OCL Science
Long Term Plan

Year 7

This year is designed to provide students with a bridge between the concepts that they have covered in primary school and those that they will go on to study in secondary. It is assumed that all students will enter with a slightly different starting point as they will be joining from a range of different primary schools that will have had different levels of expertise. Within this year, we hope to embed the learning habits and routines that will ensure that these students go on to be successful learners during their time at the school.

Each year is broken into the three disciplines. It is important that students understand the difference between these – biology is the study of multiple factors that effect living organisms and life, Physics, in contrast, typically assumes that entities behave identically. It 'builds its explanations on measurable quantities that can be put into numerical relationships and chemistry draws heavily on the use of models and modelling[footnote 55] to explain the behaviour of matter and routinely involves the synthesis of the objects it studies (Ofsted 2021).

Secure Substantive Knowledge:

- Within the chemistry units, students will be introduced to the concept of particles and using models to explain how these behave. Students will also be introduced to the concept of physical and chemical changes and the periodic table which allows us to organise elements based on their structure and in turn their properties.
- In Spring, during the physics unit, students will be introduced to the fundamentals of forces – that objects have an effect on each other. This is put into context through the effect of forces on motion, stretching of an object and in space. They will also be introduced to the concept that energy cannot be created or destroyed, simply transferred from one store to another. They are introduced to generating electricity and how humans utilise energy transfers to our advantage.
- Finally, within Biology, students will gain an understanding of how we classify organisms into categories based on their features and behaviour. They will also begin to discern between different types of organism based on their cellular structure and how these cells are organised to form complex organisms. They learn how to use a microscope and how we can use this to compare plant and animal cells. During Year 7, we also begin to look at reproduction and how characteristics are passed on via an organisms genetics and how this can lead to evolution of organisms over time.

Secure Disciplinary Knowledge (inc. practical skills):

- Students are introduced to the key experimental vocabulary during the first half term of this year. This is then built on through a series of short investigations where students follow simple methods, choosing appropriate equipment from a selection given. They are taught to draw simple graphs & describe simple relationships. They also begin to apply mathematical concepts such as substituting into a given equation, calculating means and rounding to two decimal places. They also begin to use simple unit conversions. Students also begin to look at historical figures in science and there is the option to have discussions around the lack of diversity within this community of scientists. Students also begin to look at the impact of science on our lives & how we as humans have had an impact on other organisms and habitats. The idea that science is constantly evolving will be introduced as students learn about the development of the periodic table and our understanding of fuels.
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Year	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
7	**Topic: Particles (Chemistry)** 1. Routines and Expectations (optional) 2. Variables 3. Accuracy 4. Equipment 5. Following a method 6. Drawing graphs 7. Maths in Science 8. States of matter (inc. density) 9. Changes of state 10. Melting and boiling points (Practical) 11. Expansion and contractions (Demonstration) 12. Brownian Motion and the particle model (Demonstration) 13. Types of transport 14. Atoms and elements 15. Compounds and mixtures 16. Symbols and formulae 17. Atomic Structure	**Topic: Types of reaction and the periodic table (Chemistry)** **1.** Physical and Chemical reactions 2. Pure substances and solubility 3. Rates of dissolving (Practical) 4. Filtration (Practical) 5. Crystallisation (linking to evaporation) (Practical) 6. Simple Distillation (Demonstration) 7. Chromatography (Practical) 8. Acids and Alkalis 9. Indicators (Practical) 10. Neutralisation (Practical) 11. The periodic table – structure 12. History of the periodic table 13. Metals and non-metals 14. Alloys (EXT) 15. Ceramics, Polymers, Composite	**Topic: Forces (Physics)** 1. Identifying forces – contact vs non-contact 2. Balanced and unbalanced forces 3. Resultant force 4. Newton's Laws (EXT) 5. Friction- advantages and disadvantage 6. Streamlining- everyday examples and linked to particles (EXT) (Practical) 7. Speed calculations 8. Distance- time graph 9. Velocity-time graph 10. Hooke's Law- (Practical) 11. Moments 12. Gravity, weight and mass 13. Solar system 14. Day and night 15. Seasons 16. Galaxies and universe 17. Light year	**Topic: Energy (Physics)** 1. Energy Stores 2. Energy transfers 3. Useful and wasted energy 4. Sankey diagrams (EXT) 5. Efficiency calculations 6. Energy in food 7. Heating and thermal equilibrium 8. Conduction, convection and radiation (Practical) 9. Preventing heat loss- practical skills 10. The National Grid 11. Renewable and non-renewable 12. Generating electricity from renewable and non-renewable sources 13. Renewables- advantages and disadvantages 14. Nuclear energy 15. Calculations: power and energy costs	**Topic: Interdependence and cells (Biology)** 1. Living things: MRS NERG 2. 5 Kingdoms and classes 3. Classification and keys 4. Food chains 5. Food webs 6. Pyramids of numbers 7. Pyramids of biomass (EXT) 8. Environment and habitats 9. Competition 10. Sampling techniques (EXT) (Practical) 11. Microscopes 12. Animal cells (Practical) 13. Plant cells (Practical 14. Microscope calculations (EXT) 15. Prokaryotic vs eukaryotic 16. Specialised cells 17. Stem cells 18. Cells, tissues, organs, systems	**Topic: Reproduction and Variation (Biology)** 1. Male and female reproductive organs in humans and plants 2. Gametes – humans and plants 3. Fertilisation in humans 4. Pregnancy and gestation 5. Effect of maternal lifestyle 6. Menstrual cycle 7. Pollination and seed dispersal 8. Quantitative investigations of dispersal mechanisms 9. Genetic and environmental variation 10. Genetic cross diagrams (EXT) 11. Genetic diseases and sexual determination (EXT) 12. Variation 13. Adaptation 14. Natural Selection 15. Selective Breeding 16. Endangered species and extinction 17. Biodiversity 18. Extremophiles (EXT)

