Curriculum Overview: Science

Science is a significant part of human culture and represents one of the pinnacles of human thinking capacity. It provides a laboratory of common experience for development of language, logic, and problem-solving skills in the classroom, and provides relevance to the lives of all students.

Science is taught in a Spiral curriculum A spiral curriculum is one in which there is an iterative revisiting of topics, subjects or themes throughout the course. A spiral curriculum is not simply the repetition of a topic taught. It requires also the deepening of it, with each successive encounter building on the previous one.

Competencies:

1. Thinking Scientifically: Finding an explanation, by weighing up the evidence. Developing scientific ideas by using evidence.
2. Applications and implications in Science: The role of a scientist in the real world, understanding the pros and cons of Science. How Science affects the world
3. Collaboration in Science: Using Scientific language to explain different ideas. Collaborating and sharing results and ideas across the world.
4. Investigative approaches: Planning an investigation and construct a fair test. Collecting experimental data, while working safely.
5. Working with evidence: Looking at patterns in data and drawing conclusions. Thinking about errors and odd results and evaluating results and procedure.

Literacy and Numeracy:

1. Use scientific vocabulary, terminology and definitions.
2. Recognise the importance of scientific quantities and understand how they are determined.
3. Use SI units (eg kg, g, mg; km, m, mm; kJ, J) and IUPAC chemical nomenclature unless inappropriate.
4. Use prefixes and powers of ten for orders of magnitude (eg tera, giga, mega, kilo, centi, milli, micro and nano).
5. Interconvert units.

6. Use an appropriate number of significant figures in calculation.
Through support and scaffolding, all students will be able to acquire this knowledge and develop these skills, regardless of starting point or special educational needs or disabilities.

Pre-GCSE Science

What we study in Year 7 and why we study it	Concepts	Competencies *see definition above.	Literacy /numeracy
Introduction to science We start by building basic skills that the students will need throughout their school career. This series of lessons aims to help students develop knowledge of how to work safely in a laboratory and allows them to familiarise them with the equipment and practical procedures that are unlikely to have come across in primary school.	Lab rules, using equipment correctly, scientific procedures	Investigative approach and Working with evidence.	1 2 3
Biology **Cells-** In primary schools, students explore the ideas of plants, animals and begin to look at their development. We expand on these ideas and introduce the ideas of cells as the building blocks of life.	Cells : Observing cells, plant and animal cells, specialised cells, movement of substance, unicellular organisms	Thinking Scientifically Applications and implications of science	1 2 3 4
Structure and function of body systems- Having learnt about cells and the different types of cells, we explore how these build up to form more complex structures such as tissues. We also introduce the ways in which substances travel around the body and link to diffusion which students cover in cells.	Structure and function of body systems: Levels of organisation, gas exchange, breathing, skeleton, movement of joints and muscles	Thinking scientifically Applications and implications of science	1 2 3

Reproduction- Students may have some prior knowledge gained during lessons on puberty in primary school. We introduce ideas and concepts relating to reproduction and fertilisation in both plants and animals. We also explore fertility and look at the menstrual cycle and methods to prevent pregnancy. Linking to our previous units on the structure and function of the body systems.	Reproduction: Adolescence, reproductive systems, fertilisation and implantation, development of a foetus, the menstrual cycle, flowers and pollination, fertilisation and germination, seed dispersal	Thinking scientifically Applications and implications of science	1
Chemistry **Particles and their behaviour-** In primary schools, students will have looked at different materials and their properties, and how these properties make materials suitable for different uses. In this unit, we look deeper at what materials are made up from	Particles and their behaviour: The particle model, states of matter, melting and freezing, boiling, more changes of state, diffusion, gas pressure	Collaboration in Science Thinking Scientifically	1 3 4
Elements, atoms and compounds- This unit moves on from the previous chemistry unit and looks at particles in terms of elements, how this links to compounds.	Elements, atoms and compounds: Elements, atoms, compounds and chemical formulae	Thinking scientifically	1 3 4
Reactions- developing the ideas from the previous topic. Linking the ideas that elements react together to form compounds and how we recognise that a reaction has happened.	Reactions: Chemical reactions, word equations, burning fuels, thermal decomposition, conservation of mass, exothermic and endothermic reactions	Applications and implications in science, Investigative approaches Thinking scientifically	1 2
Acids and Alkalis- Enhancing the knowledge on reactions, students learn how acids and alkalis react and how to identify an acid or alkali.	Acids and alkalis: Acids and alkalis, indicators and pH, neutralisation, making salts	Investigative approaches Working with evidence	1 3
Physics			1

