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 the 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					
Paper 1	P5	C5 & B5	Revision		

Legacy year 7 Long term plan

Chemistry	*Our legacy year seven sequence started with a skills unit before covering the basics of separation techniques and looking at atoms, elements and compounds.* • Describe the three states of matter & link these to the properties of substances (inc. changes of state, melting and boiling points, Brownian motion & types of transport) • Describe atoms, elements, compounds and mixtures and know the symbols and formula for these. • Describe the structure of an atom (electrons, protons & neutrons) • Describe the difference between physical and chemical reactions • Describe the four separation techniques (filtration, crystallisation, simple distillation & chromatography) • Describe the structure of the periodic table (inc. the properties of metals and non-metals)
Biology	*Our legacy year seven biology sequence started by looking at the classification of organisms before moving on to food webs. The second term of biology work looked at microscopes and cells before studying specialist cells and levels of organisation* • Describe the 5 kingdoms and the classes of vertebrates and classify organisms using classification keys • Link organisms using food chains & food webs and use this to describe the impact of one organism on another (including increases and decreases in numbers & competition) • Describe the environment and habitats of different organisms • Describe the key parts of a microscope • Compare and contrast animal and plant cells and prokaryotic and eukaryotic cells • Describe the features of key specialised cells in the body (and stem cells) • Link cells, tissues, organs and systems in terms of size.
Physics	*Our legacy year seven physics sequence started with force and energy before looking at motion using distance-time and velocity-time graphs* • Identify the different types of forces • Explain the impact of balanced and unbalanced forces on an object • Calculate speed and interpret distance time graphs and velocity time graphs. • Describe the different energy stores and how energy can be transferred from one store to another • Describe efficiency and how energy can be lost during different energy transfers

Disciplinary knoweldge developed:

Students learnt how to: Define the three types of variable and identify them in a range of scenarios. They talked about accuracy and explained how this can be achieved in an experiment. They learnt how to use a microscope to examine plant and animal cells. Students studied classification in biology and chemistry (e.g. organisms into kingdoms/classes & substances into solids, liquids and gases or elements, compounds or mixtures).

Students also completed some simple investigations and learnt how to follow a simple method and select appropriate equipment for different separation technique

Analysis of data: Students learnt how to draw simple graphs to represent data (bar charts, line graphs with scales provided) and how to describe the relationship shown on a graph (distance-time or velocity time as examples)

Legacy year 8 Long term plan

Chemistry	*Our legacy year eight sequence started by looking a the periodic table before studying chemical reactions. It finished with Earth science – covering the Earths structure and the formation of different rock types.* • Describe how elements are organised in the periodic table and common properties • Describe exothermic and endothermic reactions • Describe how to test for oxygen, carbon dioxide and hydrogen • Describe common reactions (metal & oxygen, metal & acid, combustion, acid & hydroxide and acid & carbonates) and write simple word & symbol equations for these • Rank metals in terms of reactivity • Describe the composition of the earth & some properties of each rock type.
Biology	*Our legacy year eight biology sequence started with food groups and digestion before looking at plant adaptions for photosynthesis. Our second term of biology looked at other human organ systems, building up to look at respiration. It finished by looking at different pathogens and how vaccinations and antibiotics could prevent or cure diseases.* • Describe the key food groups and the impact of balanced and unbalanced diets • Describe the key organs in the digestive food & explain the digestion of food. • Describe photosynthesis and explain how a plant is adapted for this process. • Describe the lungs & the processes of breathing & gas exchange • Compare aerobic and anaerobic respiration • Compare communicable and non-communicable diseases and how our body, life choices and immune system can protect us from these.
Physics	*Our legacy year eight physics sequence started with sound and light, including both reflection and refraction. The second term of physics focused on circuits before concluding with a series of lessons on magnets and electromagnets* • Describe how sounds are produced, travel and are heard. • Describe how light can be reflected and refracted giving examples in everyday life & drawing ray diagrams. • Classify items as conductors and insulators • Draw simple circuits identifying components • Describe how current & potential difference can be measured & predicted in a series and parallel circuit. • Describe the properties of magnets and draw magnetic fields.

Disciplinary knoweldge developed:

Students learnt how to: use standardised units for different measurements, write and test predictions, draw conclusions from data. They also learnt how to draw ray diagrams to represent investigations and how to draw circuit diagrams and diagrams of magnetic fields.

