Long term plan: Topic overview

Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Year seven					
C1	C2	C3	C4	B1	B2	B3	B4	P1	P2	P3	M1
Year eight					
P4	P5	P6	P7	C5a	C6	C7	C8	C9	C5b	B5	B6	B7	B8	B9

Year 7 Long term plan: Chemistry

Brief overview
Year 7 begins by giving students a observable characteristic used to identify a substance (melting point behaviour) and an experience of observing the difference between a substance and a mixture. This distinction is built up by working through separation techniques first encountered in KS2. Students will learn that substances (not materials) can exist in all three states of matter and how this relates to the particle model. Once students have built a sense of concept for "substance" we look at some different ways substances are classified by their structure and properties. C2 also introduces the representation of substances using formula. C3 develops the idea that substances have distinct properties by looking at solubility and introducing students to how properties can be quantified and represented on graphs to explore trends and make predictions. C4 builds up students concept of "chemical change" giving students experience of thinking using the chemistry "triplet" – observations, representations and sub microscopic models.

Unit	C1	C2	C3	C4
Unit title	Substances and mixtures	Substances	Solubility	Introducing chemical change
Big question/ core concept	What are substances? Core concept: Substance	What are substances? Core concept: substance What gives substances their properties? Core concept: Bonding (holding power)	What are substances? Core concept; substance What gives substances their properties? Core concept: bonding (holding power)	What is chemical change? Core concept: chemical change
Relevant end points	• Most materials are mixtures • Materials made of single substance start and finish melting at the same temperature • Every substance has a melting point	• Substances can be classified into different groups by their properties and structure • Substances are made of atoms • Substances melting points depend on their sub-microscopic structure	• Every substance has a measurable solubility in water. (This is distinct property of a substance)	• Atoms are rearranged to form new substances • New substances formed in a chemical change have new properties
Core substantive knowledge	• Substances can exist in three states of matter • Mixtures can be separated into substances • Different techniques separate different types of mixture • Solutions are clear mixtures of a solvent and solute • Particle model for liquids solids and gases • Brownian motion	• Substances are made of atoms • Elements can be metals of non-metals • Metals have giant substances so have high melting points • Non metals have molecular structures so have low mpts • Substances can be compounds or elements • Chemical reactions can rearrange atoms to form new substances	• Properties can be measured and given numerical values • Solubility of a substance depends on temperature • Dissolving happens without stirring • Dissolving is the result of the intrinsic motion of particles in the liquid state	• Word equations • Symbol equations • Particle representations of symbol equations • Multipliers (molecular substances) • State symbols • Conservation of atoms/mass in a chemical change • Precipitation (if insoluble products formed)
Core disciplinary knowledge	• Simple procedural processes for separation **techniques** • Particle **model** (as model of the sub macroscopic) • **Investigation:** Brownian motion as observational evidence of particle model	• Chemicals use symbols and formula to **represent** substances • Chemists **classify** substances into groups based on properties and structure • Chemists **classify** changes as physical or chemical	• Chemists quantify solubility **mathematically** to show trends • Graphs are used to analyse trends mathematically and make predictions • How to interpret and **analyse** graphs • That chemists make use measurement **techniques**	• Chemists link the representational, sub microscopic model and observations Reinforcing: • **Representational** • Sub microscopic **Models** • **Observations (**qualitative)

Year 7 Long term plan: Biology

Brief overview
Year 7 biology begins by revisiting students knoweldge of organisms as "living things" which show the "characteristics of living organisms" before using extensive microscope work to establish a more meaningful criteria for life – being made of cells. Students look at classification of animal cells and plant cells (including why this can be challenging) and the basic structures of these cell types. They idea of the cytoplasm and cell membrane are developed by linking to students knoweldge of the particle model to build an explanation for diffusion into and out of cells. Unit B3 develops these ideas to look at how organ systems in the human body work together to provide the substances needed for respiration to every cell. Units B2 uses the family to build a concept of genetic inheritance and the genome, including how genetics and the environment shape similarities and differences in the family. B4 looks are variation within species and how species has changed over time – including how biologists gather and interpret evidence. B4 includes students first longer form investigation at KS3.

Unit	B1	B2	B3	B4
Unit title	Cells the unit of life	Inheritance and the genome	From cells to organ systems	Variation through time
Big question/ core concept	What are organisms made of Core concept: cells	How do organisms grow and reproduce? Core concept: inheritance	What are organisms made of? Core concept: cells	Why are organisms so diverse? Core concept: evolution
Relevant end points	• All life is made of cells • Microscopes can be used to observe cells • Cells are dynamic and exchange substances with their surroundings	• All organisms in a species show variation • Variation can be caused by genetic information, the environment or both • Our genome is inherited from our parents (50% from each)	• Multicellular organisms contain organ systems • Organ systems have a specific function • Organ systems work together to maintain the conditions of life for all cells	• Members of a species can reproduce fertile young • Genetic inheritance only occurs across generations within a species • Species have gradually changed over billions of years
Core substantive knowledge	• Seven characteristics of living organisms • Typical structures of animal and plant cells • Basic functions of sub-cellular structures • Cytoplasm is a dynamic fluid (particle model) • Diffusion – particle model explanation • Structure of cell membrane enables transport of small molecules.	• Genome is all the genetic information in an organism • Role of environment and genetic inheritance in explaining similarity and difference in families • Genome is stored on DNA in the nucleus of (most) body cells • DNA is organised into chromosomes • DNA is a class of chemical and can be extracted	• Levels of organisation in animals and plants • Mechanism of breathing and adaptions for gas exchange • Structure of digestive system and function of small intestine • Role of enzymes in producing small nutrients which can be absorbed • Role of circulatory system • Role of muscular skeletal system	• Variation can be continuous or discrete • Definition of a species • Scientists use fossil evidence to study the past • Most fossils are mineralised remains of hard body parts • The fossil record is incomplete
Core disciplinary knowledge	• **Procedures** for preparing and viewing tissue slides • **classification** into animal and plant cells • **Models** can be used to explain processes (diffusion) • Biologists study life at the level of cells and biological molecules	• **Investigation:** how to follow a written method • How evidence was used to establish a **model** of DNA • There is a cross over between the study of chemistry and biology when looking at biological molecules	• Dissection provides **qualitative** evidence of the internal structure of organisms • **Models** can help us explain the functioning of biological systems • Biologists have to source organisms for dissection **ethnically** • Biologists can study live at different levels of organisation	• Collection of large-scale **quantitative** data for **analysis.** • Difference between correlation and cause • **Analysis:** Conventions for producing scatter graphs. • Collection of data (fossils) to look for **qualitative** changes

Year 7 Long term plan: Physics

Brief overview
Year 7 Physics begins by studying two of our most important core concepts – force and energy. The unit starts by checking KS2 knoweldge and distinguishing force from other concepts related to motion. The early lessons on force are designed to displace commons around force and motion. This is done by exploring equilibrium situations between weight and the normal contact force before studying the effect of friction in some depth. The second half of P1 develops students concept of energy as the "cost" of getting things done before exploring the different energy stores and simple transfers qualitatively. P2 gives students a deeper understanding of two "waves" (term not introduced) that they will have encountered at KS2 – sound and light. The unit explores how both transmit information from source to observer and dissipate (spread out) with distance from a source. Our final unit of Y7 looks at temperature through students knowledge of the particle model (from C1) and use it to explain the idea of heating and thermal stores of energy.

Unit	P1	P2	P3
Unit title	Force and energy	Sound and Light	Heating and cooling
Big question/ core concept	Why do things move and change? Core concepts: force and energy	How does information and energy spread? Core concept: waves (term not introduced in unit)	What is matter? Core concept(s): matter and energy
Relevant end points	• Objects at "equilibrium" the forces on it are balanced • Unbalanced forces cause a change in motion • Friction is a force that acts against motion • Energy stores can be used to predict how much a system can change	• Sound and light transfer information from source to observer • Both sound and light radiate from a source and become more spread out with distance.	• (Particle model of) temperature • (Particle model of) Thermal stores of energy
Core substantive knowledge	• Forces are represented with arrows and measured in newtons • Difference between force and (momentum) • Weight is a force that is pulling down • The normal contact force keeps objects in equilibrium if they are resting on a solid surface. • An object at equilibrium can be moving or stationary • The force of friction acts against motion • Fuels are "used up" but energy is transferred • Key energy stores and describing transfers	• Vibrating sources produce sound • Sound travels through a medium as vibrations • Sound travels best through mediums in their solid or liquid states • Light can reflect or "scatter" off surfaces. • The passive eye model of sight • Sun light as "white light" and how colours of light combine • Why objects appear coloured under different sources of light	• What temperature is • Thermal expansion (and how a thermometer works) • Heating as an energy transfer • Dissipation of heat • Thermal conduction • Insulators
Core disciplinary knowledge	• Representation in physics (force diagrams) • **Investigations**: controlling variables • **Analysis** of data to draw conclusions • Physics uses **mathematical** models to explain changes • Forces are an explanation which applies to a very wide range of situations • Energy is a **model** not an explanation	• **Measurement**: using a prism to observe the spectrum of light (evidence of "white" light) • **Procedures:** how to use a ray box to investigate light • **Measurement:** observations of objects under different colours as evidence of how we perceive colour using information from light	• How a thermometer **measures** temperature • **Measurement**: how to measure temperature • **Analysis**: and interpretation of line graphs

Year 7 Long term plan: “Materials science”

Brief overview
After their end of year 7 exams students study a short unit on materials science. This aims to reinforce students knoweldge of our big question “what are substances” by using the concept of “substance” to inform students understanding of what a “material” is. Studying material science provides an opportunity to discuss the technological products of scientific knoweldge.