Forces- students recall facts from year 6, relating to push and pull. This topic is taught first as it develops students' practical skills, as well as deepening their knowledge of the core principles of Physics. The topic also develops their diagram labelling skills.	Forces: Introduction to forces, squashing and stretching, drag forces and friction, forces at a distance, balanced and unbalanced forces	Thinking scientifically Applications of science	2 3
Sound- KS2 has looked at sound as a vibration and how this allows us to hear. In this topic we look at how sound is a wave and the different types of wave. This is taught in year 7, as it is one of the core concepts in Physics, this allows students to develop a curiosity of Physics relating to a visible force, the vibration in the ear, and move this knowledge beyond to understanding the idea of 'invisible' waves.	Sound: Waves, sound and energy transfer, loudness and pitch, detecting sound, echoes and ultrasound	Investigative approaches Applications and implications in science	1
Light- from sound waves, students now look at another type of wave, light. This allows students to contrast wave types and build practical skills and maths skills – using a protractor.	Light: Light, reflection, refraction, the eye and the camera, colour	Investigative approaches Applications and implications in science	1
Space- builds from KS2 knowledge of planets and the solar system. Students generally really enjoy space and it allows us to introduce some equations and using standard form.	Space: The night sky, the solar system, the earth, the moon	Applications of science Thinking scientifically	4
What we study in Year 8 and why we study it	**Concepts**	**Competencies**	**Literacy/ numeracy**

In year 8 we build on the scientific knowledge, scientific enquiry, mathematics and laboratory skills gained in year 7. **Biology** The Biology topics in year 8 we will compare the effects of healthy diet and lifestyle on the body. We will look at the reason why organisms need energy to function effectively. Lastly, we will investigate the differences between living organisms and why this is important for their existence. The topic is split up into:			
Health & lifestyle - developing the idea that our actions have an impact on our body. Linking cause and effect and analysing reports to find data to support conclusions. This is taught first, as it links to the unit taught in year 7 PSHE on healthy lifestyles. Allowing us to develop the scientific research angle.	Health and lifestyle: Nutrients, Food tests, Unhealthy diet, Digestive system, Bacteria and enzymes in digestion, Drugs, Alcohol.	Thinking scientifically Applications and implications in science Investigation techniques Working with evidence	1
Eco-system processes - linking the previous unit learning of health and lifestyle of humans to the basic processes of life and how they are essential for animal and plant survival.	Ecosystem processes: Photosynthesis, Leaves, Plant minerals, Chemosynthesis, Aerobic respiration, Anaerobic respiration, Food chains and webs, Disruption to food chains and webs, Ecosystems.	Thinking scientifically Applications and implications in science Working with evidence	1
Adaption and Inheritance - linking the basic processes of survival to how animals and plants adapt to survive and the changes this can cause to the genetic profile of a species.	Adaptation and inheritance: Competition and adaptation, Adapting to change, Variation, Continuous and discontinuous, Natural selection, Extinction.	Thinking scientifically Applications and implications in science Working with evidence	1
Chemistry The Chemistry topics in year 8 will look at where we get our needed resources from. We will learn about the structure of the Earth and the rocks of the crust. We look at how elements react, and mixtures can be separated. This helps us to link the			