Year 8

Secure Substantive Knowledge:

- During Year 8 Physics, students visit the concept of transferring energy from one place to another through waves. They also investigate how these waves behave in different scenarios and the effect that we are then able to see with our eyes or hear with our ears. Students also begin to look at the transfer of energy within electrical circuits and the use of a circuit to create electromagnets.
- Within the chemistry unit, students build on their knowledge of atoms and the periodic table to look at the structure of atoms and the arrangement of elements in the periodic table based on their properties and the effect of their structure on reactivity. They also begin to look at common chemical reactions and our representation of these using word and symbol equations. They conduct experiments to rank metals in order of their reactivity and use this knowledge to explain how metals can then be extracted from their ores. This links nicely to a closer look at the structure of the Earth and discussions about how humans use the Earth's resources and the impact that we have on our planet.
- Students go on to study humans and plants as organisations, looking in particular at the systems that have evolved within both types of organism that allow them to grow and survive. Students build on their knowledge of different types of organisms on a cellular level and how organisms interact with each other from Year 7 to explain how pathogens cause communicable diseases in humans and how our bodies have evolved to protect us from dying from these diseases. They also begin to look at how science has allowed us to develop medication and vaccinations to prevent illness**.**

Secure Disciplinary Knowledge:

- Students build on their knowledge of elements and compounds to start using symbols to represent these in common equations. They begin to write their own scientific predictions and hypotheses that they test using simple experiments, using data from these to write conclusions. They will start to draw scientific diagrams such as ray diagrams and circuit diagrams. They will begin to use data to draw simple graphs independently, complete simple calculations without help and expand their range of unit conversions. Students will continue to have tricky conversations around topics such as vaccinations and lifestyle choices. They will continue to develop the concept of a continually evolving bank of scientific ideas as they start to talk about our knowledge of transmissible diseases and the composition of the Earth.

