Science Curriculum Intent: Start to End Point Mapping – Curriculum Sequence Grids 2020 - 2021

Year 7	Term 1	Term 2	Term 3
Unit(s) – As outlined in 39 week plans	• Introduction to Science • Cells • Particles • Forces • Atoms, elements & compounds	• Sound • Reproduction • Chemical reactions • Breathing and respiration	• Reproduction • Electricity • Acids & alkalis • Space • Energy
Key Retainable Knowledge & Skills	**Introduction to Science** • **Know how to use basic scientific appraratus in a safe and accurate manner.** • **Graph/chart data accurately.** • **Identify variables in an investigation.** • **Calculate avergaes as part of data handling.** **3.8 Organisms (Cells)** • Understanding of the basic structure of cells and the functions of the components. • An ability to describe the techniques used to observe cells. • An understanding of the larger structures and functions of tissues, organs, and the different organ systems within the body. • An appreciation of the structure of the skeletal system, including names of relevant bones, and how damage of deficiency can affect these. **3.5 Matter (Particles)** • To understand the particle model for a solid, a liquid and a gas and be able to state the properties of each in relation to the movement of the particles in each model. • Changes of state are observed due to a change of energy within the particles. • Differences between a pure substance and a mixture with the ability to be able to choose and carry out the required separating technique for a mixture dependent on its properties. **3.1 Forces** • Pupils should be taught about: • forces as pushes or pulls, arising from the interaction between two objects • using force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces • forces: associated with deforming objects; stretching and squashing – springs; with rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and water • forces measured in newtons, • non-contact forces: gravity forces acting at a distance on Earth and in space, forces between magnets and forces due to static electricity •	**3.5 Matter (Atoms, elements & compounds)** • Be able to interpret the periodic table stating the differences between groups and periods with a link to patterns of reactivity. • Compare the properties of elements with the properties of a compound formed from them and be able to represent elements, compounds and mixtures with particle diagrams. • Be confident with some of the most common elements in the periodic table and their symbols. **3.9 Ecosystems (Breathing & respiration)** • Understand and describe the processes associated with respiration and how they can be applied to examples. • Ability to describe the mechanism of breathing and how key structures facilitate this. **3.4 Waves (Sound)** • To understand the terms vibration, pitch, amplitude, frequency, wavelength and oscilloscope in relation to sound waves. • To identify that some sound waves such as ultrasound have frequencies higher than the human auditory range. • To understand how sound consists of vibrations which travel as a longitudinal wave through substances. **3.6 Reactions (Chemical reactions)** • Exothermic and endothermic reactions, linked to energy changes during a chemical reaction. Energy profile diagrams used to show the change in energy and for high ability calculations can be carried out. • Types of reactions including combustion and thermal decomposition. Linking the reactions to conservation of mass with the use of word equations.	**3.10 Genes (Reproduction)** Pupils should be taught about: 1. reproduction in humans (as an example of a mammal), including the structure and function of the male and female reproductive systems, menstrual cycle (without details of hormones), gametes, fertilisation, gestation and birth, to include the effect of maternal lifestyle on the foetus through the placenta 2. reproduction in plants, including flower structure, wind and insect pollination, fertilisation, seed and fruit formation and dispersal, including quantitative investigation of some dispersal mechanisms **3.6 Reactions (Acids & alkalis)** • pH of solutions is dependent on the strength of the acid and a pH scale is used to indicate how weak or strong an acid or alkali is. • Neutralisation reactions occur when an acid and alkali are mixed together, this is linked to indigestions remedies with the possibility for practical work. **3.2 Electricity** • Build and draw simple circuits • Applying their understanding of current and potential difference. • Be able to identify series and parallel circuits. **3.7 Earth (Space)** 1. Be able to describe the planets, and our solar system and beyond **3.3 Energy** • Understand how energy is transferred from different stores. • Be able to understand the conservation of energy and link this to efficiency. • Be able to calculate power and apply this to everyday devices. • Be able to describe different energy resources • Be able to evaluate energy resources.
Key Technical Vocabulary	Cells, animal, plant, nucleus, cell membrane, cytoplasm, cell wall, cell membrane, microscope, tissues, organs, particles, solid, liquid, gas, movement, model, separation, mixture, energy, state, pure, respiration, breathing, speed, distance, time, units, gravity, mass, weight, contact forces, pressure, atoms, elements, compounds, periods, groups, periodic table, reactivity, symbols	Vibration, pitch, amplitude, frequency, wavelength, oscilloscope, sound, waves, vibrations, longitudinal, exothermic, endothermic, energy, combustion, thermal decomposition, conservation of mass, breathing, lungs, trachea	male, female, reproduction, fertilisation, pregnancy, charge, current, potential difference, series, parallel, pH, solution, acid, alkali, neutral, indicator, indigestion, earth, space, planets, moon, atmosphere, fossil fuels, renewable, reliable, planets, comets