way that we can obtain materials from within and from the environment. We also learn about what the periodic table and how it was developed. We use the knowledge to discover the patterns in reactivity within different groups and the elements properties. The Topic is split up into:			
The Periodic table - Introduction to the concept of organising atoms and the Scientists who were involved. We start with this as the basis for the year in chemistry, as it develops the idea of curiosity and development in Science, as well as embedding the idea that not all Scientific ideas are correct but are usually developed over time.	The Periodic table: Metals and non-metals, Groups and periods, The elements of group 1, The elements of group 7, The elements of group 0.	Thinking scientifically Investigation techniques Working with evidence	1 2 3 4
Separation Techniques - Having looked at elements in the previous unit, this is applying that knowledge in a practical sense to observe elements separating in a variety of ways.	Separation Techniques: Mixtures, Solutions, Solubility, Filtration, Evaporation and distillation, Chromatography.	Thinking scientifically Collaboration in science Investigation techniques Working with evidence	1
Metals & Acids - Once students have learnt about separation; we need to introduce the idea of chemical reactions and how this forms the basis for industry.	Metals and Acids: Acids and metals, Metals and oxygen, Metals and water, Metal and displacement reactions, Extracting metals, Ceramics, Composites.	Thinking scientifically Applications and implications in science Collaboration in science Investigation techniques Working with evidence	1 2 3
The Earth - Having looked at metals in the previous unit and separation techniques the final unit of the year is looking at how metals can be extracted from the Earth and develop an understanding of the structure and monetary value of the world beneath our feet.	The Earth: The Earth and the atmosphere, Sedimentary rocks, Igneous and metamorphic rocks, The rock cycle, The Carbon cycle, Climate change, Recycling.	Thinking scientifically Applications and implications in science Collaboration in science Working with evidence	1 3 4

Physics The physics topics in year 8 will explore electricity, what circuits are and how electricity they use in their homes is generated. This helps us to learn why our homes are insulated and how we are billed for our use. We then use graphs to interpret them to describe forces and their effects. The topic is split up into:			
Electricity & magnetism - This topic reviews the students prior knowledge of electricity and magnetism from KS2. Students are fascinated by these concepts and it makes a good starting point for the year, sparking a curiosity for 'how things work', developing and extending ideas previously laid down.	Electricity and magnetism: Charging up, Circuits and current, Potential difference, Series and parallel, Resistance, Magnets and magnetic fields, Electromagnets, Using electromagnets.	Thinking scientifically Investigation techniques Working with evidence	1 5 6
Energy - This unit introduces the idea of energy in multiple areas previously taught in KS2 and 3, electricity/power being one. The unit links these ideas and should students how energy is a key concept surrounding all three specialisms.	Energy: Food and fuels, Energy adds up, Energy and temperature, Energy transfer: particles, Energy transfer: radiation, Energy sources, Energy and power, Work, energy, and machines.	Thinking scientifically Applications and implications in science Investigation techniques Working with evidence	1
Motion & Pressure - Students develop ideas about how things move introduced at KS2, This unit links to forces and means that the three core concepts of physics are developed throughout the year.	Motion and pressure: Speed, Motion graphs, pressure in gases, Pressure in liquids, Pressure on solids, Turning forces.	Thinking scientifically Applications and implications in science Investigation techniques Working with evidence	1 2 3 5

GCSE Science			

What we study at GCSE	Concepts	Competencies	Literacy/numeracy
The GCSE starts with units where pupils have experienced prior knowledge of the subjects in KS3. This allows accessibility to all pupils and engages student in all three areas of Science. First Physics topic is a maths in Science where pupils are introduced to concepts that are needed for all aspects of their Science career and taught in a separate unit to allow students to focus on the mathematic concepts. **<u>Year 9</u>** **<u>Biology</u>** **Photosynthesis** Prior learning: the basic principles of photosynthesis. We expand on previous learning to understand the symbol equation and how this relates to the basis of the biological world, which links to why we teach this first in the GCSE course.	Photosynthesis, rate of photosynthesis, how plants use glucose, making the most of photosynthesis.	Thinking Scientifically Applications and implications in Science	1
Respiration Prior learning: the differences between aerobic and anaerobic respiration. We develop our understanding of the types of respiration and how respiration and photosynthesis link in terms of their products and reactants.	Aerobic respiration, the response of the body to exercise, anaerobic respiration, Metabolism and the liver.	Thinking Scientifically Applications and implications in Science	1
The human nervous system Prior learning: the basic structure of neurones. From general concepts of respiration and photosynthesis, we narrow our focus to the human body, how signals are transferred and why this is essential for human survival. This builds engagement by looking at how 'we' work	Principles of homeostasis, structure and function of the nervous system, reflex actions, the brain, the eye, common problems of the eye	Thinking scientifically Applications and implications in science Working with evidence	1

