use appropriate techniques to make skilful measurements for quantities</p>	<p>Students should be able to plan how to make systematic observations without changing a variable if it is not possible to do so.</p> <p>An observation can be biased either by an instrument; scientists seek to check any assumptions or pre-conceptions.</p> <p>Students should be able to identify possible observer bias.</p>
<b>Disciplinary Knowledge 3</b> Analytical and Evaluative Approaches	<p>Reducing the likelihood of random errors by,</p> <ul style="list-style-type: none"> <li>• the same experimenter completing each measurement;</li> <li>• using the same apparatus;</li> <li>• using the same technique.</li> </ul>	<p>The validity of the data and evaluating it in relation to its reproducibility.</p>	<p>Students should be able to make accurate qualitative observations e.g. celestial observations.</p>
<b>Disciplinary Knowledge 4</b> Applications of Science			<p>As technology advances, scientific researchers apply it to solve methodological and technical problems that have limited enquiries in the past.</p>

			Students should be able to give examples of how the development of technology has increased the body of scientific knowledge.
<b>Disciplinary Knowledge 5</b> Protocols for Measurement	Mass – milligram (mg) - a unit used to measure small masses. Students should be able to identify the standard unit and other commonly used units.		Gravitational field strength – newton per kilogram (N/kg) Distance travelled through space in one year by light - light-year (ly) Students should be able to identify the standard unit and other commonly used units

## Year 9

Autumn term	Biology	Chemistry	Physics
Substantive Knowledge	<p><b><u>Cells and communicable diseases</u></b></p> <p>Eukaryotic and Prokaryotic cell structure comparison. Role of each of the organelles: Nucleus Cytoplasm Cell membrane Mitochondria Ribosomes Chloroplast Vacuole Cell wall &amp; cellulose Compare plant and animal cells How cells are specialised to carry out a particular function: Sperm cell Nerve cell Muscle cell Root hair cell Xylem Phloem Importance of cell differentiation How microscopy techniques have developed How electron microscopy has increased understanding Differences in magnification and resolution Structure of the nucleus of the cell What are communicable diseases Examples of diseases caused by bacteria, virus, fungi and their symptoms. Bodies first line of defence. Disease transmission Second line of defence – phagocytes Third line of defence – lymphocytes</p>	<p><b><u>Atomic structure and periodic table</u></b></p> <ul style="list-style-type: none"> <li>• Atoms, elements, mixtures and compounds</li> <li>• Writing formulae of compounds</li> <li>• Separating mixtures – chromatography, crystallisation, distillation</li> <li>• Periodic table – organisation, history</li> <li>• Structure of the atom – history, models, isotopes and formation of ions</li> <li>• Electron arrangement and reactivity</li> <li>• Group 1 elements</li> <li>• Group 7 elements</li> <li>• Transition metals and noble gases</li> </ul>	<p><b><u>Energy I and particles</u></b></p> <ul style="list-style-type: none"> <li>• Energy resources</li> <li>• Calculating Energy efficiency</li> <li>• Calculating electrical power</li> <li>• Calculating electrical energy</li> <li>• Calculating work done</li> <li>• Calculating gravitational potential energy</li> <li>• Calculating Kinetic Energy</li> <li>• Calculating Elastic Energy</li> <li>• Particle Model</li> <li>• Density/ calculating density and core experiment on density</li> <li>• Internal energy</li> <li>• Gases and pressure</li> <li>• Brownian motion</li> <li>• Boyles Law</li> </ul> <p>Pressure will be revisited in forces year 10/11</p>