Unit	M1
Unit title	Substances and mixtures
Big question/ core concept	What are substances? Core concept: Substance
Relevant end points	• Most materials are mixtures • Materials made of single substance start and finish melting at the same temperature • Substances rather than materials have clearly defined “states of matter”
Core substantive knowledge	• Materials are classified based on their properties • Materials are usually made of more than one substance • Composite materials are made of more than one material • Properties of ceramics, metals and polymers • Gels and pastes are a mixture of substances in solid and liquid states
Core disciplinary knowledge	• Materials science is an “inter-disciplinary” field of science • Chemists' **classification** of states of matter applies to substances rather than materials • Materials scientists have their own forms of **classification** based on what they are studying

Long term plan: Year 7 breakdown by lesson

Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
L1. Introduction to science L2. KS2 Chemistry & pre-request knowledge test. (optional) **Topic C1: What are substances and mixtures** L1. What are substances? L2 Are all materials pure substances? L3. Do things disappear when they dissolve? L4. Can we prove if an ink is pure? L5. What is melting? L6. What is boiling? L7. How does a filter work? L8. Can we prove gases are made of particles? L9. Can we separate the salt from the sea? L10. Can we separate the cherry from the cherry coke? L11. Cherry coke practical (optional) L12. End of topic test C1 L13 Master and feedback **Topic C2: What are substances?** L1. What are elements? L2. Why do metals have high melting points? L3. Why are there so many substances? L4. What is the difference between a compound and a mixture? L5. How do chemists represent substances? L6. What do chemical formulas represent? L7. How is chemical change different from physical change? L8. How do chemical changes form new substances? L9. EOTT What are substances. L10. Feedback and mastery	**Topic C3: Solubility** L1. Why do some substances dissolve L2. How can we increase solubility? L3. How do we use graphs of solubility (optional) **Topic C4: What are chemical reactions** L1. How do we represent chemical change? L2. How can equations help us observe reactions? L3. What do symbol equations represent? L4. What happens to mass in a chemical equation? (optional) L5. How does the solubility of substances effect our observations? L6. What happens to mass in a reaction (Pt2 if complete option lesson). L7. EOTT C4 (or optional OCL assessment point). L8. Feedback and mastery **Topic B1: Cells – the unit of life** L1. What makes something alive L2. What are all living things made of? L3. What are animals made of? L4. What are plants made of? L5. Why can we not see cells? L6. How many types of cell are there? L7. How does a cell get what it needs to stay alive? L8. How do substances move in and out of a cell?	Mid year OCL assessment (optional) **Topic B2: Inheritance and the genome** L1. What makes us all unique? L2. What characteristics can be inherited L3. Where is our genome stored? L4. Can we see the DNA in fruit? L5. EOTT B1 & B2 L6. Mastery and feedback **Topic B3: From cells to organ systems** L1. What are we made of? L2. What are other organisms made of? L3. How does our digestive system work? L4. How does our digestive system keep us alive? L5. How do our lungs work? L6. Why do we need to breathe? L7. How do substances get around the body? L8. Why do we need a circulatory system? L9 Are our bones made of cells? L10 How do we move? L11 (Optional) Rat dissection L11. EOTT B3 L12. Mastery and feedback	**Topic B4: variation.** L1. What is a species? L2. Investigating variation Pt 1 L3. Investigating variation Pt 2 L4. What are fossils? L5 What can the fossil record show us? L6. EOTT Variation L7. Mastery and feedback **Topic P1: Forces & energy** L1. What are forces? L2. How do we represent forces? L3. Why are some objects stationary? L4. When do objects change their motion? L5. Can we predict how an objects motion will change? L6. Why do things stop moving? L7. Can we reduce friction? L8. Investigating friction Pt 1 L9 Investigating friction Pt 2 L10. What is the cost of moving? L11. What are the different stores of energy?	***P1 continued*** L12. What happens to energy when forces move an object L13. Why do moving objects heat up? L14. Describing energy transfers (optional) L15. EOTT P1 L16. Mastery and feedback **Topic P2: Sound and light** L1. What is sound L2. Why can we hear better under water? L3. Why do we get shadows? L4. How does light fill a room? L5. Why are some objects reflective? L6. How do we "see" objects L7. How do we get different colours of light? L8. What colour is sun light? L9. Why do some objects appear black? L10. Why do some objects appear coloured? L11. EOTT Sound and Light L12 Mastery & feedback	End of year OCL assessment **Topic P3: Heating and cooling** L1. What is temperature? L2. How do thermometers work? L3. How do objects cool? L4. Why are some materials good conductors? L5. What is the difference between temperature and energy? L6. (optional) Are some materials better at storing energy. **Topic: Material science** L1. (optional) materials and substances L2. Composite materials L3. Polymers, ceramics and metals L4 (optional) Gels and paste L5 (optional) investigating properties of polymers L6 (optional) investigating properties of polymers pt2

Year 8 Long term plan: Physics

Brief overview				
We start by introducing one of our big questions (space) that students will not have covered since KS3. This first topic uses prerequisite knowledge of forces and radiation to build a sense of where we are in the universe and how the motion of bodies in space shapes our perspective. The remaining topics develop big questions that were first encountered in Y7. "Why do things move and change" l being covered in both P5 and P7. P5 looking first at ideas around motion and distance time graphs before P7 looks at explaining common scenarios using force such a surface supporting a weight; extension of a springy material and levers. Unit P6 returns to the idea of the ray model of light deepening students understanding of how light radiates and exploring the different ways "images" can be produced. Students also learn how to use ray boxes and lasers to investigate images, reflection and refraction.				
Unit	**P4**	**P5**	**P6**	**P7**
Unit title	Where are we in space?	Moving by Force	How do we make images	More on Forces
Big question/ core concept	Where are we in space? Core concepts: Space	Why do things move and change? Core concepts: force and energy	How does information and energy spread? Core concept: waves	Why do things move and change? Core concepts: force and energy
Relevant end points	• The Earth is a sphere, and we live on its surface • Gravity exerts a pulling force towards the centre of an object and is dependent on its mass • The orbits of planets are caused by gravity	• Distance = speed x time • Distance time graphs can be used to represent the motion of an object • Acceleration is a how quickly the speed of an object is changing	• Light rays are imaginary lines which show the path and direction light can travel along • Light can produce 'images' of real objects in different ways	• Weight (N) = mass x strength of gravity • Simple machines (levers) can increase the turning effect of a force • The extension of a spring is proportional to the force exerted on it
Core substantive knowledge	• Stars are nuclear stores of energy that radiate light • Night and day are caused by the rotation of the earth • Seasons are caused by changes to the "tilt" of the earth as it orbits the sun • The solar system is a tiny part of a much larger galaxy • The universe is all of space and everything in it	• A horizontal line on a D-T graph shows an object is stationary • A straight-line sloping shows an object moving at a constant speed • A curved line shows an object that is accelerating • Drag is the result of particles exerting a pushing force on an object	• Why a pin hole camera (or eye) produces images which are upside down and back to front • The law of reflection (angle of incidence = angle of reflection • Light refracts (changes direction) • Lenses can refract light and produce an image	• Mass is a measure of the "amount" of matter in a material. Units: Kg • The force needed to support an object is equal to its weight • Turning force = force x distance from pivot • Elastic objects can return to its original size and shape after being distorted. • Surfaces produce a "contact force" because they become squashed at a microscopic level
Core disciplinary knowledge	• Gravity is an example of a powerful physics **explanation** in that applies in all known situations everywhere in the universe	• **Mathematical formulation**: many ides in physics can be expressed as mathematical equations • **Analysis:** the conventions for representing and interpreting movement using DT graphs	• Light rays are a way of **modelling** the behaviour of light • **Mathematical formulation**: many ideas in physics can be expressed as mathematical equations • **Procedures:** How to use lasers and ray boxes to investigate light • Independent and dependent variables in investigations & **reproducible experiments**	Graphs allow us to spot patterns and **analyse** data • A straight line on a graph shows the change in the dependent variable is proportional to the change in the independent variable • A curved line shows the change in the dependent variable is not proportional to the change in the independent variable

Year 8 Long term plan: Chemistry

Brief overview`
Year 8 develops the fundamentals established in Y7 to explore how chemistry shapes our planet. We start and finish with unit C5 (part A and B) which begins with looking the structure of the earth (or geosphere) and how it has changed over geological time scales (dynamic earth). Students look at minerals as an example of substances with a "giant" crystal forming structure. This unit is broken into two sections which bookend Y8 chemistry. Between parts A and B of unit C5 students revisit chemical change to look at types of chemical reaction – including neutralisation and other reactions of acids in C9. We then introduce two other important parts of the earth, its hydrosphere (liquid water) and atmosphere, before concluding by looking at physical weathering, the role of acid rain in chemical weathering and sedimentary rocks. C8 revisits Y7 work on energy transfers in the context of chemical reactions.

Unit	C5 (Parts a & b)	C6	C7	C8	C9
Unit title	How is our planet changing?	What types of chemical reaction are there?	What are the atmosphere and hydrosphere?	How is energy transferred in chemical reactions?	How do acids react?
Big question/ core concept	What is the Earth made of and how is it changing? Core concepts: Dynamic Earth	What is chemical change? Core concepts: chemical change	How does chemistry effect our world Core concept: Chemical earth	What is chemical change? Core concept: chemical change	What is chemical change? Core concepts: chemical change
Relevant end points	• The geosphere is made of different minerals • Rocks are a mixture of minerals • The surface of the earth is slowly changing as a result of physical and chemical processes	• Mass is conserved in all chemical reactions • That reactions can be classified into different types	• That the atmosphere is the mixture of gases surrounding the earth • The hydrosphere is all the water on earth • How water cycles the earth	• That energy is transferred to and from the surroundings during chemical change	• Acids can react with alkalis and metals • That solutions can be acidic or alkaline • The acidity / alkalinity of a solution is measured by the pH scale
Core substantive knowledge	• Earth's internal structure. • How the main three types of rocks are classified • How the three main rock types are formed • Difference between chemical & physical weathering • Earth's surface is made of slow-moving tectonic plates	• The characteristic features of the following "types" of reaction - Combustion - Oxidation - displacement - Thermal decomposition • That mass is conserved during thermal decomposition reactions	• Why water evaporates and clouds form. • The hydrosphere includes salt water; fresh water (surface or ground); and water vapour • The composition of today's atmosphere • .Human activity adds visible and invisible pollutants into the atmosphere	• That energy is transferred from the internal (chemical) store to the surroundings in an exothermic change • That energy is transferred form the surroundings to the internal (chemical) store of the products during an endothermic change	• A salt and water are formed in a neutralisation reaction • A salt and hydrogen are formed when an acid reacts with an alkali • Pollution can form acid rain which reacts with rocks and damages wildlife
Core disciplinary knowledge	• Earth scientists classify rocks according to their structure • The term "mineral" has a specific meaning in the earth sciences community	• Chemists classify chemical reactions into different types. • Diagrams of the sub-microscopic can be used to **model** reactions • Reactions can be **represented** in different ways	• That scientific **conclusions** are based on experimental evidence that can be reproduced by other teams	• `Chemical investigation involves careful **measurement** and recording • To measure a change in temperature you must measure before and after	• Chemical **techniques** can be used to **identify** a substance or the properties of a mixture • Diagrams of the sub-microscopic can be used to **model** reactions • Reactions can be **represented**

Year 8 Long term plan: Biology

Brief overview
Y8 biology starts by exploring the concepts of health and disease in students first exploration of the big question "What keeps organisms healthy?". Other units start students journeys into other big questions. "How organisms grow and reproduce?" is studied in unit's B6. Y8 ends with "Why do organisms depend on each other and their environment?" with students being introduced to a basic understanding of the concept of "interdependence" ahead of a more detailed journey into ecology in Y9. Our short unit on "biochemistry" consciously follows our Y8 units on chemical change enabling students to appreciate the links between disciplines. This looks at a few of the key chemical reaction in cells – drawing students attention to the sub-microscopic world of substances within cells now their chemical schema is more developed.