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Opportunities for Reading	• Cells https://www.bbc.co.uk/bitesize/topics/znyycdm • Particles https://www.bbc.co.uk/bitesize/topics/z9r4jxs • Forces https://www.bbc.co.uk/bitesize/topics/z4brd2p • Atoms, elements & compounds https://www.bbc.co.uk/bitesize/topics/zstp34j • See inside your body- Katie Daynes • Awesome Kitchen Science Experiments for Kids- Dr. Megan Olivia Hall • Lift the Flap Periodic Table- Alice James • Top Trumps Chemistry- RSC • Horrible Science books • The Scientific Secrets of Dr Who – Simon Guerrier	• Breathing & respiration https://www.bbc.co.uk/bitesize/topics/zvrrd2p • Sound https://www.bbc.co.uk/bitesize/topics/zw982hv • Reproduction https://www.bbc.co.uk/bitesize/topics/zybbkqt • Chemical reactions https://www.bbc.co.uk/bitesize/topics/zypsgk7 • See inside your body- Katie Daynes • Home Lab Exciting Experiments for Budding Scientists- Robert Winston • My First Book of Quantum Physics- Sheddad Kaid-Salah Ferron and Eduard Altarriba • Women in Science: 50 fearless pioneers who changed the world – Rachel Ignotofsky • Horrible Science books • The Scientific Secrets of Dr Who – Simon Guerrier	• Acids & alkalis https://www.bbc.co.uk/bitesize/topics/zn6hvcw • Space https://www.bbc.co.uk/bitesize/topics/z8c9q6f • Home Lab Exciting Experiments for Budding Scientists- Robert Winston • My First Book of Quantum Physics- Sheddad Kaid-Salah Ferron and Eduard Altarriba • Lift the Flap Questions and Answers about Space- Katie Daynes. • The Hitchhikers Guide to the Galaxy – Douglas Adams • Horrible Science books • We need to talk about Kelvin- Marcus Chown • The Scientific Secrets of Dr Who – Simon Guerrier • The Astronaut's Handbook – Louie Stowell • Storm in a Teacup- Helen Czerski
Developing Cultural Capital	Students are given the opportunity to change their perspective on the Universe and Life on Earth; as these topics focus on the micro-cosmos and the invisible forces at play on all levels. This opportunity to change perspective, offers students the ability to discover the layers of reality at play within themselves and around themselves. *Careers Links: Laboratory Technician, Mechanical Engineer, Biomedical Scientist, Construction Manager.*	Students are given the chance to gain an insight into how their body maintains a functional level, looking at the chemistry behind the energy that allows life to continue and also invites students to consider ways that we can lead a healthy lifestyle. In the reproduction topic, students will study how life perpetuates itself, using humans as an example of animal reproduction, as well as looking at plant reproduction. This is an important life lesson in how "babies are made" and offers the chance to approach the subject with maturity, in a safe and informed dialogue. In the waves topic, students again discover the invisible world around them, and are given opportunities to think creatively in how we can use science theory to design protective equipment for human use. Students are able, in Chemistry, to explore the idea of conservation of mass, and by doing so cultivate an appreciation for the connectedness of all things in the Universe. *Careers Links: Analytical Chemist, Sports Scientist, Acoustician, Farmer*	Knowledge of the skills required from a variety of specialists to result in space travel and discoveries. An appreciation of the Earth and our context in the universe and beyond. *Careers Links: Pharmacist, Pollution Control Officer, Light Technician, Astronaut*
Wider-curricular opportunities	• Weekly Science club	• Weekly Science club • Engaging in Science week competitions and challenges • Guest speakers from university and STEM careers within Science week • Reach for the stars visit – Helen Sharman	• Weekly Science club • Yorkshire Wildlife Park visit
Cross Curricular Links (Authentic Connections)	• Numeracy links in calculating ventilation rate and analysing graphical data. • Literacy links in terms of using key scientific terminology. • Numeracy links through calculations and graphs • Links to Design and Technology in terms of how design affects uses of circuits.	• Numeracy links via measuring angles of incidence and reflection using a protractor. • Literacy links in terms of using key scientific terminology.	• Literacy links in terms of using key scientific terminology. • Use of appropriate units when representing distances in space travel.
Key Assessment	• Particles & cells formative assessment	• Breathing & respiration, forces, atoms, elements & compounds and term one content formative assessment	• End of year summative assessment