Students also completed some simple investigations and learnt how to follow a simple method and select appropriate equipment for different separation technique

Analysis of data: Students learnt how to identify anomalies, rank things in order by measurements of a property, draw simple graphs and analyse a line graph

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.	

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	

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.	

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 (Demonstration) 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 1 14. Ions of metals and non-metals 15. Uses of metals 16. Corrosion (Separate only) 17. Corrosion prevention (Separate only) (Practical) 18. Transition metals (Separate only) 19. Properties of transition metals (Separate only) 20. Alloys 21. Uses of alloys (Separate only) 22. Alkali metals (Demonstration) 23. Halogens 24. Noble Gases 25. Gas tests (Demonstration/Practical 26. 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. Nanoparticles (Separate only) 9. Metallic Bonding 10. Comparing and contrasting types of bonding 11. Word and symbol equations 12. Balancing equations 13. Conservation of mass 14. Introducing moles (Higher only) 15. Metals and oxygen (Demonstration) 16. Metals and acid (Demonstration) 17. Metals and water (Demonstration) 18. Redox reactions (Higher only) 19. Acids and bases 20. Strong and weak acids (Higher only) (Demonstration) 21. Neutralisation 22. RP: Making Salts P1 23. RP: Making Salts P2 24. Reactivity series and displacement reactions (Practical) 25. Half equations for displacement (Higher only) 26. Reactivity series and extraction methods 27. Electrolysis of molten compounds (ionic half equations - higher only) 28. Electrolysis of aqueous compounds (ionic half equations - higher only) 29. RP Electrolysis	**Topic: Physics - 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. Investigating thermal insulators (Practical – R for Separate only) 8. Gravitational potential energy 9. Kinetic energy 10. Elastic potential energy 11. Multi-step calculations (GPE/KE/EPE/Efficiency) 12. Non-renewable resources 13. Renewable resources 14. Comparison of energy resources 15. Mini Quiz 16. Introduction to waves 17. Wave Speed equation 18. Calculating period of a wave 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 wave using a piece of string 22. Types of Electromagnetic Waves 23. Properties and Uses of Electromagnetic Waves	**Topic: Forces** **Knowledge:** 1. Scalar and vector quantities 2. Types of forces 3. Weight 4. Resultant forces 5. Vector diagrams (Higher 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 ((higher only) 14. Investigate Newton's Second Law of motion (R. Practical) Part 1 15. Investigate Newton's Second Law of motion (R. Practical) Part 2 16. Newton's third law 17. Stopping distances 18. Factors that affect thinking distance 19. Stopping distance graph (Separate only) 20. Momentum (higher only) 21. Momentum calculations (higher only) 22. RP - Relationship between force and extension (Part 1) 23. RP - Relationship between force and extension (Part 2) 24. Magnets 25. Magnetic fields 26. Electromagnets	**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 microscope 7. DNA 8. The structure of DNA (separate only) 9. Protein synthesis (Separate only) 10. Mitosis and the cell cycle 11. Incredible stem cells 12. Therapeutic cloning 13. Cloning plants (separate only) 14. Cloning animals (Separate only) 15. Sexual and Asexual reproduction 16. Evaluating types of reproduction 17. Meiosis 18. Inheritance (genetic cross diagrams) 19. Sex determination 20. Family trees 21. 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. Multiplying bacteria (Separate only) 9. Culturing microorganisms 10. Investigating Antiseptics (part 1) (Practical – R. separate only) 11. Investigating antiseptics (part 2) (Practical – R. separate only) 12. Antibiotic resistance 13. Developing new drugs (part 1) 14. Developing new drugs (part 2) 15. Monoclonal antibodies (Separate only) 16. Scatter Graphs and Health 17. Frequency tables and histograms 18. Analysis data 19. Mini Quiz 20. Plant diseases (Separate only) 21. Parts of the brain (Separate only) 22. The Eye (Separate only) 23. Myopia and hyperopia (Separate only)

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	

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	

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.	