Unit	B5	B6	B7	B8	B9
Unit title	What keeps us healthy?	How do organisms grow and reproduce?	How do we classify living things?	What is the chemistry of living things?	What are ecosystems?
Big question/ core concept	What keeps organisms healthy? Core concepts: Health	How do organisms grow and reproduce? Core concepts: Inheritance	Why are organisms so diverse Core concept: Evolution	What are organisms made of? Core concept: The cellular basis of life	Why do organisms depend on each other and their environment Core concept: Interdependence
Relevant end points	• Health is defined as physical and mental well being • .Disease can be caused by pathogens, environment, our genome or lifestyles • Only diseases caused by pathogens can be infectious	• Multicellular organisms primarily grow by cell division • All new cells are produced from existing cells dividing • Growth & development are part of an organisms life cycle • Organism reproduce sexually or asexually	• Organisms are classified based on observable characteristics and cell structure • Organisms are classified into five kingdoms • Humans are part of the kingdom "animalia"	• Producers make glucose by photosynthesis • All cells transfer energy by respiration for their life processes	• Biomass and energy are passed along food webs. • All ecosystems depend on producers • Decomposers recycle materials in an ecosystem
Core substantive knowledge	• Asthma is a disfunction of our lungs • The percentage of carbohydrate, lipid and protein in a balanced diet • Cause of obesity & deficiency diseases • How fitness contributes to good health • Food is a source of energy (a chemical store)	• Parts of human male and female reproductive systems. • Role of the menstrual cycle • What fertilisation is • How the body supports foetal development during pregnancy • How plants can reproduce sexually or asexually	• Organisms are classified hierarchically into groups • The distinction between scientific and common names	• Word equation for photosynthesis • Word equation for aerobic respiration • Why anaerobic respiration (in humans) is less efficient • Where respiration and photosynthesis happen in a cell	• Producers make all the biomass in an ecosystem. • Many plants rely on animals for pollination or seed dispersal • Population sizes of different organisms are dependent on each other
Core disciplinary knowledge	• How to measure resting heart rate and lung volume • How to measure the energy in food by simple calorimetry • Biologists **communicate** their research to improve human health	• Biology is studied as at different **levels** including the organism, interactions between organisms and organ systems	• Biologists use systems to **classify** all organisms • Use of keys in **classification** • A continuous **cycle** of collecting and analysing data constantly improves classification systems	• Biology is studied as at different **levels** including the chemistry of living things	• Biology is studied as at different **levels** including how different organisms interact in an ecosystem • Simple means of investigating seed dispersal

Long term plan: Year 8 breakdown by lesson

Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
L0 Introduction to space (and prerequisite knoweldge test) (optional) **P4 Where are we in space** L1, What are days, months and years? L2. What is gravity? L3 How does Gravity effect the solar system? L4 Why does the night sky change? (optional) L5 Where are we in space? L6 Why do we get seasons? L7 Investigating why it is hotter in summer. (optional) L8 EOTT L9 Mastery and feedback **P5 Moving by force** L1 What is speed? L2. How do we describe speed? (instantaneous vs average speed) L3 What do D-T graphs tell us? L4 How does force effect motion? (optional) L5 What is acceleration? L6 What causes drag? L7 How do parachutes work? L8 Investigating drag in different fluids (Pt 1) L9 Investigating drag in different fluids (Pt 2) L10 Relative motion L11 Moving by Force EOTT	L12 Mastery and feedback **P6 Making images** L1 How do pin hole cameras work? L2 Making pin hole cameras (optional) L3 What are reflected images? L4 What is the "law" of reflection? L5 What is "refraction"? L6 Investigating refraction (optional) L7 What are lenses? L8 How does the eye work? (optional) L9 EOTT Making images lL0 Mastery and feedback **P7 More on forces** L1 What causes weight? L2 How do we calculate weight? L3 How does a bridge supports an objects weight? L4 Investigating bridges (optional) L5 How does a floor support a weight? L6 How does force effect a spring? L7 How does a wire support an objects weight? (optional) L8 How do levers work? L9 Investigating moments of a force L10 EOTT More on forces L11 Mastery and feedback **C5a How is our planet changing?** L1. How do we classify rocks? L2 What are minerals? L3 What is the geosphere made of? L4 How is the surface of the earth changing?	**Mid year OCL assessment (optional)** L5 What happens at plate boundaries (optional) L6 How are igneous rocks formed? L7 How are rocks transformed? **C6 What types of chemical reaction are there?** L1 What are chemical reactions (optional) L2 What is combustion? L3 What are oxidation reactions? L4 Why does oxidation increase mass? (optional) L5 What is a displacement reaction? L6 Why does displacement not effect mass? (optional) L7 What is thermal decomposition? L8 How does thermal decomposition effect mass? L9 EOTT What types of chemical reaction are there? L10 Mastery and feedback **C7 What are the atmosphere and hydrosphere?** L1 What gases make up our atmosphere? L2 How are we polluting our atmosphere? L3 Why does water evaporate? L6 Why does water evaporate faster on a hot day? (optional) L7 What are clouds? L8 What is the hydrosphere? L9 How do rocks store ground water (investigation) (optional) L10 How do humans contaminate ground water? (optional)	L11 How does water cycle the planet? L12 EOTT What are the atmosphere and hydrosphere? L13 Mastery and feedback **C8 How is energy transferred in chemical reactions?** L1 Energy stores and transfers (optional recap) L2 What is an exothermic reaction? L3 How do we measure an exothermic change? L4 What is an endothermic change? L5 Measuring an endothermic change (optional) **C9 How do acids react?** L1 How can we identify acidic and alkaline solutions? L2 What is the pH scale? L3 What are neutralisation reactions? L4 How can we show an acid is neutralised (practical) (optional) L5 How is acid rain formed? L6 Investigation: what rocks does acid rain react with? (optional) L7 How do acids react with metals? L8 EOTT How do acids react L9 Feedback and mastery **C5b How is our planet changing?** L1 How does rain weather rocks? L2 What is the difference between weathering and erosion? L3 How are sedimentary rocks formed?	L4 Why is crude oil found in rocks? L5 EOTT How is our planet changing L6 Mastery and feedback **B5 What keeps us healthy?** L1 What is "good health"? L2 What causes disease? L3 What causes asthma? L4 What causes Covid-19? (optional) L5 How do we get the nutrients we need? L6 What is malnutrition? L7 How much energy is in food? L8 Investigating energy in food L9 What is fitness? L10 Investigating fitness (optional) L11 EOTT: What keeps us healthy L12 Feedback and mastery **B6 How do organisms grown and reproduce?** L1 How do (multicellular) organisms grow? L2 What are life cycles? L3 How do organisms develop and reproduce? L4 How does the female reproductive system work?	L5 How is the male reproductive system different? L6 How does a baby develop? L7 How do plants reproduce? L8 What is in a seed (Seed and flower dissection) (optional) L9 EOTT growth and reproduction L10 Mastery and feedback **B7 How do we classify living things** L1 How do biologists classify organisms L2 Why biologists classify organisms into kingdoms? L3 Where do humans fit in the classification system? **B8 What is the chemistry of living things?** L1 How do producers make glucose? L2 Where does photosynthesis happen in a leaf? (optional) L3 How do cells transfer energy? L4 What reactions take place in plant cells? L5 Can our cells respire without oxygen? **End of year OCL assessment** **B9 What is an ecosystem?** L1 What are food webs? L2 How do food webs effect populations? L3 Why does an ecosystem depend on producers? L4 Why are pollinators so important? L5 Why are decomposers important? L6 Field work Pt1 (optional) L7 Field work pt2 (optional) (5 core lessons)

Legacy curriculum Year 9-11

Long term plan: Topic overview

This sequence is being taught to years nine, ten and eleven in 2023-24. The Year seven and eight part of this sequence is no longer delivered as our current year seven and eight are on our new curriculum sequence (please see our other long term plan document for these year groups). Unit numbering starts from the beginning of Y9 with previous content shown in a summary document.

Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Year nine					
C1	C2	P1	P2	B1	B2
Year ten					
B3	B4	P3	P4	C3	C4
Year eleven					
C5	B5	P5	REVISION		

Year 9 Long term plan

Biology: The wondrous diversity of life and its human stewards	*Our Y9 curriculum provides a bridge between KS4 and KS3. We start with returning to the big question "what are living things made of?" with a substantial unit building up students' concept of "cells" first introduced in topic B1. We then look deeper into the idea of "infection" and develop the concept of "pathogens" in answer to the question "what keeps organisms healthy?" with a conscious decision to focus on both plants and animals. This unit includes work on sexual health and contraception* *The two most significant units of Y9 biology are topics B13 and B14 looking in detail at the ideas of evolution by natural selection and students impact on biodiversity. We aim for students to have a rounded understanding of the scientistic answer to why life is so diverse and a deep understanding of how various human activates threaten fragile ecosystems.* **B10:** the cellular basis of life **B11:** Health and infectious disease **B12:** Biodiversity and human impact **B13:** Variation through evolution
Chemistry: The periodic table, rates and structure of the atom.	*Year 9 chemistry returns to our three core "big questions" of chemistry and introduces students to how chemical knowledge is represented on the periodic table and a more complex model of the atom.* *Year 9 starts by introducing the periodic table by looking at the meaning of the term periodic and the patterns in physical and chemical properties down the groups. Our unit on rates of reaction builds upon prior knowledge "What is chemical change?" to develop a meaningful chemical definition of "rate". Students are introduced to the Bohr model of the atom for the first time and use it to explain the trends in the periodic properties of the elements. Year 9 also includes a practical unit returning to the separation techniques introduced in year 7 to develop a more rigorous procedural knowledge of these techniques.* **C10:** Substances and mixtures **C11**: The periodic table **C12**: Rates of reaction **C13**: Structure of the atom
Physics: Developing ideas of electricity and magnetism	*We intentionally wait to begin the question "What are electricity and magnetism?" until Y9 because of the cognitive demands of both the practical work required and the abstract modelling of electricity. A substantial period of time is spent in year 9 embedding the practical skills of using circuits and qualitative relationships between the concepts of current, voltage, resistance and energy. Y9 also sees students build on their understanding of the particle movement of water and sound waves to look at the graphical representations of waves. Y9 finishes with a unit building students understanding of "density" and pressure. Topic 13 is one of our most challenging topics pushing students towards a complicated application of balanced and unbalanced forces to make sense of pressure in fluids and convection.* P08: Electricity P09: Waves P10: More on Electricity P11: Magnetism P12: Floating and sinking