Year Group	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
8	**Topic: Waves and Pressure (Physics)** 1. Transverse and longitudinal (EXT) 2. Producing sounds (Demonstration) 3. How sound travels 4. Hearing sounds – structure of the ear 5. Properties of sound waves (Demonstration) 6. Using sound: ultrasound and echo waves 7. Waves – EM waves (inc water waves) 8. Introduction to light 9. Comparing sound & light waves 10. Wave calculations 11. The eye (Optional Practical/demonstration) 12. Reflection (diffuse and specular)(Practical) 13. Refraction (inc. prisms) (Practical) 14. Seeing colour (EXT) (Practical) 15. Pressure (over area) (Demonstration) 16. Pressure (in liquids) (Demonstration) 17. Pressure (in gases) (Demonstration)	**Topic: Electricity and Magnetism (Physics)** 1. Conductors and Insulators (Practical) 2. Electrical circuits (Practical) 3. Current (Practical) 4. Potential difference 5. Measuring potential difference 6. Series and Parallel circuits (Practical) 7. Resistance in a circuit 8. Power in a circuit 9. Static electricity (Demonstration) 10. Magnets 11. Making Magnets 12. Drawing magnetic fields(Practical) 13. Earth's magnetic field 14. Electromagnets (Practical) 15. Using Electromagnets (inc. introduction to D.C. motors)	**Topic: Chemical reactions (Chemistry)** 1. Atomic Structure 2. Electronic Configuration 3. Ar and Mr (EXT) 4. Alkali metals (group 1) 5. Halogens (Group 7) 6. Noble Gases (Group 0) 7. Reactivity of Group 1 and 7 (EXT) 8. Naming compounds (EXT) 9. Writing formulae (EXT) 10. Exothermic and endothermic reactions 11. Testing for gases 12. Metals and oxygen (Practical) 13. Metals and acid reactions (Practical) 14. Acids and hydroxides 15. Acids and carbonates (Practical) 16. Combustion (Demonstration) 17. Word and symbol equations 18. Balancing equations 19. Conservation of mass	**Topic: Reactions and the environment (Chemistry)** 1. The Reactivity series (Practical) 2. Displacement reactions 3. Extracting metals 4. Rates of reaction (EXT) 5. Thermal decomposition and catalysts (Practical) 6. Composition of the Earth 7. Structure of the Earth 8. The Rock Cycle 9. Igneous rocks 10. Sedimentary rocks 11. Metamorphic rocks (Practical) 12. Fossil fuel formation 13. The Earth's Atmosphere 14. The carbon cycle 15. Climate change and the greenhouse effect 16. Finite resources and recycling	**Topic: Energy from food (Biology)** 1. Food groups 2. Balanced and unbalanced diets 3. Energy in food (Practical) 4. Tissues and organs of the digestive system (Demonstration) 5. Digestion 6. Absorption – diffusion, active transport, osmosis (EXT) 7. Enzymes in the digestive system 8. Photosynthesis 9. Investigating Photosynthesis (Practical) 10. Leaf adaptations – Gas exchange 11. Root adaptation - Absorption of water 12. Transpiration/translocation (EXT) (Practical) 13. Testing for starch (Practical)	**Topic: Keeping Healthy (Biology)** 1. Sub cellular structures (recap) 2. Cells, tissues, organs and systems 3. The lungs (Demonstration) 4. Breathing 5. Gas exchange 6. The heart and blood (Demonstration) 7. The circulatory system 8. The skeletal & muscular system 9. Aerobic respiration 10. Anaerobic respiration 11. Exercise and respiration (Practical) 12. Communicable vs non communicable diseases 13. Microorganisms 14. Pathogens 15. Antibiotics 16. Human defences 17. Vaccination 18. Drugs & lifestyle choices

Year 9

Secure Substantive Knowledge:

- Students build on their chemistry knowledge of elements and compounds, looking at compounds and formulae used to represent these substances. They also begin to look at how our concept of an atom has changed over time. They look at patterns and how different groups in the periodic table react and bond together and how this can be modelled using different types of diagram. This unit also builds on the knowledge of common reactions in Year 8 so that students are able to predict which substances will be produced in different reactions and how they would prove that these substances have been made. Students are introduced to electrolysis and how this can be used to separate more reactive elements from their ore and create substances like hydrogen and oxygen.
- Within Physics, students take a deeper look at waves and energy transfers, in particular looking at efficiency of these transfers and the GPE, kinestic energy and elastic potential energy store and how calculations allow us to predict the amount of energy that should be held in that store (should a closed system with no energy loss be used!). Students also start to observe and measure physical properties of waves, representing these using diagrams. Students will be introduced to the different types of quantity within science (scalar and vector). They will look at the quantitative effect of different forces on an objects motion and shape and begin to complete more complex calculations and graphical representations of data.
- Building on the use of the microscope in Year 7, students will look in more details at the types of cells. They will begin to discuss how humans use replication of cells to their advantage and how our concept of the human genome has had an impact on our knowledge of inheritance. They will also look more closely at specific types of communicable disease and how new drugs are developed. They will begin to analyse more complex data sets, using this to draw conclusions. Finally, students will go on to look at the brain and eye and how these complex organs in our body function and are susceptive to damage and how our knowledge of science has once again, allowed us to intervene and in lots of cases, identify the issue and put in place solutions.