Hormonal coordination Prior learning: that tissues can be organised into organs with particular functions in the body. Hormonal control is linked to nervous control of the body and students begin to link the idea that the body is a communication hub, of short and long actions, to enable humans to survive.	Principles of hormonal control, the control of blood glucose levels, treating diabetes, the role of negative feedback, human reproduction. Hormones and the menstrual cycle, artificial control of fertility, infertility treatments, plant hormones and responses. Using plant hormones	Thinking scientifically Applications and implications in science Collaboration in science Investigation techniques Working with evidence	1
Homeostasis in action Prior learning: the importance of light to plant for photosynthesis. Developing the understanding that plants and animals have processes to maintain a constant system. This links and further consolidates the knowledge from the previous two units.	Controlling body temperature, removing waste products, the human kidney, dialysis-artificial kidney, kidney transplants.	Thinking scientifically Applications and implications in science Investigation techniques	1
Reproduction Prior learning: the basic processes of human reproduction. Students link the structure and function of the reproductive system to the hormones that control it, also developing ideas on the artificial control of fertility and the ethics involved. This extends students to put the ideas they have learnt in previous modules into real life situations and to develop their understanding of the complex ethics behind scientific discoveries.	Types of reproduction, cell division in sexual reproduction, the best of both worlds, DNA and the genome, DNA structure and protein synthesis, gene expression and mutation, inheritance in action, inherited disorders, screening for genetic disorders.	Thinking scientifically Applications and implications in science	1
<u>Chemistry</u> **Rates and equilibrium** Prior learning: the properties of the different states of matter in terms of particle model, including gas pressure. What	Rates of reaction, collision theory and surface area/	Thinking scientifically Applications and implications	1 2 3

catalysts do. This unit develops student understanding of why reactions happen and how to complete GCSE chemistry practical tasks safely and with valid results. The unit has a large practical element and covers key concepts explained before by linking them to practical techniques. This makes it an ideal topic to start the GCSE course, both exciting students to love chemistry and developing the essential research skills they will need throughout the GCSE in all elements of Science.	temperature, concentration and pressure, catalysts, reversible reactions, energy and reversible reactions, dynamic equilibrium, altering conditions.	Investigation techniques Working with evidence	4 5 6
Crude oil and fuels Prior learning: simple techniques for separating mixtures such as distillation, some examples of combustion and thermal decomposition reactions. In this unit we introduce the concept of organic chemistry, developing the idea of uses of carbon and how this shapes our current world. Students use the practical skills of the previous chemistry unit to explain fuels and their uses.	Hydrocarbons, fractional distillation of oil, burning hydrocarbon fuels, cracking hydrocarbons	Applications and implications in science Collaboration in science	1 2
Organic reactions Prior learning: the structure and bonding of some simple molecular substances. Organic reactions builds on the crude oil and fuels unit by looking at how reactions can build new molecules and how this changes the properties and uses of the molecule.	Reactions of alkenes, structures of alcohols, carboxylic acids and esters, reactions and uses of alcohols. Reactions of carboxylic acids and esters.	Thinking scientifically Applications and implications in science Investigation techniques Working with evidence	1 2
Polymers Prior learning: polymers are long molecules made of many repeating groups of atoms. Further expanding the unit of crude oil and organic reactions, students look at how polymers are made and used in industry and in the lab.	Addition polymerisation, condensation polymerisation, natural polymers, DNA	Thinking scientifically Applications and implications in science	1
<u>Physics</u>		Thinking scientifically	1 2