Year 9 Long term plan: Chemistry

Narrative
Year 9 begins by exploring the arrangement of particles in a solid, liquid and gas and relate use this knowledge of their arrangement to explain properties such as boiling point and density. They will then learn about the differences between pure substances and mixtures and investigate how substances can be separated based on properties such as boiling point. Students zoom in on these particles and begin to learn about the structure of atoms and the properties of the proton, neutron and electron. Students will revisit the idea of changing theories by exploring the timeline of how our current model of the atom was developed where they look in more depth at the work of Rutherford and the alpha particle scattering experiment. Students will then learn about the different isotopes that exist and use this knowledge as a foundation for understanding what relative atomic mass is, building on their knowledge of atomic structure to calculate things such as relative atomic and formula mass. Students learn how the periodic table has changed over time due to the work of Mendeleev. This will lead students to begin to explore different groups in the periodic table and learn about the patterns of chemical and physical properties that exist within groups. Students will build on their earlier knowledge of atomic structure to explain these patterns. In Autumn 2, students start learning about ionic, covalent and metallic bonds. How each is formed and represented using different models.. Students will be introduced to the mole as a unit of measurement and will do simple calculations using this unit. We explore reactions of metals in detail and how to use knowledge of word and symbol equations to represent these reactions. Students will be introduced to the definitions of acids, alkalis and bases and apply their earlier knowledge of equations to represent neutralisation. Separate students will also carry out titrations to identify the concentration of an unknown acid or alkali. Finally, students will learn about the reactivity series of metals and apply this to large scale industrial processes used to extract meals such as electrolysis.

Unit	C1	C2
Unit title	Chemistry Fundamentals	Investigative Chemistry
Big question/ core concept	What are substances? Core concept: Substance	What gives substances their properties? Core concept: Bonding
Relevant end points	***Students should understand that:*** ✓ Most materials are mixtures of substances. ✓ Materials made of single substances have distinct properties.	***Students should understand that:*** ✓ All matter is made of atoms. The arrangement and bonding between atoms explains a substances properties. Bonding is the result of electrostatic attractions.
Core substantive knowledge	➢ Describe the properties of solids, liquids and gases ➢ Classify substances as elements, compounds and mixtures. ➢ Describe each separation technique & decide which to use in given scenarios ➢ Describe the structure of the atom ➢ Describe how the structure of the atom has evolved over time ➢ Describe how the periodic table is arranged and how this has changed over time ➢ Describe the key properties and patterns of groups in the periodic table	➢ Describe types of bonding and explain the properties of each class of substance ➢ Represent substances and bonds between atoms using different diagrams ➢ Explain chemical reactions in terms of conservation of mass ➢ Write word and symbol equations for common reactions ➢ Use moles as a unit of measurement ➢ Use moles to balance equations and calculate mass ➢ Calculate concentration ➢ Explain reactions in terms of oxidation and reduction ➢ Classify substances as strong or weak acids ➢ Describe neutralisation ➢ Explain the process of electrolysis
Core disciplinary knowledge	• Chemists use models of the sub microscopic domain of substances to explain the properties and behaviour of substances. • Chemists use a range of unique symbols, formula, nomenclature, diagrams and equations. • Substances can be classified into groups. This enables chemists to identify patterns and trends. • Data from chemical measurements can be used to identify trends. • Provides evidence to test ideas. There are a range of qualitative and quantitative investigative techniques. • Chemistry requires skilled use of specialised equipment. This includes chemical measurement.	

Year 9 Long term plan: Physics

Narrative
In Year 9, students build on ideas of conservation introduced in chemistry and begin to explore the idea of conservation of energy. Students will learn about different stores of energy and how these stores change in open and closed systems. Students will begin to use calculations to represent these changes quantitatively and will use this knowledge to understand the relationship between different variables in an equation. Students will then look more broadly at the Earth's energy resources and evaluate the advantages and implications of using these resources. Next, students will learn how energy is transferred in the form of waves and learn the differences between transverse and longitudinal waves and investigate the reflection and refraction of these waves through different mediums. Students will then learn about the electromagnetic in terms of the differing properties, uses and potential dangers of each wave. In Spring 2, students will start to explore how objects move and how this motion may be changed due to the effect of forces. Students will begin by looking at different types of forces and the effects they can have on objects before looking in more detail at weight and gravitational force. Students will learn what a resultant force is, and the role it plays in the motion of objects. Students will apply this knowledge to a range of systems and learn how to represent these forces in free body a vector diagrams. Students will then focus on how the speed and velocity of objects may change over a period of time and analyse graphs representing this motion. Students will then explore each of Newton's laws of motion, applying these to different systems and carrying our calculations to represent the numerical relationships between different quantities. Students will carry out investigations into Newton's third law of motion and Hooke's law and represent their results graphically. Finally, students will learn about momentum and how this impacts our knowledge of safety features.

Unit	P1	P2
Unit title	Energy and Waves	Forces
Big question/ core concept	How does information and energy spread? Core concept: Waves and Energy	Why do things move and change? Core concept: Force and Energy
Relevant end points	✓ Waves, including sound, water and electromagnetic waves transfer energy and information.	✓ Changing the motion of an object requires a net force to be acting on it. Calculating the "energy" stored in a system allows us to make predictions about how much change is possible. ✓ This is because energy is always conserved but some energy is always dissipated into smaller and less useful stores.
Core substantive knowledge	➢ Identify energy stores and transfers ➢ Use equations to complete calculations ➢ Describe renewable and non-renewable energy sources and compare these ➢ Describe the properties of waves using appropriate scientific terminology	➢ Identify different types of force ➢ Explain the effect of a resultant force on an object ➢ Use Newton's Laws to predict and explain the motion of an object ➢ Describe magnetic fields and the effect they have on objects
Core disciplinary knowledge	• Aims for the most fundamental explanations that apply in widest range of situations • Explanations include tests which support or disprove the idea. • Explanations are based on observations and experimental measurements • Arguments are developed from data, discussed and debated • Many explanations use models to think with and use to make predictions • Many models can be expressed as mathematical formulas	

Year 9 Long term plan: Biology

Narrative
In Year 9 students look in depth at different types of cells. Students build the foundation of knowledge to learn how tissues, organs and organ systems are specially adapted to carry out important processes inside living things in year 10. Students will learn the role of mitosis and meiosis in producing new cells and importance of producing cells with the correct number of chromosomes. They are then introduced to stem cells and the important role they can play in research and treatment of disease as well as exploring some of the implications of using them. We learn how the development of the microscope has allowed us to see cells at higher resolution and this has led to a better understanding of how living things function. One example of this is through our knowledge of DNA and the role it plays in inheritance. Students will learn the structure of DNA and explore how DNA is arranged and its role in passing on genetic information to offspring. Students will use Punnett squares to predict the outcome of genetic crosses and apply this to sex determination and genetic conditions such as cystic fibrosis and polydactyly. Students explore the debates about how cloning techniques can be used in research, medicine and in agriculture. We then look at how living things interact through communicable diseases. Students explore how we prevent these pathogens from entering before looking at the role of white blood cells in destroying pathogens that enter. They will also learn about what vaccines are and how they provide us with immunity against diseases. Students will then learn how medicines are discovered and developed through exploring pre-clinical and clinical trials. Separate students will also explore the brain, the eye and plants in more detail.

Unit	B1	B2
Unit title	Cell Biology	Communicable Disease
Big question/ core concept	What are living things made of? Core concept: Cellular basis of life How do organisms grow and reproduce? Core concept: Inheritance	What keeps organisms healthy? Core concept: Health
Relevant end points	✓ The cell is the basic unit of life from which organisms emerge. Organisms are adapted to survive in their environment. Multicellular organisms have different levels of organisation to maintain the conditions for life ✓ Organisms reproduce by passing their genetic information from one generation to the next. How an organism develops depends on its genome and its environment.	✓ Health results from interactions between an organism's body, behaviour, its environment and other organisms.
Core substantive knowledge	➢ Identify types of cells and how these link to form tissues, organs and systems. ➢ Explain how to use a microscope and compare the different types of microscopes linking to what they are used for. ➢ Describe mitosis and meiosis. ➢ Describe the role of stem cells in organisms and medicine. ➢ Describe the structure of DNA and its role as our hereditary material. ➢ Construct genetic diagrams to show how characteristics are inherited.	➢ Describe different types of disease, how these can be caused, treated and prevented. ➢ Describe ways in which organisms prevent pathogens from entering. ➢ Explain how the immune system protects us from pathogens. ➢ Describe how new drugs are made. ➢ **Analyse data on disease.**
Core disciplinary knowledge	• Biologists collect data in a variety of settings including field work. Variables in biology can be difficult to control. • Different biologists study life at different levels. From biological models to population of organisms • Biologists have to carefully consider how specimens are sourced and treated during research • Observations and data can be analysed and interpreted quantitatively and qualitatively • A cycle of collecting and analysing data provides evidence that biologists use to develop and improve explanations, classification systems and models • Biologists communicate about their work with a range of audiences within and beyond the scientific community, to facilitate evidence-informed debate and decision-making.	