Autumn 1	Autumn 2	Spring 1	Spring 2
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. The digestive system 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. Rates of reaction in the body 21. Diffusion 22. Diffusion and Surface area (Practical) 23. Diffusion in action 24. Kidneys and their function (Separate only) 25. Kidneys and ADH (Separate only) 26. Treating Kidney failure dialysis (Separate only) 27. Treating Kidney failure transplant (Separate only)	**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 (Separate only) 9. Plant cells, tissues and organs 10. Osmosis 11. Osmosis in action 12. RP Osmosis 1 13. RP Osmosis 2 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. RP Photosynthesis 1 22. RP Photosynthesis 2 23. Using glucose and nitrogen in plants 24. Mini Quiz 25. Tropisms (Separate only) 26. Plant hormones (Separate only) 27. RP Germination 1 (Separate only) 28. RP Germination 2 (Separate only) 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 37. Food security (Separate only)	**Topic: Nuclear and Thermal Physics** **Knowledge:** 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. Types of radioactive decay 15. Nuclear equations 16. Half life 17. Modeling radioactive decay 18. Irradiation and Contamination 19. Uses of radiation (Separate only) 20. Background radiation (Separate only) 21. Evaluating hazards 22. Nuclear Fission (Separate only) 23. Nuclear Fusion (Separate only) 24. Mini Quiz 25. Particle model - density and states 26. RP investigating density 27. Changes of state 28. Heating and cooling graphs 29. Latent heat 30. Specific heat capacity 31. RP investigating specific heat 32. Comparing LH and SLT (higher only 33. Pressure in gases 34. Gas pressure part 2 (Separate only) 35. Pressure in liquids and hydaulics (Separate only) 36. Pressure at different depths (Separate only) (Demonstration) 37. The Atmosphere (Separate only) 38. Floating and sinking (Separate only)	**Topic: Electricity and Astrophysics** **Knowledge:** 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. RP Resistance of a wire (Part 1 and 2) 8. Light Dependent Resistors 9. Thermistors 10. RP IV Characteristics Part 1 11. RP IV Characteristics 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. Changing Orbits (Separate only) 26. The Doppler effect (Separate only) 27. The Big Bang and Red shift (Separate only) 28. Dark Mass and Dark Energy (Separate only) 29. Black bodies and radiation on Earth (Separate only)

Summer 1	Summer 2
Topic: Reacting Substances **Knowledge:** 1. Exothermic and endothermic reactions 2. RP Temperature Changes Part 1 3. RP Temperature Changes Part 2 4. Reaction profiles 5. Bond energies (Higher only) 6. Electrochemical cells and voltage (separate only) 7. Rechargeable and non-rechargeable batteries (separate only) 8. Fuel Cells (Separate only) 9. Half equations for fuel cells (Separate only) 10. Measuring rates of reaction 11. Factors affecting rates of reaction 12. Limiting reactants (Higher only) 13. Drawing rates of reaction graphs 14. RP Investigating the effects of concentration on rates of reaction. 15. Catalysts 16. Mini Quiz 17. Reversible reactions (Demonstration) 18. Chatelier Principle (higher only) 19. Conservation of mass 20. Relative Formula Mass 21. Atom economy (Separate only) 22. Introducing moles (Higher only) 23. Reacting Masses (Higher only) 24. Percentage yield (Separate only) 25. Concentration 26. Introduction to titration (Separate only) 27. RP Titrations Part 1 (separate only) 28. RP Titrations Part 2 (separate only) 29. Calculating the volume of a gas (Separate only) 30. RP Testing for ions (Separate only)	**Topic: Humans and the Earth** **Knowledge:** 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 17. Ceramics and Composites (Separate only) 18. Polymers (Separate only) 19. The Haber process 1 (Separate only) 20. Le Chatelier's Principle and the Haber Process (Separate only) 21. NPK Fertilisers (separate only)

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.

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.