	<p>Antibodies and how they work Immunity Antibiotics and how they work Painkillers and how they work Drug testing stages Blind and double blind trials. Placebo's Plant disease</p>		
Disciplinary Knowledge	<p><u>Literacy:</u> Answering 6 mark questions. <u>Numeracy:</u> Scale calculations Magnification calculations Standard form Estimation of size Use a light microscope SA:V ratio's calculated and compared Calculate percentage gain and loss Measure rate Use percentages Measuring the area of a circle <u>Working scientifically:</u> Develop models and analogies to develop explanations of how cells divide. Evaluation of risks and benefits <u>Practical skills:</u> Recognise and draw images of cells Aseptic technique</p>	<p><u>Literacy:</u> development of vocab – see KO words in bold; AO2/AO3 style GCSE questions/long answer <u>Numeracy:</u> calculating numbers of sub atomic particles recording data in a table <u>Working scientifically:</u> making and recording practical observations; writing equations; understand how theories have developed over time; recognise the importance of peer review; use a variety of models <u>Practical skills:</u> separating a variety of mixtures</p>	<p><u>Literacy:</u> Understand Particle models <u>Numeracy:</u> Using equations Rearranging equations Converting units Applying knowledge of renewable energy to real-life situations. Calculating pressure <u>Working scientifically:</u> Measuring density of regular and irregular objects Understand what causes pressure <u>Practical skills:</u> Density required practical</p>
<b>Spring Term</b>	<b>Biology</b>	<b>Chemistry</b>	<b>Physics</b>
Substantive knowledge	<p><b><u>Supplying the cell and body systems</u></b> In this section we will learn about the human digestive system which provides the body with nutrients and the respiratory system that provides it with oxygen and removes carbon dioxide. In each case they provide dissolved materials that need to be moved quickly around the body in the blood by the circulatory system. Damage to any of these systems can be</p>	<p><b><u>What is it made of?</u></b></p> <ul style="list-style-type: none"> <li>• Difference between pure/impure substances</li> <li>• What a formulation is and how they are important in everyday life</li> <li>• Principles and uses of chromatography- inc. RP</li> <li>• Identification of common gases- Carbon dioxide, hydrogen, oxygen and chlorine.</li> </ul>	<p><b><u>Electricity and Magnetism</u></b></p> <ul style="list-style-type: none"> <li>• Circuit symbols</li> <li>• Electric current</li> <li>• How resistance affects current</li> <li>• I-V characteristics and ohmic conductors</li> <li>• Like poles repel, unlike poles attract</li> <li>• Magnetic field lines</li> <li>• Permanent and temporary magnets</li> </ul>

	<p>debilitating if not fatal. Although there has been huge progress in surgical techniques, especially with regard to coronary heart disease, many interventions would not be necessary if individuals reduced their risks through improved diet and lifestyle.</p> <p>4.1.3.1 Diffusion 4.1.3.3 Active transport 4.2.1 Principles of organisation</p>	<ul style="list-style-type: none"> <li>• What is conservation of mass, Conservation of mass in chemical equations and how this relates to balanced symbol equations</li> <li>• How to calculate relative formula mass</li> <li>• How to calculate percentage mass</li> </ul>	<ul style="list-style-type: none"> <li>• Strength and shape of a magnetic field</li> <li>• Electromagnets</li> </ul>
Disciplinary Knowledge	<p><u>Literacy:</u> HW literacy task – girl born with no blood New vocab linked to each system – knowledge organisers and key word list available.</p> <p><u>Numeracy:</u> calculation of surface area to volume ratio Graph plotting rate calculations (enzyme required practical)</p> <p><u>Working scientifically:</u> <u>Required practical</u></p> <ol style="list-style-type: none"> <li>1. <u>Food tests</u> – analysing data and interpreting results, working safely</li> <li>2. <u>Enzymes</u> – identifying variables, planning an investigation, analysis and evaluation of results</li> </ol>	<p><u>Literacy:</u> Interpreting a method, comparison of formulations. Development of vocab- see key words on knowledge organiser. Opportunity for AO2/AO3 style GCSE questions</p> <p><u>Numeracy:</u> Measuring from a thermometer- potential purity practical Addition when calculating relative formula mass Calculating percentages Division when calculating rf values Measuring using a ruler/changing units when identifying distances moved by substance/solvent Recognise importance of scientific quantities and understand how they are determined Writing equations Using appropriate significant figures in answers</p> <p><u>Working scientifically:</u> Developing a method to determine if the formulation for a substance really does matter.</p> <p><u>Practical skills:</u> Chromatography required practical Formulations practical Use balance to prove conservation of mass where no reactants or products are gases in a closed system.</p>	<p><u>Literacy:</u></p> <p><u>Numeracy:</u> plotting graphs, linear relationships, calculations of current, voltage and resistance.</p> <p><u>Working scientifically:</u></p> <p>Practical skills – use a plotting compass to map a magnetic field</p>
Summer Term	Biology	Chemistry	Physics