Long term plan: Year 9 breakdown by lesson

Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Topic: Chemistry Fundamentals **Knowledge:** 1. Changing states of matter 2. Atoms and Elements 3. Compounds and Formulae 4. Pure Substances and solutions 5. Separation techniques (Demonstrations) 6. RP Chromatography P1 7. RP Chromatography P2 8. Changing Atomic Theories 9. Protons, Neutrons and Electrons 10. Electron Configuration 11. Isotopes and Relative Atomic Mass 12. Development of the Periodic table 13. Mini Quiz 14. Ions of Metals and Non Metals 15. Uses of Metals 16. Alloys 17. Alkali Metals (Demonstration) 18. Halogens 19. Noble Gases 20. Gas Tests (Demonstration practical) 21. Mini Quiz 2	**Topic: Investigative Chemistry** **Knowledge:** 1.Ionic Bonding 2. Ionic Compounds 3. Properties of Ionic Compounds 4. Covalent Bonding 5. Simple Covalent Molecules 6. Giant Covalent Structures 7. Fullerenes and Graphene 8. Metallic Bonding 9. Comparing and Contrasting types of bonding 10.Word and symbol equations 11.Balancing Equations 12.Conservation of Mass 13.Introducing Moles (HT only) 14.Metals and Oxygen 15.Metals and Acid 16.Metals and Water 17.Redox Reactions (HT only) 18.Acids and Bases 19.Strong and Weak Acids (HT only)	**Topic: Energy and Waves** **Knowledge:** 1. Energy Stores and Energy Transfers 2. Open and Closed Systems 3. Work Done 4. Power 5. Efficiency Calculations 6. Insulation 7. Gravitational Potential Energy 8. Kinetic Energy 9. Elastic Potential Energy 10.Multi Step Calculations (GPE/KE/EPE/Efficiency) 11.Non-Renewable Resources 12.Renewable Resources 13.Comparison of Energy 14.Mini Quiz 15.Introduction to Waves 16.Wave Speed Equation 17.Calculating Period of a Wave	**Topic: Forces** **Knowledge:** 1. Scalar and Vector Quantities 2. Types of Forces 3. Weight 4. Resultant Forces 5. Vector Diagrams (HT only) 6. Speed and Velocity 7. Distance Time Graphs 8. Acceleration and Deceleration 9. Velocity Time Graphs 10. Terminal Velocity 11.Newton's First Law 12.Newton's Second Law 13.Inertia and Inertial Mass (HT only) 14. Investigate Newtons Second Law of Motion RP Part 1 15. Investigate Newtons Second Law of Motion RP Part 2 16. Newton's Third Law 17. Stopping Distances 18. Factors that Affect Thinking Distance 19. Momentum (HT only) 20. Momentum Calculations (HT only)	**Topic: Cell Biology** **Knowledge:** 1. Types of Cells 2. Specialised Cells 3. Tissues, Organs and Systems 4. Introducing Microscopes 5. RP Using Microscopes 6. Types of Microscopes 7. DNA 8. Mitosis and the Cell Cycle 9. Incredible Stem Cells 10. Therapeutic Cloning 11. Sexual and Asexual Reproduction 12. Evaluating types of Reproduction 13. Meiosis 14. Inheritance (genetic cross diagrams) 15. Sex determination 16. Family Trees 17. Genetic Diseases	**Topic: Communicable Diseases** **Knowledge:** 1.. Viral Diseases 2. Bacterial Diseases 3. Fungal and Protists 4. Our Barriers to Diseases 5. The Immune System 6. Vaccinations 7. Medicines 8. Culturing Microorganisms 9. Antibiotic Resistance 10.Developing new drugs Part 1 11.Developing new drugs Part 2 12.Scatter Graphs and Health 13.Frequency tables and Histograms 14.Analysis data 15.Mini Quiz

Long term plan: Year 9 breakdown by lesson

Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
	Topic: Investigative Chemistry continued **Knowledge:** 20. Neutralisation 21. RP Making Salts P1 22. RP Making Salts P2 23. Reactivity Series and Displacement Reactions 24. Half Equations for Displacement Reactions (HT only) 25. Reactivity Series and Extraction Methods 26. Electrolysis of Molten Compounds Ionic half equations (HT only) 27. Electrolysis of Aqueous Compounds (Ionic half equations HT only) 28. RP Electrolysis	**Topic: Energy and Waves continued** **Knowledge:** 19.RP Measuring Speed of a Wave using a Ripple Tank Part 1 20. RP Measuring Speed of a Wave using a Ripple Tank Part 2 21.Measuring the Speed of a Wave using a piece of string 22.Types of Electromagnetic Waves 23.Properties and Uses of Electromagnetic Waves	**Topic: Forces continued** **Knowledge:** 21. RP Relationship between Force and Extension Part 1 22. RP Relationship between Force and Extension Part 2 23. Magnets 24. Magnetic Fields 25. Electromagnets		

Year 10 Long term plan

Physics: Energy and energy transferred.	*Y10 physics is linked together by the big idea of energy which underpins several of our key questions. Across all topics students are supported in recognising the qualitative nature of physics. That we can use mathematical relationships between (sometimes abstract) concepts to make accurate predictions about phenomena. Students investigate this further through a series of required practical's. All physics topics in year 10 are in essence applications of the big idea of "energy transfers" and that modelling them mathematically enables us to make accurate predictions. This supports students understanding of role of mathematical modelling which is central to how knowledge is developed within physics.* *Students also cover a short unit developing their understanding of the concept of the particle model and atomic structure in answer to "What is matter?" The final units being placed at the end of the sequence because of their overlap with big questions within chemistry.* **P13**: Energy **P14**: Electricity **P15**: Domestic uses of electricity **P16**: Particle model **P17**: Structure of the atom and radiation
Chemistry: Chemical bonding.	*The aim of Y10 is for students to make a qualitative leap in their answers to the first two big questions of chemistry. We start by bringing together several Y9 topics and introducing a simplified electrostatic model of the atom. This model of the atom is used throughout topic C14 to link the different types of chemical bonding to one central underlying concept (electrostatic attraction). This encourages students to develop a more flexible schema around chemical structure to support further progression. Students then return to more complex examples of chemical change supported by their more advanced understanding of the nature of chemical bonding.* **C14**: Chemical bonding **C15**: Chemical Changes **C16**: Qualitative chemistry **C17**: Rates of reaction
Biology: Systems within cells and organisms	*KS4 biology starts by developing a cellular basis for students concept of "growth" before returning to ways substances are transferred across the cell membrane (last dealt within detail during Y7). Our start to KS4 biology is linked together by a focus on "systems" within organisms leading students to an understanding of how different processes within organisms are themselves interdependent. B15 is a vast unit which starts with looking at enzyme action and biological molecules (sub-microscopic - biochemistry) and digestion before linking together ideas of biological organisation (what are living things made of?) with health and disease (how do organisms stay heathy) at the level of organs and organ systems. The year finishes with a look at the development of drugs and vaccinations before deepening students knowledge of the biochemistry introduced in Y9.* **B14:** Cell structure, division and transport **B15:** Systems and organisation **B16:** Infection and disease **B17:** Bioenergetics

Year 10 Long term plan: Biology

Narrative
In Year 10 students learn that all living things need to respire and explore the substances they need for this reaction (oxygen and glucose) as well as the harmful waste products (such as carbon dioxide). Students also begin to learn the role that plants play in transferring energy from the Sun through photosynthesis. Students will explore the substances required by plants for this process (light energy, carbon dioxide and water) as well as the products (oxygen and glucose). We are introduced to the idea of surface area to volume ratio and the role this plays in an organism's ability to exchange substances efficiently. We then look at specially adapted exchange and transport systems in both plants and animals and within these systems, we explore the transport mechanisms through which substances move in and out of cells, namely diffusion, active transport, and osmosis. Students are introduced to the factors that affect the rate of these types of transport and begin to apply this understanding to the adaptations that exchange, and transport systems have in order to maximise this rate and meet its respiratory and photosynthetic needs. Students will learn the role that enzymes play as biological catalysts in helping organisms to break down larger molecules so that they can be transported, exchanged, and then used by cells. We will explore the factors that affect the rate of these enzyme-controlled reactions and lay the foundations for understanding why conditions inside cells must be controlled, which is explored further in year 11. Students studying the Separate course will also explore how the kidneys are adapted to remove waste products such as urea. We then look at how energy is transferred through living things through feeding relationships and the interactions between organisms within an ecosystem, including through the water and carbon cycles. We will also learn about human activities that are impacting on ecosystems as well as on these cycles. Students will also explore the methods ecologists use to measure living things within ecosystems.

Unit	B3	B4
Unit title	Human Biology	Plant Biology
Big question/ core concept	What are living things made of? Core concept: Cellular basis	Why do organisms depend on each other and their environment? Core concept: Interdependence
Relevant end points	✓ The cell is the basic unit of life from which organisms emerge. Organisms are adapted to survive in their environment. Multicellular organisms have different levels of organisation to maintain the conditions for life for all their cells.	✓ Organisms compete with and depend on other organisms for the materials and energy that cycle through ecosystems. A change to one population, or environmental condition can have a huge impact on biodiversity.
Core substantive knowledge	➢ Compare and contrast types of respiration. ➢ Describe how the lungs, heart and blood are designed for efficient respiration. ➢ Describe how food is digested including the role of enzymes. ➢ Link digestion to rates of reaction. ➢ Describe how the kidneys function (separate only). ➢ Describe the three types of transport.	➢ Use and interpret food chains and webs to describe the relationship between different organisms. ➢ Describe how sampling can be used to describe the distribution of organisms in an ecosystem. ➢ Explain how photosynthesis is used to produce food within plants and the factors that can affect this process. ➢ Describe the effect of hormones in plants (tropisms, germination) (separate only). ➢ Describe how carbon and water are transferred from one form to another.
Core disciplinary knowledge	• Biologists collect data in a variety of settings including field work. Variables in biology can be difficult to control. • Different biologists study life at different levels. From biological models to population of organisms • Biologists have to carefully consider how specimens are sourced and treated during research • Observations and data can be analysed and interpreted quantitatively and qualitatively • A cycle of collecting and analysing data provides evidence that biologists use to develop and improve explanations, classification systems and models	

Year 10 Long term plan: Physics

Narrative
In year 10 students will learn how energy and information can be transferred in the form of waves. They will explore a range of both transverse and longitudinal waves and observe and measure how they behave during reflection and refraction. Students will gain an understanding of how the properties of these waves make them both useful and harmful to humans. Students will then explore the particles that make up substances and make links between the arrangement of these particles and properties such as density and pressure. Students will explore how our understanding of the atom has changed over time and will appreciate how observations and measurements by scientists have changed our theories over time. We will then look at how to measure the energy changes that take place when substances are heated up and change state and carry out calculations to determine this energy change. Students will then explore the behaviour of radioactive isotopes and learn about the properties of alpha, beta and gamma and how these relate to their hazards and uses. Students will model the behaviour of this radioactive decay and use data from graphs and tables to calculate properties such as the half-life of radioactive decay. In Spring 2, students will explore how energy is transferred in electrical circuits through learning about current, potential difference and resistance. They will observe and measure these factors in both series and parallel circuits and investigate the relationship between them in different Ohmic and non-Ohmic conductors.. Students will then learn how this energy is transferred to homes using the national grid. Finally, students will learn about our place in the universe and explore how large objects such as planets, stars and satellites interact due to gravitational force. Students will learn how the life cycle of a star is dependent on its size and the role that stars play in providing Earth with heavier elements through nuclear fusion.