Maths in Science; in KS3 students have used simple equation and drawn simple graphs to explain experimental data. When we first developed the course, we realised students needed to have a baseline of Maths knowledge that wasn't there. We developed this stand alone starter unit to support our students with the Maths content of the Science course.	Rearranging equations, graph work; both discontinuous and continuous. Use of formula triangles, application of equations in unfamiliar equations.	Applications and implications in science Collaboration in science Investigation techniques Working with evidence	3 4 5 6
Forces in balance Prior learning: Force is measured in newtons (N) using a newton-meter. An object is in equilibrium when the forces acting on it are balanced. Forces are the basis for all Physics, therefore we start by developing and expanding student's prior knowledge of forces and introduce the first equations for students to know.	Vectors and scalars, forces between objects, resultant forces, moments at work, levers and gears, centre of mass, moments and equilibrium, parallelogram of forces, resolution of forces.	Thinking scientifically Applications and implications in science Investigation techniques Working with evidence	1 2 3 4 5 6
Motion Prior learning: Speed is measured in metres per second. Motion is a tangible subject that students can really see and measure. We introduce the idea of vectors here and develop graph drawing skills. Students start to link the concept that motion is related to forces.	Speed and distance time graphs, velocity and acceleration, analysing motion graphs.	Thinking scientifically Applications and implications in science Collaboration in science Investigation techniques Working with evidence	1 2 3 5 6
Force and motion Prior learning: Drag forces and friction resist the motion of moving objects. When objects interact, each one exerts a force on the other. The force in a stretched object is called tension an dit increases if the object is stretched more. The weight of an object is due to the force of gravity on it. The first three units are all linked into this unit. Applying the knowledge gained to explain how two concepts link together and how to apply the mathematical knowledge to support this.	Force and acceleration, weight and terminal velocity, forces and braking, momentum, conservation of momentum, impact forces, safety and forces, forces and elasticity.	Thinking scientifically Applications and implications in science Collaboration in science Investigation techniques Working with evidence	1 2 3 5 6
		Thinking scientifically	1 2

Force and pressure Prior learning: Particle model of solids, liquids and gases. Students will use the knowledge about particle structure from an earlier chemistry unit to expand their ideas in relation to pressure and how this links to forces. This interlinking of the three specialisms is important to keep emphasising throughout the course.	Pressure and surfaces, pressure in a liquid at rest, atmospheric pressure, upthrust and flotation.	Applications and implications in science Collaboration in science Investigation techniques Working with evidence	3 4 5 6

YEAR 10 **<u>Biology</u>** **Cells** Prior Learning: Animal and plant cell structures, how cells are specialised and how to use a microscope. This unit develops previous knowledge of cells and further deepens students understanding of cell structures and microscope history.	History and future of the microscope. Animal and plant cells, Eukaryotic and prokaryotic cells, specialisation in cells, diffusion, osmosis, active transport. Exchanging materials.	Thinking scientifically Collaboration in science Working with evidence	1 2 3 4 5
Cell division Prior Learning: The role of diffusion in the movement of materials in and between cells and reproduction in animals and plants. Students develop the link between cells and reproduction. How DNA is transferred through mitosis and meiosis. This is the starting point for all the topics of the year, from which all the topics build from.	Cell division, growth and differentiation, stem cells, stem cell ethics.	Thinking scientifically Applications and implications in science	1 2 3 4 5
Organisation and the digestive system Prior Learning: the importance of the digestive system, the basic structure and function of the human gas exchange system and the mechanism of breathing. This unit looks how cells in the digestive system are adapted to their role, and links to the previous unit of cell reproduction and chemistry unit of rates.	Tissues and organs, human digestive system, chemistry of food, catalysts and enzymes, factors affecting enzyme actions, how the digestive system works, making digestion efficient.	Thinking scientifically Applications and implications in science Collaboration in science Investigation techniques Working with evidence	1
Organising animals and plants Prior Learning: the role of the leaf stomata in gas exchange in plants. From organisation of the human body, we move onto organisation of plants and animals. Students develop an understanding of how these systems link from cell to animal/plant.	The blood, blood vessels, heart, helping the heart, breathing and gas exchange, tissues and organs in plants, transport system in plants, evaporation and	Thinking scientifically Applications and implications in science Working with evidence	1