Disciplinary Knowledge		<p><b><u>The Earth's atmosphere</u></b></p> <ul style="list-style-type: none"> <li>• Evolution of the atmosphere</li> <li>• Composition of the atmosphere</li> <li>• Greenhouse gases and the greenhouse gas effect</li> <li>• Climate change</li> <li>• Carbon footprint</li> <li>• Complete and incomplete combustion</li> <li>• Atmospheric pollutants</li> </ul>	<p><b><u>Forces I</u></b></p> <ul style="list-style-type: none"> <li>• Scalar and vector quantities</li> <li>• Contact and non-contact forces</li> <li>• Weight and gravitational fields</li> <li>• Calculating the weight of an object</li> <li>• Resultant force</li> <li>• Definition of a joule</li> <li>• Work done and energy transfer</li> <li>• Calculating the work done when a force moves an object</li> <li>• Thinking distance, braking distance and stopping distances.</li> <li>• Reaction times and thinking distance</li> <li>• Braking distance</li> <li>• Energy transfers when stopping</li> </ul>
Key Disciplinary Skills		<p>Balance equations for combustion          Use evidence and graphs to conclude information          using and finding reputable scientific resources about climate change          have an understanding about the world around them and how the atmosphere has changed</p>	<p>Literacy          Numeracy: calculations; use of calculator, rearranging equations          Working scientifically: use of units          Practical skills</p>