Unit	P3	P4
Unit title	Waves, Particles and Radioactivity	Electricity and Astrophysics
Big question/ core concept	How does information and energy spread? Core concept: Waves and Energy What is matter? Core concept: Matter	What is electricity and magnetism? Core concept: Electromagnetism Where are we in space? Core concept: Space
Relevant end points	✓ Waves, including sound, water and electromagnetic transfer energy and information. ✓ The world is made of matter and all matter is made of particles. The particle model can be used to explain how matter behaves. All matter is made of atoms which are made of smaller, sub atomic, particles.	✓ The movement of charge forms electric current and causes magnetic fields. We use electrical currents to power our society. ✓ The Earth is a tiny part of an unimaginably large universe. All mass in the universe attracts other mass with a gravitational force. We can use the idea of gravity to explain how the universe is changing.
Core substantive knowledge	➢ Describe the EM spectrum ➢ Describe the properties of light & how light is reflected, refracted (separate only). ➢ Describe how unstable radioactive substances emit radiation. ➢ Calculate half-life and link this to use and risk. ➢ Compare densities of different substances. ➢ Describe pressure in gases (and liquids – separate only) ➢ Calculate specific heat capacity and latent heat and link to heating and cooling curves.	➢ Draw electrical circuits. ➢ Explain how to measure current and potential difference and predict these values in different circuits. ➢ Classify components and Ohmic or non-Ohmic ➢ Describe the properties of mains electricity and how electricity is moved around the country using the national grid. ➢ Describe the solar system (separate only) ➢ Describe the life cycle of a star (separate only) ➢ Describe The Big Bang Theory and our evidence for this (separate only)
Core disciplinary knowledge	• Aims for the most fundamental explanations that apply in widest range of situations • Explanations include tests which support or disprove the idea. • Explanations are based on observations and experimental measurements • Arguments are developed from data, discussed and debated • Many explanations use models to think with and use to make predictions • Many models can be expressed as mathematical formulas	

Year 10 Long term plan: Chemistry

Narrative
In Year 10 students learn that chemical reactions involve a transfer of energy that is either endothermic or exothermic. They will understand that scientists can observe and measure this change. Students will revisit the idea of rate by learning how different factors affect the rate of chemical reactions. They will observe changes in rate both qualitatively and through taking quantitative measurements, which will then allow them to analyse rates of reactions graphically and make predictions about how the rate will be affected when different factors are changed. Students will then be introduced to the idea of reversible reactions by making observations and through exploring theoretical reactions. They will apply Le Chatelier's principle to a range of reversible reactions and use this to predict the outcome on the yield of different substances. Students will also learn the law of conservation of mass and use this to balance symbol equations. They will also learn the importance of the mole as a unit of measurement to chemists and use this to calculate the mass of different substances. Separate students will also carry out tests and make observations in order to identify the presence of different ions during reactions. Throughout the first unit, students will move from looking at isolated reactions to applying their knowledge to reactions carried out on a mass scale in industry. In the second unit, students start to look more broadly at the relationship between chemistry and our Earth. They will start by learning how the composition of the atmosphere has changed over time and draw on their knowledge from B2 to understand the important role that plants and algae play in this. They will then explore ways that Human activity has impacted on the Earth through combustion of fossil fuels, processing water and through removal of raw materials. Students will learn about the ways in which we can reduce this impact and evaluate different processes and products through the lens of environmental, economic, social and ethical perspectives.

Unit	C3	C4
Unit title	Reacting Substances	Humans and The Earth
Big question/ core concept	What is chemical change? Core concept: Chemical change	How does chemistry affect our world? Core concept: Chemical Earth What is the Earth made of and how is it changing? Core concept: Dynamic Earth
Relevant end points	✓ In chemical reactions atoms are rearranged to form new substances. The new substances produced will have different properties from the substances they are formed from. Mass and energy are always conserved in chemical changes.	✓ Substances can move within and between Earth's atmosphere, hydrosphere, geosphere and biosphere as part of large-scale Earth systems. Chemical substances produced by human activity are changing our planet. ✓ The structure of the earth is slowly changing. The Earth provides us with a rich source of resources
Core substantive knowledge	➢ Describe exothermic and endothermic reactions quantitatively and qualitatively ➢ Explain how chemical cells work (separate only) ➢ Describe and explain the effect of different factors on rates of reaction. ➢ Explain how reversible reactions work and the effect of different factors on these (Le Chatelier's principle) ➢ Calculate relative formula masses and moles. ➢ Use a titration to calculate concentration (separate only)	➢ Describe the composition of the Earth's atmosphere and how this has changed over time. ➢ Describe the impact of humans on the Earth including global warming, use of water, and creation of sewage.
Core disciplinary knowledge	• Chemists use models of the sub microscopic domain of substances to explain the properties and behaviour of substances. • Chemists use a range of unique symbols, formula, nomenclature, diagrams and equations. • Substances can be classified into groups. This enables chemists to identify patterns and trends. • Data from chemical measurements can be used to identify trends. • Provides evidence to test ideas. There are a range of qualitative and quantitative investigative techniques. • Chemistry requires skilled use of specialised equipment. This includes chemical measurement.	

Long term plan: Year 10 Combined Science breakdown

Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Topic: Human Biology 1. Aerobic respiration 2. Anaerobic respiration 3. Lungs and Ventilation 4. Gas Exchange 5. Fermentation 6. The Heart 7. Blood vessels and Blood flow 8. Blood composition 9. CHD 10. Non communicable disease 11. Disease data 1 12. Mini quiz 13. Digestion 14. Enzymes 15. Optimal conditions for enzymes 16. Testing for food groups 1 (R.Practical) 17. Testing for good groups 2 (R.Practical) 18. pH and Enzymes 1 (R.Practical) 19. pH and Enzymes 2 (R.Practical) 20. Reaction rates in the body 21. Diffusion 22. Diffusion and Surface area (Practical) 23. Diffusion in action	**Topic: Plant Biology** 1. Food webs 2. Ecosystems 3. Predator and Prey 4. Ecological Sampling techniques 5. Quadrats (R.Practical) 6. Plant cells, tissues, and organs 7. Osmosis 8. Osmosis in action 9. Osmosis 1 (R. Practical) 10. Osmosis 2 (R.Practical) 11. Active transport 12. Transpiration 13. Transpiration experiments (Part 1&2) 14. Translocation 15. Photosynthesis 16. Limiting factors (Higher only) 17. Inverse square law (Higher only) 18. Photosynthesis 1 (R. Practical) 19. Photosynthesis 2 (R.Practical) 20. Using glucose and nitrogen in plants 21. Mini Quiz 22. Carbon Cycle 23. Water cycle 24. Biodiversity and human impact 25. Maintaining biodiversity	**Topic: Nuclear and Thermal Physics** 1. Types of EM Spectrum 2. Properties and uses of electromagnetic waves 3. Investigating IR radiation (R.Practical) 4. Refraction of light 5. Atoms (recap) 6. Changing atomic theories (recap) 7. Physics of atoms 8. Radioactive decay 9. The three types of decay 10. Nuclear equations 11. Half life 12. Modeling radioactive decay 13. Contamination and Irradiation 14. Uses of radiation 15. Mini Quiz 16. Particle model - density and states 17. RP investigating density 18. Changes of state 19. Heating and temperature 20. Latent heat 21. Specific heat 22. RP investigating specific heat 23. Comparing LH and SLT (higher only) 24. Pressure in gases	**Topic: Electricity** 1. Electrical Circuits Introduction 2. Calculating current and Charge Flow 3. Current in Series and Parallel Circuits 4. Potential Difference in Series and Parallel Circuits 5. Ohm's Law 6. Resistance in Series and Parallel Circuits 7. Factors affecting resistance (R.Practical Part 1 and Part 2) 8. Light Dependent Resistors 9. Thermistors 10. Investigating non-Ohmic conductors (R.Practical) Part 1 11. Investigating non-Ohmic conductors (R.Practical) Part 2 12. Mini Quiz 13. Mains electricity and AC & DC 14. Plugs 15. Power calculations 16. Work done calculations 17. Equations practice (Optional) 18. Recap of electromagnets 19. National Grid and Transformers 20.	**Topic Reacting Substances** 1. Exothermic and endothermic reactions 2. Temperature changes (R.Practical) 3. Reaction profiles 4. Bond energy (H only) 5. Measuring rates of reaction 6. Factors affecting rate of reaction 7. Drawing rates of reaction graphs 8. Factors affecting rates of reaction (R.Practical) 9. Catalysts 10. Mini Quiz 11. Reversible reactions (Demonstration) 12. Le Chatelier's principle (H only) 13. Factors affecting equilibrium (H only) 14. Word equations and conservation of mass 15. Relative formula mass 16. Reacting masses (H only) 17. Calculating mass of a solute (H only) 18. Calculating moles in a solution (H only) 19. Explaining concentration (H only)	**Topic: Humans and the Earth** 1. The Early Earth's Atmosphere 2. Theories of the atmosphere 3. The Greenhouse Effect 4. Effects of global warming 5. Reducing our carbon footprint 6. The Harmful Effects of Combustion 7. Resources used by humans 8. Sustainable development 9. Potable Water 10. Desalination 11. Evaluating potable water methods 12. Analysing water samples (R.Practical) 13. Wastewater 14. Sewage Treatment 15. Mini Quiz 16. Phytomining and bioleaching 17. Life Cycle Assessment 18. Reduce, Reuse, Recycle