	transpiration, factors affecting transpiration.		
Communicable diseases Prior learning: The consequence of imbalances in the diet. Once students have an understanding of how a body is built up, we look at processes that can cause harm to cells.	Health and disease, pathogens and disease, growing bacteria in the lab, preventing bacterial growth, preventing infections, viral diseases, bacterial diseases, diseases caused by fungi and protists, human defence responses, plant diseases, plant defence responses.	Thinking scientifically Applications and implications in science Collaboration in science Investigation techniques Working with evidence	1 4
Preventing and treating disease Prior Learning: the importance of bacteria in the human digestive system. Linking the concepts of cells and disease to the treatment of illness.	Vaccination, antibiotics and painkillers, discovering drugs, developing drugs, making monoclonal antibodies, using monoclonal antibodies.	Thinking scientifically Applications and implications in science Collaboration in science Investigation techniques Working with evidence	1 4
Non communicable diseases. Prior Learning: The impact of exercise and smoking on the human gas exchange system and the effect of recreational drugs on behaviour, health and life processes. To finish this section of units, students analyse how humans can put themselves at risk by their own actions.	Non- communicable diseases, cancer, smoking and the risk of disease, diet, exercise and disease, alcohol and other carcinogens.	Thinking scientifically Applications and implications in science Collaboration in science Investigation techniques Working with evidence	1 4
<u>Chemistry</u> **Atomic structure** Prior Learning: a simple model of the atom, representing atoms as hard, solid spheres of differing sizes and masses, the	Atoms, chemical equations, separating mixtures, fractional	Thinking scientifically	1 2

difference between atoms, elements and compounds. We start year 10 looking at atomic structure, building on ideas from KS3 and looking at the history behind the atoms discovery, engaging students in the principles of the scientific discovery.	distillation and paper chromatography, history of the atom, structure of the atom, ions, atoms and isotopes, electronic structures	Applications and implications in science Collaboration in science	3 4 6
The Periodic table Prior Learning: how to use chemical symbols and formulae to represent elements and compounds, how to represent chemical reactions using formulae ad using chemical equations, how patterns in reactions can be predicted with reference to the periodic table. This topic links to the previous, allowing students to understand how atomic structure changes to form different elements and the way the periodic table was developed.	Development of the periodic table, electronic structures and the periodic table, group 1 and 7 elements, explaining trends, transition elements.	Thinking scientifically Applications and implications in science Collaboration in science Working with evidence	1 2 3 4
Structure and bonding Prior Learning: the properties of metals and non-metals. From the structure of the periodic table, students now translate this into how atoms bond together and the properties this gives.	States of matter, Atoms into ions, ionic bonding, giant ionic structures, covalent bonding, simple molecules, giant covalent structures, fullerenes and graphene, bonding in metals, giant metallic structures, nanoparticles, application of nano particles.	Thinking scientifically Applications and implications in science Collaboration in science	1 4
Chemical analysis Prior Learning: the difference between pure substances and mixtures and how to identify some pure substances. Linking the previous module: identification and calculations needed in the chemical industry.	Pure substances and mixtures, analysing chromatograms, testing gases, tests for gases, test for positive ions, tests for negative ions, instrumental analysis.	Thinking scientifically Investigation techniques Working with evidence	1 2 3 6

The Earth's atmosphere Prior Learning: the composition of the atmosphere, the production of carbon dioxide by human activity and its impact on climate. Linking with work on simple covalent molecules and future biology work on ecology in year 11.	History of our atmosphere, evolving atmosphere, greenhouse gases, global climate change, atmospheric pollutants.	Thinking scientifically Applications and implications in science Collaboration in science Investigation techniques Working with evidence	1 3
The Earth's resources Prior Learning: about the earths as a source of limited resources and the efficacy of recycling. This links to the previous unit, by linking structure of earth to the resources it can provide.	Finite and renewable resources, how is water made safe to drink, treating waste-water, extracting metals from ores, life cycle assessments, reduce, reuse, recycle.	Applications and implications in science Collaboration in science Investigation techniques Working with evidence	1
Physics **Wave Properties** Prior Learning: the top of a water wave is called a crest and the bottom is called a trough, light travels much faster than sound and can travel through space whereas sound cannot. These units all link together in year ten, starting with waves and moving to energy. We include electromagnetism here as it reintroduces the idea of electricity and links to forces generating this flow of electrons.	Nature of waves, properties of waves, reflection and refraction, sound waves, use of ultrasound, seismic waves.	Thinking scientifically Applications and implications in science Investigation techniques	1 2 3 4 5
Electromagnetic waves Prior Learning: the spectrum of white light is continuous from red to orange, yellow to green and blue to violet.	The electromagnetic spectrum, light, infrared, microwaves, radio waves, uses in communication, ultraviolet, x-ray, gamma waves, x-ray use in medicine.	Thinking scientifically Applications and implications in science Collaboration in science Investigation techniques Working with evidence	1 2 3 4 5
Light		Thinking scientifically	1 2