**Year 10 – AQA GCSE Combined Science Trilogy**

	<b>Biology</b>	<b>Chemistry</b>	<b>Physics</b>
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<p>Substantive Knowledge</p>	<p><b><u>Bioenergetics</u></b></p> <ul style="list-style-type: none"> <li>• Photosynthesis</li> <li>• Respiration</li> </ul> <p>Students learn that plants can harness the Sun's energy in photosynthesis to make food. That this process liberates oxygen which has built up over millions of years in the Earth's atmosphere. Both animals and plants use this oxygen to oxidise food in a process called aerobic respiration which transfers the energy that the organism needs to perform its functions. That anaerobic respiration and lactic acid in muscles causes fatigue.</p> <p><b><u>Infection and response</u></b></p> <ul style="list-style-type: none"> <li>• Pathogens</li> <li>• Disease</li> <li>• Immune system</li> </ul> <p>Students learn that pathogens are microorganisms such as viruses and bacteria that cause infectious diseases in animals and plants. Students learn that microbes can produce toxins that damage tissues and make us feel ill. Students will explore how we can avoid diseases by reducing contact with them, as well as how the body uses barriers against pathogens. Students study the function of the immune system. The look at the risks from unusual or dangerous diseases, the role of vaccination and antibiotics.</p> <p><b><u>Inheritance, variation and Evolution</u></b></p> <ul style="list-style-type: none"> <li>• Reproduction</li> <li>• Cell division including revisiting mitosis and meiosis</li> <li>• Genetics</li> <li>• Evolution</li> </ul>	<p><b><u>Quantitative Chemistry</u></b></p> <ul style="list-style-type: none"> <li>• Compound formulae</li> <li>• Reaction equations</li> <li>• Chemical symbols</li> </ul> <p>Students use quantitative analysis to determine the formulae of compounds and the equations for reactions.</p> <p>Chemical reactions can be classified in various ways. Identifying different types of chemical reaction allows chemists to make sense of how different chemicals react together, to establish patterns and to make predictions about the behaviour of other chemicals.</p> <p><b><u>Chemical changes</u></b></p> <ul style="list-style-type: none"> <li>• Predictions</li> <li>• Complex reactions</li> </ul> <p>Students learn that experimenting with chemical reactions in a systematic way and organizing their results logically.</p> <p>Students learn about the reaction of metal with oxygen and acids.</p> <p>Students learn about the reaction of metal oxide and metal carbonates acids.</p> <p>Students learn about new materials and processes.</p> <p>Understand the complex reactions that take place in living organisms. The extraction of important resources from the earth.</p> <p><b><u>Energy Changes</u></b></p> <ul style="list-style-type: none"> <li>• Energy transfer</li> <li>• Electricity production</li> </ul> <p>Students learn that energy changes are an important part of chemical reactions. About the transfer of energy leading to the breaking and formation of bonds. Students study Exothermic reactions and Endothermic reactions. Students</p>	<p><b><u>Electricity</u></b></p> <ul style="list-style-type: none"> <li>• Charge</li> <li>• Conduction</li> <li>• Circuits</li> <li>• Power</li> </ul> <p>Students learn that electric charge is a fundamental property of matter everywhere. That the difference in the microstructure of conductors, semiconductors and insulators makes it possible to design components and build electric circuits.</p> <p>Students learn that electrical power fills the modern world with artificial light and sound, information and entertainment, remote sensing, and control.</p> <p><b><u>Atomic structure</u></b></p> <ul style="list-style-type: none"> <li>• Nuclear forces</li> <li>• Radiation</li> </ul> <p>Students learn about the structure of the atom, nuclear forces and stability.</p> <p>Students learn about ionising radiation, that it is hazardous but can be very useful. They will learn about the discovery of radiation and how ideas about radiation have changed. Early researchers suffered from their exposure to ionising radiation. Students learn how radioactive materials are used in medicine, industry, agriculture and electrical power generation.</p> <p><b><u>Forces and application</u></b></p> <ul style="list-style-type: none"> <li>• Elasticity</li> <li>• Pressure</li> </ul> <p>Students learn about work done and energy transfer. They will investigate Forces and elasticity. They will also study pressure in a fluid and atmospheric pressure.</p>
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	<p>Students learn about sexual and asexual reproduction. Students will learn about DNA and the human genome.</p> <p>Students learn how to draw genetic cross diagrams and determine gender from them.</p> <p>Students study genetic inheritance and genetic diseases.</p> <p>Students study selective breeding and assess its impact. Students learn about classification and Variation.</p> <p>Students study Evolution and Evidence for evolution. Fossils and Extinction.</p> <p>Students learn about antibiotic resistant bacteria and how they have evolved.</p> <p>Students study genetic engineering</p>	<p>learn about heating and cooling effect in a range of everyday applications.</p> <p>Students learn that some interactions between ions in an electrolyte result in the production of electricity and how cells and batteries use these chemical reactions to provide electricity.</p> <p><b><u>The rate and extent of chemical reaction</u></b></p> <ul style="list-style-type: none"> <li>• Activation Energy</li> <li>• Energy change</li> <li>• Equilibrium</li> </ul> <p>Students learn about collision theory and activation energy. They study the factors which affect the rate of chemical reactions including heat, concentration, surface area catalysts and pressure.</p> <p>Students will calculate the rate of reaction and study reversible reactions and energy changes and reversible reactions.</p> <p><b>Higher tier - The effect of changing concentration/temperature/pressure on equilibrium</b></p>	
Disciplinary Knowledge	<p><b>Required practical - Photosynthesis</b></p> <ul style="list-style-type: none"> <li>• Make observation and drawing of a transverse section of leaf.</li> <li>• Process data from investigations involving stomata and transpiration rates to find arithmetic means.</li> <li>• Use different sampling techniques and calculate surface areas and volumes.</li> </ul> <p>Solve simple algebraic equations.</p>	<p><b>Required practical - Preparation of a pure, dry sample of a soluble salt</b></p> <ul style="list-style-type: none"> <li>• Investigate pH changes when a strong acid neutralises a strong alkali.</li> <li>• Recognise and use expressions in decimal form.</li> <li>• Use ratios, fractions and percentages.</li> <li>• Make estimates of the results of simple calculations.</li> <li>• Translate information between graphical and numeric form.</li> <li>• Mixing of reagents to explore chemical changes and/or products.</li> </ul> <p><b>Required practical - Electrolysis</b></p>	<p><b>Required practical - Resistance of a wire</b></p> <ul style="list-style-type: none"> <li>• Translate information between graphical and numeric form.</li> </ul> <p><b>Required practical - Investigate I–V characteristics of a variety of circuit elements</b></p> <ul style="list-style-type: none"> <li>• Assess danger from different radioactive sources.</li> <li>• Model half-life</li> <li>• Draw half-life graphs</li> </ul> <p><b>Required practical - Force and extension</b></p> <ul style="list-style-type: none"> <li>• Plan experiments or devise procedures.</li> <li>• Carry out experiments with correct manipulation of apparatus, the accuracy of</li> </ul>

		<ul style="list-style-type: none"> <li>• Safe use of a range of equipment to separate chemical mixtures.</li> <li>• Explain how testing a prediction can support or refute a new scientific idea.</li> </ul> <p><b>Required practical - Exothermic and Endothermic reaction investigation</b></p> <ul style="list-style-type: none"> <li>• Drawing and interpreting appropriate graphs from data to determine rate of reaction.</li> <li>• Plot two variables from experimental or other data.</li> <li>• Determine the slope and intercept of a linear graph.</li> <li>• Draw and use the slope of a tangent to a curve as a measure of rate of change</li> </ul>	<p>measurements and health and safety considerations.</p> <ul style="list-style-type: none"> <li>• Translate data from one form to another.</li> <li>• Plot two variables from experimental or other data</li> <li>• Carry out and represent mathematical and statistical analysis.</li> <li>• Use an appropriate number of significant figures in calculation.</li> </ul>
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### Year 11 AQA GCSE Combined Science Trilogy