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

Year 11 Combined Science

Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
1. Cells, specialisation & microscopy 2. Mitosis & stem cells 3. Cell transport 4. Organ systems & health 5. Plant systems & photosynthesis 6. Respiration & exercise 7. Communicable disease and defence 8. Vaccination, antibiotics, and drug development 10. Atoms, compounds, mixtures, subatomic 11. Periodic Table, E. structure, Groups 12. Covalent, ionic, metallic bonding, giant covalent 13. Mass calculations 14. Mass calculations 15. Reactivity series, extraction and redox 16. Acids and alkali 17. Electrolysis 18. Exo and Endo 20. Types of energy and resources 21. Electricity (circuits and efficiency) 22. Electricity (power and national grid) 23. Calculations 24. Heat (SHC & LH) 25. Atoms & isotopes 26. Half-life, uses and dangers of radiation 27. Nuclear equation and types of decay.	**Mock preparation time.** 1. Gravity & weight, resultant forces 2. Forces & work done 3. Hooke's law 4. Distance & displacement 5. Speed, velocity & DT graphs 6. Acceleration & VT graphs 7. Newton's Laws 8. Stopping, reactions & braking dist 9. Momentum 10. Transverse & longitudinal, Wave properties 11. Types of EM waves, properties and uses 12. Magnetic poles & magnetic fields 13. Electromagnetism 14. Fleming LHR, F=BIL & motors	1. Collision theory, Ea & Catalysts 2. Factors affecting rate of reaction & Calculating rate of reaction 3. Reversible and DE, Energy changes in RR 4. Equilibrium & Le Chatelier's 5. Crude oil & Fractional distillation 6. Cracking 7. Pure substances, substances & formulations 8. Chromatography & Gas tests 9. Atmosphere & changes 10. Greenhouses gasses & human activities 11. Climate change, Carbon footprint & pollutants 12. Sustainable development 13. Potable water & wastewater 14. LCAs & recycling 15. Vectors, scalars, contact & non-contact 16. Homeostasis & the nervous system 17.Endocrine systems 18.Reproduction systems 19.Sexual reproduction & meiosis 20.DNA and genome systems 21. Variation & Evolution 22. Selective breeding & genetic engineering 23. Evidence for evolution 24. Classification & Communities 25. Abiotic factors & biotic factors	**Mock preparation time.** **Interleaved practice and application to different contexts** Address gaps in knowledge and build on links between different topics when applied to a range of scenarios: Biology Paper 2 Chemistry Paper 2 Physics Paper 2	**Interleaved practice and application to different contexts** Address gaps in knowledge and build on links between different topics when applied to a range of scenarios: Biology Paper 1 Chemistry Paper 1 Physics Paper 1 GCSE Exams begin	GCSE Exams

Year 11 Separate Science

Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
1. Cells 2. Culturing Microorganisms 3. Cell division 4. Transport in cells 5. Digestive system and enzymes 6. Circulatory system 7. Non-communicable disease 8. Communicable disease 9. Monoclonal antibodies 10. Plant organisation and disease 11. Photosynthesis 12. Respiration 13. Atomic model 14. Periodic table 15. Metal & groups 16. Ionic and metallic bonds 17. Electrolysis 18. Covalent bonding 19. Quantative Chemistry 1 20. Quantative Chemistry 2 21. Metal extraction 22. Acids 23. Exothermic and endothermic 24. Cells 25. Energy stores (kinetic / Elastic / GPE) 26. Energy changes and efficiency 27. Electricity 28. Power P=It E=P/t E=QV (two step practice) 29. Static electricity 30. Density and state change 31. Heat calculations 32. Pressure 33. Radioactivity 34. Half-lives 35. Fission and fusion	**Mock preparation time.** 1. Bonding recap 2. Crude oil and human impact 3. Alkanes and alkenes (drawing and prop) Demo testing for alkenes 4. Combustion 5. Fractional distillation and cracking 6. Alkene reactions 7. Alcohols and making alcohols 8. Carboxylic acids and Esters 9. Addition polymerisation and condensation polymerisation 10. Naturally occurring polymers	1. Magnets and magnetic fields 2. Electromagnets and their uses 3. Motor effect 4. FBIL 5. The generator effect 6. National grid and transformers and transformer structure 7. Transformer power equation 8. Static electricity 9. Electric fields 10. Radio waves 11. Sound waves and uses of soundwaves 12. Vector diagrams 13. Orbits 14. Moments 15. Leavers and Gears 16. Classification 17. Natural selection and evolution 18. Evidence of evolution 19. Genotypes, phenotypes and genetic crosses 20. Mendel 21. Genetic modification and genetic engineering 22. Inheritance 23. The nervous system and reflex arcs 24. Homeostasis 25. Endocrine and negative feedback loops 26. Controlling blood glucose 27. Contraception 28. IVF 29. Embryo screening 30. Comparing the hormonal and nervous system	**Mock preparation time.** **Interleaved practice and application to different contexts** Address gaps in knowledge and build on links between different topics when applied to a range of scenarios: Biology Paper 2 Chemistry Paper 2 Physics Paper 2	**Interleaved practice and application to different contexts** Address gaps in knowledge and build on links between different topics when applied to a range of scenarios: Biology Paper 1 Chemistry Paper 1 Physics Paper 1 GCSE Exams begin	GCSE Exams