Long term plan: Year 10 Separate Science breakdown

Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Topic: Human Biology 1. Aerobic respiration 2. Anaerobic respiration 3. Lungs and Ventilation 4. Gas Exchange 5. Fermentation 6. The Heart 7. Blood vessels and Blood flow 8. Blood composition 9. CHD 10. Non communicable disease 11. Disease data 1 12. Mini quiz 13. Digestion 14. Enzymes 15. Optimal conditions for enzymes 16. Testing for food groups 1 (R Practical) 17. Testing for good groups 2 (R Practical) 18. pH and Enzymes 1 (R Practical) 19. pH and Enzymes 2 (R Practical) 20. Reaction rates in the body 21. Diffusion 22. Diffusion and Surface area (Practical) 23. Diffusion in action 24. Kidneys and the function (Separate only) 25. Kidneys and ADH (Separate only) 26. Treating Kidney failure dialysis (Separate only) 27. Treating Kidney failure transplant (Separate only) 28. Parts of the brain (Separate only) 29. Brain Surgery (Separate only) 30. The Eye (Separate only) 31. Myopia and hyperopia (Separate only) 32. Cloning plants (separate only) 33. Cloning animals (Separate only) 34. The structure of DNA (separate only) 35. Protein Synthesis (Separate only) 36. Multiplying bacteria	**Topic: Plant Biology** 1. Food webs 2. Ecosystems 3. Predator and Prey 4. Ecological Sampling techniques 5. Quadrats (R Practical) 6. Distribution of Species (Separate only) 7. Pyramids of biomass and tropic levels (Separate only) 8. Decomposers 9. Plant cells, tissues and organs 10. Osmosis 11. Osmosis in action 12. Osmosis 1 (R. Practical) 13. Osmosis 2 (R Practical) 14. Active transport 15. Transpiration 16. Transpiration experiments (Part 1&2) 17. Translocation 18. Photosynthesis 19. Limiting factors (Higher only) 20. Inverse square law (Higher only) 21. Photosynthesis 1 (R. Practical) 22. Photosynthesis 2 (R Practical) 23. Using glucose and nitrogen in plants 24. Mini Quiz 25. Tropisms (Separate only) 26. Plant hormones (Separate only) 27. Germination 1 (Separate only) (R Practical) 28. Germination 2 (Separate only) (R. Practical) 29. Carbon Cycle 30. Water cycle 31. Rate of Decay (Separate only) 32. Biogas generators (Separate only) 33. Decay part 1 (Separate only) (R. Practical) 34. Decay part 2 (Separate only) (R. Practical) 35. Biodiversity and human impact 36. Maintaining biodiversity	**Topic: Nuclear and Thermal Physics** 1. Types of EM Spectrum 2. Properties and uses of electromagnetic waves 3. Investigating IR radiation (R Practical) 4. Reflection of light (Separate only) 5. Refraction of light 6. Investigating reflection and refraction of light (separate only) (R Practical) 7. Lenses (Separate only) (Demonstration) 8. Magnification (Separate only) 9. Colour (Separate only) 10. Atoms (recap) 11. Changing atomic theories (recap) 12. Physics of atoms 13. Radioactive decay 14. The three types of decay 15. Nuclear equations 16. Half life 17. Modeling radioactive decay 18. Contamination and Irradiation 19. Uses of radiation 20. Background radiation 21. Evaluating hazards 22. Nuclear Fission and Fusion (Separate only) 23. Mini Quiz 24. Particle model - density and states 25. RP investigating density 26. Changes of state 27. Heating and temperature 28. Latent heat 29. Specific heat 30. RP investigating specific heat 31. Comparing LH and SLT (higher only 32. Pressure in gases 33. Work done and pressure (Separate only) 34. Calculating Pressure (Separate only) 35. Pressure at different depths	**Topic: Electricity and Astrophysics** 1. Electrical Circuits Introduction 2. Calculating current and Charge Flow 3. Current in Series and Parallel Circuits 4. Potential Difference in Series and Parallel Circuits 5. Ohm's Law 6. Resistance in Series and Parallel Circuits 7. Factors affecting resistance (R Practical Part 1 and Part 2) 8. Light Dependent Resistors 9. Thermistors 10. Investigating non-Ohmic conductors (R Practical) Part 1 11. Investigating non-Ohmic conductors (R Practical) Part 2 12. Mini Quiz 13. Mains electricity and AC & DC 14. Plugs 15. Power calculations 16. Work done calculations 17. Equations practice (Optional) 18. Recap of electromagnets 19. National Grid and Transformers 20. Transformers structure and equation (Separate only) 21. Transformers power equation (Separate only) 22. Solar System (Separate only) 23. Life Cycle of a star (Separate only) 24. Orbits (Separate only) 25. Orbits 2 (Separate only) 26. Red Shift and Expanding Universe (Separate only) 27. The Big Bang Theory (Separate only) 28. Dark Mass and Dark Energy (Separate only) 29. Black bodies and radiation	**Topic Reacting Substances** 1. Exothermic and endothermic reactions 2. Temperature Changes (R Practical) 3. Reaction profiles 4. Bond energies 5. Chemical cells and voltage (separate only) 6. Rechargeable and non-rechargeable batteries (separate only) 7. Fuel Cells (Separate only) 8. Half equations for fuel cells (Separate only) 9. Measuring the rate of reaction 10. Factors affecting rates of reaction 11. Drawing rates of reaction graphs 12. Factors affecting rates of reaction (R Practical) 13. Catalysts 14. Mini Quiz 15. Reversible reactions (Demonstration) 16. Chatelier Principle (higher only) 17. Factors affecting equilibrium (higher only) 18. Word equations and conservation of mass 19. Relative Formula Mass 20. Reacting Masses (higher only)* 21. Calculating mass of a solute 22. Calculating moles in a solution (higher only) 23. Using titration to calculate concentration (Separate only) 24. Titrations Part 1(separate only) (R Practical) 25. Titrations Part 2 (separate only) (R Practical) 26. Explaining concentration (higher only) 27. Calculating gas volume from relative formula mass (Separate only)	**Topic: Humans and the Earth** 1. The Early Earth's Atmosphere 2. Theories of the atmosphere 3. The Greenhouse Effect 4. Effects of global warming 5. Reducing our carbon footprint 6. The Harmful Effects of Combustion 7. Resources used by humans 8. Sustainable development 9. Potable Water 10. Desalination 11. Evaluating potable water methods 12. Analysing water samples (R Practical) 13. Waste Water 14. Sewage Treatment 15. Mini Quiz 16. Phytomining and bioleaching 17. Life Cycle Assessment 18. Reduce, Reuse, Recycle 19. Ceramics (Separate only) 20. Polymers (Separate only) 21. Thermosetting and thermosetting polymers (Separate only) 22. Glass (Separate only) 23. Reducing our human impact (Separate only) 24. The Haber process 1 (Separate only) 25. Conditions graphs (Separate only) 26. The Haber process 2 (Separate only) 27. NPK Fertilisers (separate only) 28. Atom economy (Separate only) 29. Percentage yield (Separate only)

Long term plan: Year 10 Separate Science breakdown

Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Topic: Human Biology 37. Culturing Microorganisms 38. Investigating Antiseptics Part 1 RP 39. Investigating Antiseptics Part 2 RP 40. Monoclonal Antibodies	**Topic: Plant Biology** 37. Food Security	**Topic: Nuclear and Thermal Physics** 36. Floating and Sinking 37. The Atmosphere	**Topic: Electricity and Astrophysics**	**Topic: Reacting Substances** 28. Calculating gas volumes from balanced equations 29. Testing for Ions 30. Testing for Ions Part 1 31. Testing for Ions Part 2	**Topic: Humans and the Earth**

Year 11 Long term plan

Chemistry Chemistry n a changing planet.	*Y11 Chemistry comprises a series of short units which picks up and develops ideas covered earlier in the course. The units, covering C2 chemistry are linked thematically by the application of chemistry to societies' interaction with our planet and its resources.. C22 explores organic chemistry for the first time – picking up from work in Year 8 looking at how fossil fuels are created. C24 and C25 similarly pick up the story of how chemistry affects the Earth from topics C7 and C11 in Year eight.* **C18**: Organic chemistry **C19**: Chemical analysis **C20**: Earths atmosphere **C21**: Using the Earth's resources
Physics: Why objects move and information spreads	*Our final year of physics returns to one of the most central concepts in physics – force. Both unit P19 & 20 give a more developed, and quantitative, treatment of the ideas of force and motion developed in years seven and eight. Introducing acceleration equations, velocity-time graphs and the conservation of momentum. Units P21 builds on the Year 9 unit "waves" by looking at the electromagnetic spectrum and wave equations. Physics finishes by returning to the idea of electromagnetism introduced in P12 and exploring the motor effect.* **P18**: Forces and their effects **P19**: Force and Motion **P20**: Waves **P21**: electromagnetism
Biology: Systems within cells and organisms	*Biology starts with the looking briefly at the nervous system before exploring the uses of hormones within the human body. B20 develops a model of inheritance and relates it back to the ideas of evolution first explored in detail in unit 14. Our biology story closes with a final unit looking at ecology and the human threat to biodiversity that was covered in some depth in unit B13.* **B18:** controlling our bodies **B19:** From Inheritance to evolution **B20:** ecology

Year 11 Long term plan: Biology

Narrative
In Year 11, students explore how we can classify organisms based on their characteristics and how these classification groups have changed as our understanding of cells and DNA has developed. Students then sue their knowledge of DNA and inheritance from year 9 to look more broadly at how organisms have evolved through natural selection. Students then explore how s=humans have used their knowledge of inheritance and DNA to create organisms with desirable characteristics through both selective breeding and genetic modification. They will look at the benefits and implications of these methods and evaluate the impact on individual organisms and whole ecosystems. Students will then look at ways in which organisms are specially adapted to their environment with a focus on the ways in which organisms carry out homeostasis. Students will first explore the nervous system in more depth and focus on reflexes as a way of responding rapidly to harmful stimuli and will carry out an investigation into how our reaction time can be affected by different factors such as caffeine. Students then explore our endocrine system as a mechanism for carrying our homeostasis and draw comparisons between the two. Students will build a more in-depth knowledge of glands, the hormones they produce and the affect they have on organs. Students will then look at both the control of blood glucose and control of the menstrual cycle in more depth. Separate students will also look at the role of hormones and kidneys in control of water. Finally, students will build on their knowledge of the menstrual cycle to explain how fertility can be controlled using contraceptive methods and fertility treatment. Students will explore implications of fertility treatment and embryo screening.

Unit	B5
Unit title	Evolving Organisms
Big question/ core concept	How do organisms grow and reproduce? Core concept: Inheritance Why are living things so diverse? Core concept: Evolution What are living things made of? Core concept: Cellular basis
Relevant end points	✓ Organisms reproduce by passing their genetic information from one generation to the next. How an organism develops depends on its genome and its environment. ✓ Organisms compete with and depend on other organisms for the materials and energy that cycle through ecosystems. A change to one population, or environmental condition can have a huge impact on biodiversity. ✓ The diversity of organisms, living and extinct, is the result of evolution by natural selection.
Core substantive knowledge	➢ Describe the groups used to classify organisms ➢ Describe the process of natural selection ➢ Interpret evolutionary tree diagrams ➢ Describe the processes of selective breeding and genetic engineering ➢ Describe the human nervous system and compare and contrast reflexes and conscious decisions ➢ Describe the endocrine system and how it can be used to control glucose (and water – separate only). ➢ Describe how hormones control the menstrual cycle and how these can be used to control/intervene with fertility.
Core disciplinary knowledge	• Biologists collect data in a variety of settings including field work. Variables in biology can be difficult to control. • Different biologists study life at different levels. From biological models to population of organisms • Biologists have to carefully consider how specimens are sourced and treated during research • Observations and data can be analysed and interpreted quantitatively and qualitatively • A cycle of collecting and analysing data provides evidence that biologists use to develop and improve explanations, classification systems and models • Biologists communicate about their work with a range of audiences within and beyond the scientific community, to facilitate evidence-informed debate and decision-making.