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Year 8	Term 1	Term 2	Term 3
Unit(s) – As outlined in 39 week plans	• • Chemical reactions • Reproduction • Acids & alkalis • Space	• Periodic table • Magnetism • Health & lifestyle • Separation techniques	• Thermal energy transfers • Ecosystems • Adaptation & inheritance • Metals and materials

Key Retainable Knowledge & Skills	**3.6 Reactions (Chemical reactions)**
	• Exothermic and endothermic reactions, linked to energy changes during a chemical reaction. Energy profile diagrams used to show the change in energy and for high ability calculations can be carried out.
	• Types of reactions including combustion and thermal decomposition. Linking the reactions to conservation of mass with the use of word equations.
	
	3.10 Genes (Reproduction)
	• Describe the structure of the male and female reproductive systems and be able to explain how these are adapted for fertilisation and pregnancy.
	
	3.6 Reactions (Acids & alkalis)
	• pH of solutions is dependent on the strength of the acid and a pH scale is used to indicate how weak or strong an acid or alkali is.
	• Neutralisation reactions occur when an acid and alkali are mixed together, this is linked to indigestions remedies with the possibility for practical work.
	
	3.7 Earth (Space)
	• An ability to describe appearances of planets or moons from diagrams showing their position in relation to the earth and sun.
	• An understanding of why there are seasons.,
	• Applying their knowledge of gravity to how field strength differs on different planets.
		3.5 Matter (Periodic table)
		• Be able to interpret the periodic table stating the differences between groups and periods with a link to patterns of reactivity.
		
		3.2 Electromagnets (Magnetism)
		• Describe how electromagnets can be generated and used. Understand the factors that increase the strength of the magnetic field.
		• Understand the force of attraction between permanent magnets.
		• Use the idea of field lines to show how the direction or strength of the field around a magnet varies.
		• Explain observations about navigation using Earth's magnetic field.
		
		3.8 Organisms (Health & lifestyle)
		• An understanding of the digestive system and how different organs work alongside each other to break down and absorb components of food.
		
		3.5 Separation techniques
		• Understanding how to separate mixtures by the processes of: chromatography, filtration, evaporation, distillation.
		• Understanding pure and impure substances and solutions.
			3.3 Energy (Thermal energy transfer)
			• Understand and describe how thermal energy is transferred through different pathways, by particles in conduction and convection, and by radiation.
			
			3.9 Ecosystems
			• An appreciation of how organisms are interlinked within an ecosystem and to describe how a change in environmental factors could affect these organisms.
			• An ability to identify the structure of a flower and to describe how these enable pollination and fertilisation to take place.
			• An appreciation of the important role insects play in the process of pollination and what would happen if their populations declined.
			  ○ Understand and describe the processes associated with respiration and how they can be applied to examples.
			  ○ An understanding of photosynthesis and how the structure of the plant enables this reaction to take place.
			• Be able to describe the methods used to identify the presence of starch within plant structures.
			
			3.10 Genes (Adaptation & inheritance)
			• To understand the terms species, variation, evolution, biodiversity, and competition in relation to organisms.
			• To understand how variation within a population of species can occur.
			• To understand the process of natural selection and how this can lead to evolution.
			• To explore how an understanding of inheritance can be used to explain variation and natural selection.
			
			3.5 Metals and materials
			• An appreciation for the scarceness of earth's resources and describe approaches that can be taken to reduce waste products.
			• Understand the composition of the earth's atmosphere and the problems associated with using fossil fuels.
			• Understanding the reaction of metals and displacement reactions
			• An understanding of extracting metals and electrolysis.