Secure Disciplinary Knowledge:

- Within this unit, students are given plenty of opportunities to practice representing elements, compounds and general reactions using symbols. They begin to evaluate the limitations of using particular types of model to represent substances. They write their own scientific hypotheses and test these using the evidence to support their conclusions. They begin to identify anomalies and describe how to deal with them. They start to look at more complete relationships on a graph and use lines of best fit to extract data. They develop their bank of scientific diagrams to include wave diagrams and free body diagrams. They build on their use of the microscope in year 7 to discuss the use of one type of microscope over another.
- They continue to complete calculations of increasing difficulty, calculating means, rounding to a given number of decimal places and signficiant figures and converting a wider range of units without being prompted. There are opportunities to revisit the concept of an evolving scientific knowledge base with discussions around the structure of the atom, developments in microscopes and how these have supported our understanding of scientific concepts. Students also begin to apply their knowledge of science to explain how we have used this to extract resources from the Earth and how this has at times, been wasteful.

Year Group	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
9	**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. Chromatography (R.Practical) 7. Changing Atomic Theories 8. Protons, Neutrons and Electrons 9. Electron configuration 10. Isotopes and relative atomic mass 11. The periodic table 12. The modern periodic table 13. Mini Quiz 14. Metals and non-metals 15. Uses of metals 16. Corrosion (Separate only) 17. Corrosion prevention (Separate only) (Practical) 18. Transition metals (Separate only) 19. Typical properties (Separate only) 20. Alloys 21. Properties and uses of alloys 22. Alkali metals (Demonstration) 23. Halogens 24. Noble Gases 25. Gas tests (Demonstration/Practical	**Topic: Investigative Chemistry** **Knowledge:** 1. Ionic bonding part 1 2. Ionic bonding part 2 3. Properties of ionic bonding 4. Covalent bonding 5. Properties of covalent structures 6. Giant covalent structures 7. Nanoparticles (Separate only) 8. Metallic Bonding 9. Comparing and contrasting types of bonding 10. Word and symbol equations 11. Balancing equations 12. Conservation of mass 13. Metals and oxygen (Demonstration) 14. Metals and acid (Demonstration) 15. Metals and water (Demonstration) 16. Redox reactions (Higher only) 17. Acids and bases 18. Acids - weak and strong (Separate only) (Demonstration) 19. Neutralisation 20. RP: Soluble Salts 20. Reactivity series and displacement reactions (Practical) 21. Ionic half equations for displacement (Higher only) 22. Reactivity series and extraction methods 23. Electrolysis of molten compounds (ionic half equations - higher only) 24. Electrolysis of aqueous compounds (ionic half equations - higher only) 25. Electrolysis part 1 (R.Practical) 26. Electrolysis part 2 (R.Practical)	**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. Waves equation 18. Measuring period of a wave 19. RP: Measuring speed of a wave using a ripple tank 20. Measuring the speed of sound 21. EM Spectrum	**Topic: Forces** **Knowledge:** 1. Scalar and vector quantities 2. Types of forces 3. Weight 4. Resultant forces 5. Vector diagrams 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) 15. Newton's third law 16. Stopping distances 17. Energy transfers in stopping 18. Momentum (higher only) 19. Momentum calculations (Separate only) 20. Hooke's Law 21. Relationship between force and extension 22. Circular Motion 23. Magnets 24. Magnetic fields 25. 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 (bases and monomers = separate only) 8. The Human Genome 9. Mitosis and the cell cycle 10. Incredible stem cells 11. Therapeutic cloning 12. Cloning plants (separate only) 13. Cloning animals (Separate only) 14. Asexual reproduction 15. Sexual Reproduction and Meiosis 16. Sexual vs asexual reproduction 17. Examples of unusual reproduction 18. Inheritance (genetic cross diagrams) 19. Family trees 20. Genetic diseases and sex determination 21. Protein Synthesis (Separate only)	**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. Analysing Antibiotics 13. Antibiotic resistance 14. Developing new drugs (part 1) 15. Developing new drugs (part 2) 16. Monoclonal antibodies (Separate only) 17. Scatter Graphs and Health 18. Frequency tables and histograms 19. Analysis data 20. Mini Quiz 21. Plant diseases (Separate only) 22. Parts of the brain (Separate only) 23. Brain Surgery (Separate only) 24. The Eye (Separate only) 25. Myopia and hyperopia (Separate only)