Prior Learning: there are different types of waves, such as sound waves and electromagnetic waves, but they all have common properties such as refraction.	Reflection and refraction of light, light and colour, lenses, using lenses.	Applications and implications in science Investigation techniques Working with evidence	3 4 1
Electromagnetism Prior Learning: a magnet lines up with the earth's magnetic field, an electric motor is used to turn objects. An electric generator produces an electric current when it turns.	Magnetic fields, magnetic fields of electric currents, electromagnets in devices, motor effect, generator effect, alternating current generator, transformers, transformers in action.	Thinking scientifically Applications and implications in science Collaboration in science Investigation techniques Working with evidence	2 3 4 5 6 1
Conservation and dissipation of energy Prior Learning: energy is a quantity that can be measured and calculated, the total energy before and after a change has the same value, energy transfers can be compared in terms of usefulness.	Changes in energy stores, conservation of energy, energy and work, gravitational potential energy stores, kinetic energy and elastic energy stores, energy dissipation, energy and efficiency, electrical appliances, energy and power.	Thinking scientifically Applications and implications in science Collaboration in science	2 3 4 5 6 1
Energy transfer by heating Prior Learning: Energy transfers by heating can be reduced by using insulating materials, energy is transferred by radiation, the energy needed to heat an object depends on its mass and the material it is made of.	Energy transfer by conduction, infrared radiation, specific heat capacity, heating and insulating buildings.	Thinking scientifically Applications and implications in science Investigation techniques Working with evidence	2 3 4
<u>Year 11</u> **<u>Biology</u>**			1

Variation and evolution Prior Learning: how inheritance works. These units are taught in year 11 as a good understanding of biology is necessary to allow students to understand the idea of inheritance and how this links to evolution, along with the adaptations of plants and animals to their surroundings.	Variation, Evolution by natural selection, selective breeding, genetic engineering, cloning, adult cell cloning, ethics for genetic technologies.	Thinking scientifically Applications and implications in science Collaboration in science Investigation techniques Working with evidence	1
Genetics and evolution Prior Learning: how biological ideas develop, about the characteristics of eukaryotic and prokaryotic cells and the difference between animal, bacterial and plant cells	History of genetics, theories of evolution, history of Darwin, Evolution and speciation, evidence for evolution, fossils and extinction, antibiotic resistant bacteria, classification, new systems of classification.	Thinking scientifically Applications and implications in science Collaboration in science Investigation techniques Working with evidence	1
Adaptations, interdependence and competition Prior Learning: the plants and animals have different requirements from their environments, Darwin's theory and about natural selection	Importance of communities, organisms and their environment, distribution and abundance, competition in animals and plants, adapt and survive, adaptation in animals and plants.	Thinking scientifically Applications and implications in science Collaboration in science Investigation techniques Working with evidence	1
Organising an ecosystem Prior Learning: that plants need mineral ions and water from the soil, carbon dioxide from the air and light to make the chemical they need, factors that affect the growth of bacterial populations. Carbon cycle in chemistry.	Feeding relationships, materials cycling, the carbon cycle, rates of decomposition.	Thinking scientifically Applications and implications in science Collaboration in science Investigation techniques Working with evidence	1
Biodiversity and ecosystem		Applications and implications in science	2 3