Key Technical Vocabulary	Breathing, lungs, trachea, particles, solid, liquid, gas, movement, model, separation, mixture, energy, state, pure, respiration, breathing, speed, distance, time, units, gravity, mass, weight, contact forces, pressure, energy, transfer, store, pancreas, light, medium, absorb, reflect, ray diagram, image, predict, waves, exothermic, endothermic, male, female, reproduction, fertilisation, pregnancy, pH, solution, acid, alkali, neutral, indicator, indigestion, earth, space, planets, moon, atmosphere, fossil fuels.	Groups, periods, reactivity, electromagnets, strength, magnetic field, attract, repel, field lines, species, , metals, non-metals, reactivity, exothermic, endothermic, energy, combustion, thermal decomposition, conservation of mass, digestive system, stomach, intestines, gullet	Energy, transfer, conduction, convection, radiation, ecosystem, pollination, fertilisation, flower, respiration, photosynthesis, starch, planets, moon, Earth, smelting, polymers, extraction, metals, reactions, electrolysis, sun, fossil fuels, variation, evolution, biodiversity, competition, population, species, natural selection, inheritance
Opportunities for Reading	• Light https://www.bbc.co.uk/bitesize/topics/zw982hv • Chemical reactions https://www.bbc.co.uk/bitesize/topics/zypsgk7 • Reproduction https://www.bbc.co.uk/bitesize/topics/zybbkqt	• Periodic table https://www.bbc.co.uk/bitesize/topics/zstp34j • Health & lifestyle https://www.bbc.co.uk/bitesize/topics/zf339j6 • Magnetism https://www.bbc.co.uk/bitesize/topics/z4brd2p	• Thermal energy transfers https://www.bbc.co.uk/bitesize/topics/zc3g87h • Ecosystems https://www.bbc.co.uk/bitesize/topics/zxhhvcw • Metals and materials https://www.bbc.co.uk/bitesize/topics/zgvbkqt

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	• Acids & alkalis https://www.bbc.co.uk/bitesize/topics/zn6hvcw • Space https://www.bbc.co.uk/bitesize/topics/z8c9q6f • What's Chemistry All About? - Alex Firth • Home Lab Exciting Experiments for Budding Scientists- Robert Winston • My First Book of Quantum Physics- Sheddad Kaid-Salah Ferron and Eduard Altarriba • Lift the Flap Questions and Answers about Space- Katie Daynes. • Horrible Science books • We need to talk about Kelvin- Marcus Chown • The Scientific Secrets of Dr Who – Simon Guerrier • The Astronaut's Handbook – Louie Stowell • Storm in a Teacup- Helen Czerski	• Separation techniques https://www.bbc.co.uk/bitesize/topics/zstp34j • Lift the Flap Periodic Table- Alice James • Top Trumps Chemistry- RSC • Kay's Anatomy- Adam Kay • Horrible Science books • The Scientific Secrets of Dr Who – Simon Guerrier	• Adaptation & inheritance https://www.bbc.co.uk/bitesize/topics/zxhhvcw • The Secret beneath my Feet- Charlotte Guillian • The Story of Life (Evolution) - Ruth Symons • The Bee Book- Charlotee Milner • Horrible Science books • The Scientific Secrets of Dr Who – Simon Guerrier
Developing Cultural Capital	In the reproduction topic, students will study how life perpetuates itself, using humans as an example of animal reproduction, as well as looking at plant reproduction. This is an important life lesson in how "babies are made" and offers the chance to approach the subject with maturity, in a safe and informed dialogue. In the waves topic, students again discover the invisible world around them, and are given opportunities to think creatively in how we can use science theory to design protective equipment for human use. Students are able, in Chemistry, to explore the idea of conservation of mass, and by doing so cultivate an appreciation for the connectedness of all things in the Universe. Knowledge of the skills required from a variety of specialists to result in space travel and discoveries. An appreciation of the Earth and our context in the universe and beyond. *Careers Links: Farmer, Pharmacist, Pollution Control Officer, Light Technician, Astronaut*	Students learn to appreciate their actions and lifestyle choices on their life and long term health and their impact on other living things. Students learn how this information is passed between generations and can develop over time. *Careers Links: Clinical dietician, water purification officer, robotic engineer.*	Linking ecosystems to social, moral, ethical issues surrounding environmental impact and current affairs. The Genes topic allows students to appreciate further the vast array of life on Earth and the mechanism by which so much variety of life has blossomed. Knowledge of the skills required from a variety of specialists to result in space travel and discoveries. An appreciation of the Earth and our context in the universe and beyond. *Careers Links: Environmental consultant, solar farm manager, molecular geneticist, genetic counsellor, R & D chemist*
Wider-curricular opportunities	• Weekly STEM club	• Weekly STEM club • Engaging in Science week competitions and challenges • Guest speakers from university and STEM careers within Science week • Planetarium visit in Science week	• Weekly STEM club
Cross Curricular Links (Authentic Connections)	• Numeracy links in calculating ventilation rate and analysing graphical data. • Literacy links in terms of using key scientific terminology. • Numeracy links through calculations and graphs • Links to Design and Technology in terms of how design affects uses of circuits.	• Numeracy links via average calculations in terms of population.	• Developing geographically enhanced knowledge of utilising the Earth's natural resources for energy supplies • An appreciation of SMSC when dealing with the ethics involved with data collection regarding organisms. • Numeracy links in balancing equations and analysis of graphical data showing populations. • An understanding of key scientific terminology and the best way to appropriately use them. • Use of appropriate units when representing distances in space travel
Key Assessment	• Chemical reactions, light and Y7 content formative assessment	• Chemical reactions, reproduction, light, acids and alkalis, space, health and lifestyle, periodic table and prior KS3 content formative assessment	• End of year summative assessment