Year 10

Secure Substantive Knowledge:

- Students look further at humans being complex systems, looking at the different types of respiration and how the body is designed to ensure that these systems work effectively together. They use their knowledge of enzymes from Year 8 to look at the impact of different factors on enzymes and therefore rates of reaction in the body. Developing their knowledge of how substances can move from one place to another, they look at examples of this happening in both humans and plants and how this is determined by concentration and the size of particles. Building on the work in Year 7, students also look at how complex the interactions between organisms can be and the effect that humans can have on disrupting these relationships and how humans can utilise other living organisms to their advantage. Students should also be introduced to how damaging this can be and how science can be used to help us to prevent this having a truly negative impact on ecosystems.
- Within the physics unit, students will look in more details at radiation. They will the interaction of light waves with different surfaces and substances, radiation from unstable radioactive atoms and the impact of gaining and losing kinetic energy on temperature and state of substances. Finally, they will look at the impact of forces on different surfaces both in solids and fluids. Building on knowledge of circuits from Year 8, students will look at the relationship between current, potential difference and resistance. They will link this to transfer of energy across the country. Finally, separate science students will revisit the magnitude of space and the role of different forces in the phenomenon that exist within our universe.
- Finally, students will use their knowledge of chemical reactions to look at factors affecting reactions quantitatively and qualitatively. They will build on their understanding of using equations to represent reactions to illustrate the theory of conservation of mass using a number of different calculations. They will look further at the changes that have occurred to our planet since it's creation and the impact that humans are having during our life time. They will also learn about the use of resources by humans and how science has enabled us to manufacture new materials that allow us to live our lives with more ease.

Secure Disciplinary Knowledge:

- Students use models to represent a range of different scientific phenomenon and can discuss the limitations of using these. They test hypotheses using more complicated scientific invetsigations and use the data from these quantitatively and qualitatively. They are able to suggest a range of techniques that would be appropriate to use within an investigation and are able to discuss why they have chosen one over another. Students can decide on the most appropriate method to present data and are able to evaluate their data sets based on repeatability, reproducibility, accuracy and precision.
- Students can complete multistep calculations, round numbers to a number of decimal places and calculate the volume of different 3D shapes. They will also be able to use a tangent to complete quantitative analysis of data presented in a graph.
- Students will have discussion around the start of life, changing models of the solar system and our understanding of electricity. There will also be further opportunities to develop students knowledge of their impact on the world around them (e.g. distribution of organisms) and how scientific developments have impacted our lives (e.g. use of fertilisers, development of streetlights/automatic car lights etc).