Prior Learning: how people reproduce, the types of food people need to keep them healthy and the impact of poor diet on non-communicable diseases.	Human population explosion, land and water pollution, air pollution, deforestation and peat destruction, global warming, impact of change, maintaining biodiversity, trophic levels and biomass, biomass transfers, factors affecting food security, making food production efficient, sustainable food production.	Collaboration in science Working with evidence Thinking scientifically Applications and implications in science	1 2 3 4 5 6
<u>Chemistry</u> **Chemical calculations** Prior Learning: the conservation of mass in chemical reactions, how to use the particle model to describe changes of state. In this year we look at bringing the knowledge of the periodic table and industry to understand reactions and quantitative chemistry.	Relative mass and moles, equations and calculations, from masses to balanced equations, yield of a chemical reaction, atom economy, expressing concentrations, titrations and calculations, volume of gases.	Thinking scientifically Applications and implications in science Collaboration in science Investigation techniques Working with evidence	1 2 3 4 5 6
Chemical changes Prior Learning: how to define acids and alkalis in terms of neutralisation reactions, how to use the pH scale for measuring acidity and alkalinity.	Reactivity series, displacement reactions, extracting metals, salts from metals, salts from insoluble bases, neutralisation and pH scale, strong and weak acids.	Thinking scientifically Applications and implications in science	1 2 3 5
Electrolysis Prior Learning: about displacement reactions and the reactions of acids with metals to produce a salt plus hydrogen, the reaction of acids with alkalis to produce a salt plus water	Introduction to electrolysis, changes at the electrodes, extracting aluminium,	Collaboration in science Investigation techniques Working with evidence	1

	electrolysis of aqueous solutions.	Thinking scientifically Applications and implications in science Collaboration in science Investigation techniques Working with evidence	2
Energy changes Prior Learning: combustion and rusting are examples of oxidation reactions, that chemical reactions are exothermic and endothermic.	Exo and endo-thermic reactions, using energy transfers from reactions, reaction profiles, bond energy calculations, chemical cells and batteries, fuel cells.	Applications and implications in science Collaboration in science Working with evidence	1
Using our resources Prior Learning: some properties of ceramics, polymers and composites, the use of carbon in obtaining metals from metal oxides.	Rusting, alloys, polymers, properties of polymers, glass, ceramics and composites, making ammonia-Haber process, economics of Haber process, making fertilisers in the lab, making fertilisers in industry.	Applications and implications in science Collaboration in science Investigation techniques Working with evidence	1
<u>Physics</u> **Energy resources** Prior Learning: a renewable resource will not run out because it is a natural process, burning fossil fuels releases carbon dioxide gas, which is a greenhouse gas, into the atmosphere. In year 11 we look at energy resources revisiting ideas from year 10 chemistry and showing the links with Physics.	Energy demands, energy from wind and water, power from the sun and the Earth, Energy and the environment. Energy issues.	Thinking scientifically Applications and implications in science Collaboration in science Investigation techniques Working with evidence	1 2 3 4 5 6
Electric circuits Prior Learning: there are two types of electric charge, potential difference is measured in volts and current is measured in amperes. Electricity is an abstract concept that requires understanding of the energy unit that have been taught previously.	Energy charges and fields, current and charge, potential difference and resistance,	Applications and implications in science	1 2 6
Electricity in the home			

Prior Learning: a cell or battery pushes electrons round a circuit, power is how much energy is transferred per second. Linking with the previous topic, to link learning to real life applications. **Molecules and matter** Prior Learning: mass is the amount of matter in a substance and is measured in kilograms, gas particles move about very quickly and collide with the surface of the gas container. Another abstract theory, it requires a good understanding of atoms and particles, which have now been covered in Chemistry. **Radioactivity** Prior Learning: the nucleus of an atom is composed of protons and neutrons. abstract theory, that again requires a good understanding of atoms and particles, which have now been covered in Chemistry. **Space** Prior Learning: energy is released when hydrogen nuclei fuse together in the Sun. This unit requires an understanding of waves, the properties of light and radioactivity.	component characteristics, series circuits, parallel circuits. Alternating current, Cables and plugs, electrical power and potential difference, electrical currents and energy transfer, appliances and efficiency. Density, states of matter, changes of state, internal energy, specific latent heat, gas pressure and temperature, gas pressure and volume. Atoms and radiation, discovery of the nucleus, changes in the nucleus, alpha, beta and gamma radiation, activity and half-life, nuclear radiation in medicine, nuclear fission, nuclear fusion, nuclear issues. Formation of the solar system, life history of a star, planets, satellites and orbits, expanding universe, beginning and future of the universe.	Thinking scientifically Applications and implications in science Collaboration in science Investigation techniques Working with evidence Thinking scientifically Applications and implications in science Collaboration in science Working with evidence Thinking scientifically Applications and implications in science Collaboration in science Working with evidence	1 2 3 1 3 4 1 2 3 4 5 6