	<b>Biology</b>	<b>Chemistry</b>	<b>Physics</b>
Substantive Knowledge	<p><b><u>Ecology</u></b></p> <ul style="list-style-type: none"> <li>• Abiotic and biotic factors</li> <li>• Adaptation</li> <li>• Decomposition</li> <li>• Biodiversity</li> </ul> <p>Students learn about communities and levels of organization. Students learn about adaptations how they help organisms survive. Students study how materials are cycled and decomposition. They will look at waste management, land use, deforestation and revisit global warming. Students learn about the importance of biodiversity and maintaining biodiversity.</p> <p><b><u>Homeostasis and response</u></b></p> <ul style="list-style-type: none"> <li>• Nervous system</li> </ul>	<p><b><u>Organic chemistry</u></b></p> <ul style="list-style-type: none"> <li>• Fossil Fuels</li> <li>• Distillation</li> <li>• Hydrocarbons</li> <li>• Alkenes and polymerisation</li> </ul> <p>Students learn about the process of fossil fuel formation. The naming systems for alkanes and alkenes. Students build on their knowledge of separation techniques and look at the fractional distillation process. Students learn to describe the patterns in the fractions from crude oil in terms of flammability, boiling point, colour and viscosity. Students study the properties and structures of hydrocarbons – Alkanes and Alkenes. Students learn about the cracking process including the conditions.</p>	<p><b><u>Forces and motion</u></b></p> <ul style="list-style-type: none"> <li>• Scalars and vectors</li> <li>• Motion change</li> <li>• Pressure</li> <li>• Newton’s Laws</li> <li>• Momentum</li> </ul> <p>Students learn about scalar and vector quantities. Students identify examples of contact and non-contact forces. Students learn about gravity, balanced and unbalanced and they develop their ability to draw forces diagrams. Students will use force diagrams to calculate resultant force and predict motion changes. Students learn to describe motion along a line and calculate. Students draw and interpret distance-time graphs and speed time graphs. Students will measure acceleration and factors effecting it.</p>

	<ul style="list-style-type: none"> <li>• Glucose</li> <li>• Hormones</li> </ul> <p>Students learn about the human endocrine system and the importance of homeostasis. Students learn the structure and function of the nervous system.</p> <p>Students learn about the control of blood glucose concentration and diabetes.</p> <p>Students study hormones in human reproduction and contraception.</p> <p><b>Higher tier - The use of hormones to treat infertility. Negative feedback.</b></p>	<p><b><u>Chemical analysis</u></b></p> <ul style="list-style-type: none"> <li>• Formulations</li> <li>• Chromatography</li> </ul> <p>Students learn about pure substances and define formulations. Students study chromatography and gas tests. They will complete gas test for hydrogen, oxygen and carbon dioxide. Students will also learn about tests for chlorine gas.</p> <p><b><u>Chemistry of the Earth's Atmosphere</u></b></p> <ul style="list-style-type: none"> <li>• Composition and change</li> <li>• Pollutants</li> </ul> <p>Students learn about the composition of the Earth's atmosphere and how it has changed. They will revisit oxygen production and photosynthesis, carbon dioxide the role plants play in reducing the level in the atmosphere.</p> <p>Students learn about the greenhouse gases and climate change. Students learn about their carbon footprint and its reduction.</p> <p><b><u>Using the Earth's resources</u></b></p> <ul style="list-style-type: none"> <li>• Classification</li> <li>• Water Treatment</li> </ul> <p>Students learn to identify resources required for life on Earth. Resources will be classified as finite/renewable/sustainable.</p> <p>Students learn about potable water and water treatment methods.</p> <p>Students study the Life cycle assessment and carry them out. They will also look at ways of reducing the use of resources.</p> <p><b>Higher tier - Alternative methods of extracting metals.</b></p>	<p>Students learn Newton's Laws of motion and factors affecting braking distance and stopping distance.</p> <p><b>Higher tier - Momentum is a property of moving objects. Conservation of momentum. Pressure in a fluids.</b></p> <p><b><u>Waves</u></b></p> <ul style="list-style-type: none"> <li>• Properties</li> <li>• Emission and absorption</li> </ul> <p>Students learn about examples of transverse and longitudinal waves. They will study the properties of waves.</p> <p>Students learn about types of electromagnetic waves, their properties and the uses and applications of electromagnetic waves. Students will investigate the emission and absorption of infrared radiation.</p> <p><b><u>Magnets and Electromagnets</u></b></p> <ul style="list-style-type: none"> <li>• Poles</li> <li>• Fields</li> <li>• Electromagnetism</li> </ul> <p>Students learn about the poles of a magnet, magnetic fields and how to view them. Students learn about the movement of poles within a magnetic field. Students investigate factors affecting electromagnetism.</p> <p><b>Higher tier - Fleming's left-hand rule, Electric motors.</b></p>
Disciplinary Knowledge	<p><b>Required practical - Reaction time, Variables</b></p> <ul style="list-style-type: none"> <li>• Use of apparatus, recording measurements.</li> </ul>	<p><b>Required practical - Water Purification</b></p> <ul style="list-style-type: none"> <li>• Use of appropriate apparatus</li> <li>• Measurement of pH in different situations.</li> </ul>	<p><b>Required practical – Acceleration</b></p> <ul style="list-style-type: none"> <li>• Use apparatus and techniques to measure motion.</li> </ul>