Year Group	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
10	**Topic: Human Biology** **Knowledge:** 1. Aerobic respiration 2. Anaerobic respiration 3. Fermentation (Practical) 4. The lungs (Demonstration) 5. The heart (Practical/Demonstration) 6. Blood vessels and blood flow 7. Composition of blood 8. Cardiovascular diseases 9. Mini Quiz 10. Disease data 1 11. Disease data 2 12. Digestion 13. Enzymes 14. Testing for food groups (R.Practical) 15. pH and Enzymes (R.Practical) 16. Reaction rates in the body 17. Diffusion 18. Kidneys and the function (Separate only) 19. Kidneys and ADH (Separate only) 20. Dissections and Data (Separate only) 21. Diffusion and Surface area (Practical) 22. Diffusion in action	**Topic: Plant Biology** **Knowledge:** 1. Food webs 2. Predator and prey graphs 3. Ecological Sampling techniques 4. Quadrats (R.Practical) 5. Distribution patterns 6. Pyramids of biomass and tropic levels 7. Decomposers (Separate only) 8. Plant cells, tissues and organs 9. Osmosis 10. Osmosis 1 (R. Practical) 11. Osmosis 2 (R.Practical) 12. Active transport 13. Transpiration & Translocation 14. Transpiration investigation (Practical) 15. Photosynthesis 16. Photosynthesis (R. Practical) 17. Using glucose and nitrogen in plants 18. Limiting factors (higher only) 19. Inverse square law (higher only) 20. Mini Quiz 21. Tropisms (Separate only) 22. Plant hormones (Separate only) 23. Germination 1 (Separate only) (R.Practical) 24. Germination 2 (Separate only) (R. Practical) 25. Carbon Cycle 26. Water cycle 27. Decay (Separate only) 28. Biogas generators (Separate only) 29. Decay part 1 (Separate only) (R. Practical) 30. Decay part 2 (Separate only) (R. Practical)	**Topic: Nuclear and Thermal Physics** **Knowledge:** 1. EM Spectrum 2. Investigating IR radiation (Separate only) (R.Practical) 3. Reflection of light (Separate only) 4. Refraction of light (Separate only) 5. Investigating reflection and refraction of light (separate only) (R.Practical) 6. Lenses (Separate only) (Demonstration) 7. Magnification (Separate only) 8. Colour (Separate only) 9. Atomic physics 10. Radioactive decay 11. The three types of decay 12. Nuclear equations 13. Half life 14. Half life calculations 15. Contamination and Irradiation 16. Uses of radiation 17. Background radiation 18. Evaluating hazards 19. Nuclear Fission and Fusion (Separate only) 20. Mini Quiz 21. Particle model - density and states 22. Changes of state 23. Heating and temperature 24. Calculating density (R.Practical) 25. Pressure in gases 26. Work done and pressure (Separate only) 27. Calculating Pressure (Separate only) 28. Pressure at different depths (Separate only) (Demonstration) 29. Floating and sinking (Separate only) 30. The Atmosphere (Separate only) 31. Mini Quiz	**Topic: Electricity and Astrophysics** **Knowledge:** 1. Electrical Circuits Introduction 2. Calculating current 3. Current in circuits (practical) 4. Potential Difference in circuits (practical) 5. Resistance in circuits 6. Factors affecting resistance (R.Practical) 7. Ohm's Law 8. Light Dependent Resistors (Demonstration) 9. Thermistors (Demonstration) 10. Investigating non-Ohmic conductors (R.Practical) 11. Mini Quiz 12. Mains electricity and AC & DC 13. Plugs (Practical) 14. Power calculations 15. Work done calculations 16. Equations practice 17. National Grid and Transformers 18. Transformers structure and equation (Separate only) 19. Transformers power equation (Separate only) 20. Solar System (Separate only) 21. Life Cycle of a star (Separate only) 22. Orbits (Separate only) 23. Orbits 2 (Separate only) 24. Red Shift and Expanding Universe (Separate only) 25. The Big Bang Theory (Separate only)	**Topic: Reacting Substances** **Knowledge:** 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) **28.** Calculating gas volumes from balanced equations (Separate only) 29. 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. 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)

		31. Biodiversity and human impact 32. Maintaining biodiversity 33. Food security (Separate only)	32. Specific heat capacity 33. Investigating specific heat capacity (R.Practical) 34. Latent heat 35. Heating and cooling graphs	26. Dark Mass and Dark Energy (Separate only) 27. Black bodies (Separate only) 28. Radiation and the Earth (Separate only)	30. Testing for ions part 1 (Separate only) (R.Practical) 31. Testing for ions part 2 (Separate only) (R.Practical)	

Year 11

Secure Substantive Knowledge:
These units of work have been placed here as they require students to have good conceptual understanding of a wide range of different topics. They require students to have this understanding as they link multiple topics together and without secure knowledge of each contributing area, students will struggle to have the working memory to be able to make these connections.

- Students start by looking at the use of biology to our advantage. The briefly revisit natural selection and evolution and then look at two outcomes of evolution – the nervous and endocrine system that have allowed us to control a multitude of factors within the body.
- Within the chemistry unit, students revisit bonding as this provides the fundamental knowledge for this unit. They then go on to look at how substances made of very similar elements, all covalently bonded together can have a huge range of properties and therefore uses.
- Finally, within the physics unit, students look at the application of forces and energy in our lives.
- The content in this year is designed to finish by February in Year 11 to allow for some time to revise and practice core concepts that students may need additional support with.