Year 11 Long term plan: Chemistry

Narrative	
In Year 11 students will bring together knowledge from previous chemistry units and start to explore the way in which we release energy rom fossil fuels and the impact this has on the Earth. They will start by learning how crude is formed before drawing on earlier knowledge of mixtures to learn that crude oil is made of different hydrocarbons. Students will be introduced to alkanes and alkenes and will draw on their earlier knowledge of structure and bonding to explain their properties. They will also apply their earlier knowledge of drawing molecular structures in order to represent alkanes and alkenes. Students will then explore the increased demand for shorter hydrocarbons and use knowledge of boiling points to explain the process of fractional distillation. Students will be introduced to a new reaction called cracking and gain more practice representing substances using molecular structures and formulae. They will learn about combustion reactions and make links to earlier learning in both chemistry and biology to explain the impact of both complete and incomplete combustion on the Earth. Students are then introduced to polymers, having explored this in a biological context in year 9, and learn how to represent these from different monomers. Finally, separate students will explore the physical and chemical properties of alcohols, carboxylic acids and esters and carry out investigations to make observations on their reactions.	
Unit	**C5**
Unit title	Organic Chemistry
Big question/ core concept	How does chemistry affect our world? Core concept: Chemical Earth What is the Earth made of and how is it changing? Core concept: Dynamic Earth
Relevant end points	✓ Substances can move within and between Earth's atmosphere, hydrosphere, geosphere and biosphere as part of large-scale Earth systems. Chemical substances produced by human activity are changing our planet. ✓ The structure of the earth is slowly changing. The Earth provides us with a rich source of resources
Core substantive knowledge	➢ Describe the composition of crude oil and how this can be separated into useful fractions. ➢ Describe the structure and properties of alkanes and alkenes. ➢ Describe combustion reactions. ➢ Explain the impact of the products of combustion reactions on the Earth. ➢ Describe the reactions of organic compounds (separate only)
Core disciplinary knowledge	• Chemists use models of the sub microscopic domain of substances to explain the properties and behaviour of substances. • Chemists use a range of unique symbols, formula, nomenclature, diagrams and equations. • Substances can be classified into groups. This enables chemists to identify patterns and trends. • Data from chemical measurements can be used to identify trends. • Provides evidence to test ideas. There are a range of qualitative and quantitative investigative techniques. • Chemistry requires skilled use of specialised equipment. This includes chemical measurement.

Year 11 Long term plan: Physics

Narrative
In year 11, students bring together knowledge of magnets, electrical current and forces to understand how electromagnets work. They will begin by learning what an electromagnet is before looking at ways that the strength of an electromagnet can increased. Higher tier students will also build on this further by exploring the motor effect and using Fleming's left-hand rule to make predictions about the direction of the force produced. Students will also develop their mathematical understanding of this relationship through use of the F = BIL equation. Separate students will then draw comparison between the motor and generator effect and learn how this is used in power stations to generate electricity as well as uses in devices such as a microphone and loudspeaker. This will require students to draw on knowledge from year 9 on energy resources and energy transfers. Finally, students will revisit the idea of transformers, this time through a quantitative lens through calculations using primary and secondary voltage.

Unit	**P5**
Unit title	Electricity and Magnetism
Big question/ core concept	What is electricity and magnetism?
Relevant end points	✓ The movement of charge forms electric current and causes magnetic fields. We use electrical currents to power our society.
Core substantive knowledge	➢ Describe how magnets can be used to generate electricity or movement. ➢ Describe how the national grid is designed making use of electromagnetic induction and alternating currents (separate only). ➢ Describe the production of static electricity in terms of electrons (Separate only). ➢ Draw electric field patterns (Separate only).
Core disciplinary knowledge	• Aims for the most fundamental explanations that apply in widest range of situations • Explanations include tests which support or disprove the idea. • Explanations are based on observations and experimental measurements • Arguments are developed from data, discussed and debated • Many explanations use models to think with and use to make predictions • Many models can be expressed as mathematical formulas

Long term plan: Year 11 Combined Science break down

Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1
Topic: Electrolysis and Humans and the Earth	**Topic: Using biology to our advantage**	**Topic: Organic Chemistry and Polymers**	**Topic: Application of Forces and Waves**	**Topic: Interleaved practice and application to different contexts**
Knowledge: 1. Reactivity Series and Displacement 2. Reactivity Series and Extraction Methods 3. Electrolysis of Molten Compounds 4. Electrolysis of Aqueous Solutions 5. RP Electrolysis 1 **Humans and the Earth** 1. The Early Earth's Atmosphere 2. Theories of the Atmosphere 3. The Greenhouse Effect 4. Evidence for the Greenhouse Effect 5. Effects of Global Warming 6. Reducing our carbon footprint 7. The harmful effects of Combustion 8. Resources used by Humans 9. Potable Water 10. Waste Water and Sewage 11. Evaluating Potable Water Methods 12. RP Analysing Water Samples 13. Mini Quiz 14. Phytomining and Bioleaching 15. Life Cycle Assessments 16. Reduce, Reuse, Recycle	**Knowledge:** 1. Classification 2. Natural selection and evolution 3. Evidence for evolution 4. Genotypes and Phenotypes 5. Genetic Cross Diagrams 6. Genetic engineering and Modification 7. Inheritance summary essay 8. The Nervous System and Synapses 9. Conscious and Unconscious Responses 10. RP Investigating human reaction time Part 1 11. RP Investigating human reaction time Part 2 12. Homeostasis 13. Mini Quiz 14. The Endocrine system 15. Negative Feedback Loops (HT only) 16. Controlling blood glucose 17. Diabetes 18. Hormones and the Menstrual Cycle 19. Contraception 20. IVF (HT only) 21. Embryo Screening 22. Comparing Nervous and Hormonal Response	**Knowledge:** 1. Ionic bonding recap 2. Metallic bonding recap 3. Covalent bonding recap 4. Crude oil 5. Drawing Alkanes and Alkenes 6. Properties of Alkanes and Alkenes 7. Combustion 8. Testing for Alkenes (Practical) 9. Fractional Distillation 10. Cracking 11. Polymers	**Knowledge:** 1. Electricity recap 2. Magnets 3. Magnetic fields 4. Electromagnets 5. The Motor Effect (Flemings Left Hand rule) 7. Magnetic Flux Density (HT only) 8. National Grid and Transformers 9. Radio Waves (HT only)	Address gaps in knowledge and build on links between different topics when applied to a range of scenarios Physics Paper 2 revision Chemistry Paper 2 revision Biology Paper 2 revision Physics Paper 1 revision Chemistry Paper 1 revision Biology Paper 1 revision GCSE exams

Long term plan: Year 11 Separate Science break down

Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1
Topic: Electrolysis and Humans and the Earth	**Topic: Using biology to our advantage**	**Topic: Organic Chemistry and Polymers**	**Topic: Application of Forces and Waves**	**Topic: Interleaved practice and application to different contexts**
Knowledge: 1. Reactivity Series and Displacement 2. Reactivity Series and Extractions methods 3. Corrosion 4. Corrosion Prevention 5. Transition metals 6. Properties of Transition Metals 7. Uses of Alloys 8. Nanoparticles 9. Electrolysis of Molten Compounds 10. Electrolysis of Aqueous Solutions 11. RP Electrolysis 1 Humans and the Earth 1. The Early Earth's Atmosphere 2. Theories of the Atmosphere 3. The Greenhouse Effect 4. Evidence for the Greenhouse Effect 5. Effects of Global Warming 6. Reducing our carbon footprint 7. The harmful effects of Combustion	Knowledge: 1. Classification 2. Natural selection and evolution 3. Evidence for evolution 4. Comparing theories of evolution 5. Structure of DNA 6. Protein Synthesis 7. Genotypes and Phenotypes 8. Genetic Cross Diagrams 9. Gregor Mendel and Inheritance 10. Genetic engineering and Modification 11. Inheritance summary essay 12. The Nervous System and Synapses 13. Conscious and Unconscious Responses 14. RP Investigating human reaction time Part 1 15. RP Investigating human reaction time Part 2 16. Homeostasis 17. Thermoregulation 18. Mini Quiz 19. The Endocrine system 20. Negative Feedback Loops (HT only) 21. Controlling blood glucose 20. Diabetes	Knowledge: 1. Ionic bonding recap 2. Metallic bonding recap 3. Covalent bonding recap 4. Crude oil 5. Drawing Alkanes and Alkenes 6. Properties of Alkanes and Alkenes 7. Combustion 8. Testing for Alkenes (Practical) 9. Fractional Distillation 10. Cracking 11. Polymers 12. Alkene reactions 13. The Alcohols (Practical) 14. Making Alcohol by Fermentation 15. Carboxylic acid reactions 16. Esters 17. Addition Polymerisation 18. Condensation Polymerisation 19. Naturally occurring polymers	Knowledge: 1. Electricity recap 2. Magnets 3. Magnetic fields 4. Electromagnets 5. Uses of Electromagnets 6. The Motor Effect (Flemings Left Hand rule) 7. Magnetic Flux Density (HT only) 8. The Generator Effect 9. National Grid and Transformers 10. Transformer Structure 11. Transformer Power Equations 12. Applications of the Motor Effect and Generator Effect 13. Radio Waves (HT only) 14. Sounds Waves 15. Uses of Sound Waves 16. Vector diagrams 17. Moments 18. Levers and Gears 19. Static electricity 20. Electric Field Patterns	Address gaps in knowledge and build on links between different topics when applied to a range of scenarios Physics Paper 2 revision Chemistry Paper 2 revision Biology Paper 2 revision Physics Paper 1 revision Chemistry Paper 1 revision Biology Paper 1 revision GCSE exams

Long term plan: Year 11 Separate Science break down

Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1
Topic: Electrolysis and Humans and the Earth continued.	**Topic: Using biology to our advantage continued.**	**Topic: Organic Chemistry and Polymers**	**Topic: Application of Forces and Waves**	**Topic: Interleaved practice and application to different contexts**
Knowledge: **8. Resources used by Humans** **9. Potable Water** **10. Waste Water and Sewage** **11. Evaluating Potable Water Methods** **12.RP Analysing Water Samples** **13. Mini Quiz** **14. Phytomining and Bioleaching** **15. Life Cycle Assessments** **16. Reduce, Reuse, Recycle** **17. Ceramics and Composites** **18. Polymers** **19. The Haber Process 1** **20. Le Chateliers Principle and the Haber Process** **21. NPK Fertilisers**	**Knowledge:** **21. Controlling Water Part 1** **22. Controlling Water Part 2** **23. Hormones and the Menstrual cycle** **24. Contraception** **25. IVF (HT only)** **26. Embryo Screening** **27. Comparing Nervous and Hormonal Response**			