	<ul style="list-style-type: none"> <li>• Safe and ethical use of a living organisms (plants or animals).</li> <li>• Translate data into graphs.</li> </ul> <p><b>Required practical - Field investigations</b></p> <ul style="list-style-type: none"> <li>• Use of apparatus, recording measurements</li> <li>• Safe and ethical use of a living organisms (plants or animals)</li> <li>• Use sampling techniques to study distribution and abundance of organisms.</li> <li>• Develop hypotheses.</li> <li>• Plan experiments to test hypotheses.</li> <li>• Use of transects and quadrats.</li> <li>• Estimates of population size.</li> <li>• Understand principles of sampling.</li> <li>• Use mean, mode and median.</li> <li>• Plot and draw appropriate graphs.</li> </ul>	<ul style="list-style-type: none"> <li>• Draw conclusion from data collected.</li> <li>• Separate chemical mixtures including. evaporation/distillation and chromatography</li> <li>• Safe use of appropriate heating devices.</li> </ul> <p><b>Required practical – Chromatography</b></p> <ul style="list-style-type: none"> <li>• Separate chemical mixtures including. evaporation/distillation and chromatography</li> <li>• Record a range of measurements accurately.</li> </ul>	<ul style="list-style-type: none"> <li>• Develop hypotheses.</li> <li>• Evaluate methods and suggest possible improvements.</li> <li>• Present and interpret observations and data.</li> <li>• Present reasoned explanations including relating data to hypotheses.</li> <li>• Use SI units.</li> </ul> <p><b>Required practical – Waves</b></p> <ul style="list-style-type: none"> <li>• Use of appropriate apparatus</li> </ul> <p>Present observations and other data using appropriate methods.</p>
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#### Years 10/ 11 GCSE Biology

The additional parts are taught within the unit that they are in and are as follows:

B3 – monoclonal antibodies, plant disease

B5 – brain, the eye, control of body temperature, hormone responses in plants

B6 sexual vs asexual reproduction in plants, DNA and mutations, theories of evolution

B7 decay and required practical, trophic levels in an ecosystem, food production

#### Years 10/11 Chemistry

The additional parts are taught within the unit that they are in and are as follows:

C2 - nanotechnology

C3 – atom economy and % yield, using concentrations of solutions and titration required practical

C4 – titrations

C5 – chemical cells and fuel cells

C7 – reactions of alkenes and alcohols, synthetic and naturally occurring polymers

C8 – identification of ions by analysis and instrumental techniques

C10 – using materials, the Haber process and the use of NPK fertilisers

#### Years 10/11 Physics

The additional parts are taught within the unit that they are in and are as follows:

Electricity – static electricity

Particle model – pressure

Atomic structure - hazards and uses of radioactive emissions and background radiation

Forces – moments, forces and gears, pressure and pressure differences in fluid, velocity-time graphs, momentum

Waves – some parts of waves in air, fluids and solid, convex and concave lenses,

Magnetism and electromagnetism – interpret diagrams of electromagnetic devices, induced potential, the National grid and transformers

Space – the whole unit! Solar system, stability of orbital motions, satellites and red shift