Secure Disciplinary Knowledge:

- During this final unit, students are expected to be able to pull together all of the skills that they have developed over the previous five years. They build on their concepts of how scientific theories have developed, discussing investigative processes such as Dolly the sheep and by looking at what has gone wrong and using this to develop hypotheses that can then be tested. They also make use of their knowledge of scientific diagrams to draw organic compounds and use these models to represent reactions that happen within organic chemistry.
- Students are expected to process data quantitatively and qualitatively from graphs and tables. They have opportunities to develop their use of multistep equations Students have opportunities to discuss fertility and contraception and the debates that occur between science and religion. They also learn more about the impact of science on our lives for example in looking at our use of motor effect within Physics and stem cells within Biology and treatment of medical conditions using these.

Year Group	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
11	**Topic: Using biology to our advantage** **Knowledge:** 1. Classification 2. Natural selection and evolution 3. Comparing theories of evolution (separate only) 4. Evidence for evolution 5. Genetic cross diagrams part 1 6. Genetic cross diagrams part 2 7. Mendal and inheritance (separate only) 8. Selective breeding 9. Genetic engineering and modification 10. Inheritance summary essay 11. The nervous system & synapses 12. Conscious and unconscious reponses 13. Investigating human reaction time (R. Practical) part 1 14. Investigating human reaction time (R. Practical) part 2 15. Homeostasis 16. Thermoregulation (Separate only) 17. Mini Quiz (optional) 18. The Endocrine system	**Topic: Organic Chemistry & polymers** **Knowledge:** 1. Ionic bonding recap 2. Metallic bonding recap 3. Covalent bonding recap 4. Crude Oil 5. Alkanes 6. Alkenes 7. Bromine Test (Practical) 8. Fractional Distillation 9. The Fractions 10. Cracking 1 11. Cracking 2 12. Polymers (Combined only) 13. Reducing our human impact (Combined only) 14. Organic Compound diagrams (Separate only) 15. Alkene reactions 1 (Separate only) (Practical) 16. Alkene reactions 2 (Separate only)	**Topic: Application of forces & waves** **Knowledge:** 1. Magnets 2. Magnetic fields 3. Electromagnets (Demonstration) 4. The Motor Effect (Flemings' left hand rule) (Demonstration) 5. Magnetic Flux Density (higher only) 6. Generating electricity (Demonstration) 7. National Grid and Transformers 8. Transformer structure (Separate only) 9. Transformer power equation (Separate only 10. Applications of the motor effect and generator effect (Separate only) 11. Radio waves (higher only) 12. Sound waves (Separate only) 13. Uses of sound waves (Separate only)	**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 Paper 2 mock exams	**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 Physics Paper 1 Chemistry Paper 1 Biology Paper 1	

	19. Negative feedback loops (higher only) 20. Controlling glucose 21. Diabetes 22. Controlling water (Separate only) part 1 23. Controlling water (Separate only) part 2 24. Hormones and the Menstrual cycle 25. Contraception 26. IVF (higher only) 27. Embryo screening 28. Comparing nervous and hormonal responses	17. The Alcohols (Separate only) (Practical) 18. Alcohol reactions (Separate only) 19. Fermentation (Separate only) 20. Carboxylic acid reactions (Separate only) 21. Carboxylic acid and water (Separate only) 22. Esters (Separate only) (Demonstration) 23. Addition Polymerisation (Separate only) 24. Condensation Polymerisation (Separate only) 25. Amino Acids and Polymerisation (Separate only) 26. Polymers in food (Separate only)	14. Vector diagrams (separate only) 15. Moments (Separate only) 16. Levers and gears (Separate only) 17. Static electricity (Separate only) (Demonstration) 18. Electric field patterns (Separate only) *lots of these topics covered earlier in the curriculum but revisited here because they are difficult concepts for students.			[redacted]

Please note:

- 'Separate only' = content that needs to be covered only by students studying separate sciences (3 separate GCSEs)
- 'combined only' = content that needs to be covered only by students studying combined sciences: trilogy (2 separate GCSEs)
- 'EXT' = extension topic – these are optional topics that can be included into your curriculum with higher attaining groups or if you have more curriculum time in your curriculum. These will not be assessed in the End of Year exams but will provide students with a broader curriculum and prepare students for studying Separate Science.
- Practicals and demonstrations are indicated in brackets. These are optional. GCSE Required Practicals are indicated with an R. Practical. These must be studied by all students.