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Year 9	Term 1	Term 2	Term 3
Unit(s) – As outlined in 39 week plans	22.Earth 16. Ecosystems 19. Adaptation & Inheritance 5.1 Atomic structure & the periodic table 5.9 Chemistry of the atmosphere 6.1 Energy	6.3 Particle model of matter 4.1 Cell Biology 5.2 Bonding, structure & the properties of matter 5.10 Using resources	6.2 Electricity 6.1 Energy 6.4 Atomic structure 4.1 Cell Biology 4.2 Organisation (Enzymes and digestion section)
Key Retainable Knowledge & Skills	**3.7 Earth** • Describe the structure of sedimentary rock. • Describe how grains of sand and bits of rock can be transported and deposited. • Explain how sediments are cemented together to make rock. • Explain what happens to sedimentary rock at very, very high pressures and temperatures. **3.9 Ecosystems** • An appreciation of how organisms are interlinked within an ecosystem and to describe how a change in environmental factors could affect these organisms. • An ability to identify the structure of a flower and to describe how these enable pollination and fertilisation to take place. • An appreciation of the important role insects play in the process of pollination and what would happen if their populations declined. o Understand and describe the processes associated with respiration and how they can be applied to examples. o An understanding of photosynthesis and how the structure of the plant enables this reaction to take place. • Be able to describe the methods used to identify the presence of starch within plant structures. **3.10 Genes (Adaptation & inheritance)** • To understand the terms species, variation, evolution, biodiversity, and competition in relation to organisms. • To understand how variation within a population of species can occur. • To understand the process of natural selection and how this can lead to evolution. • To explore how an understanding of inheritance can be used to explain variation and natural selection. **5.1 Atomic structure and the periodic table** • Understanding of key terms, atom, element, compound and mixture with the ability to represent chemical formulae by word and balanced symbol equations. • An ability to describe a mixture and describe and explain the different separation techniques. • An appreciation of the history and discovery of the atom and how this developed through time. • Understand and describe the structure of the atom and relative electrical charges of subatomic particles and relate the size and scale to objects in the physical world. • Calculations of the relative atomic mass & representations of electronic structures in diagrams. • An understanding of the periodic table in terms of its structure, how it was developed, metals & non-metals and being able to explain the properties of groups 0, 1 and 7 and make further predictions of trends down the group.	**6.3 Particle Model of Matter** • Use the relevant equation to calculate the density of objects and practically determine the density of regular and irregular objects. • Explain how density varies in solids, liquids and gases • Describe the different states of matter and how substances change state, how their internal energy changes accordingly and be able to calculate the amount of energy required (using the relevant equation). **Required practical 17: an investigation to determine the density of a regular and an irregular object** **4.1 Cell Biology** • The structure of plant and animal cells (eukaryotic cells) and bacteria cells (prokaryotic cells). • An understanding of magnification & related calculations • Types of cell related to their function in a tissue, an organ or organ system, or the whole organism. • How cells differentiate to form specialised cells • The stages of the cell cycle, including mitosis. • Function of stem cells in embryos, in adult animals and in the meristems in plants. • Diffusion and how different factors affect the rate. • Osmosis and active transport and relate these to the uptake of substances by living organisms. **Required practical activity 1: use a light microscope to observe, draw and label a selection of plant and animal cells. A magnification scale must be included.** **Required practical activity 2: investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue.** **5.2 Bonding, structure and the properties of matter** • Understanding of key types of bonding, ionic bonding, covalent bonding, and metallic bonding in terms of electrostatic force, and the transfer or sharing of electrons. • An ability to represent ionic bonding using dot and cross diagrams to show the ions involved. • An appreciation different ways in which ionic compounds or covalent molecules could be represented so that they can describe the limitations of each type of model. • An ability to represent covalent bonding using dot and cross diagrams to show the atoms involved. • Be able to recognise and explain the diagram for metallic bonding. • Understand and explain the properties of ionic compounds, small molecules, polymers, giant covalent structures, metals and alloys. • Have an overview of the different allotropes of carbon and be able to explain the similarities and differences in their structure and properties. • An understanding of the three states of matter and changes of state and how they can be represented.	**6.2 Electricity** • An understanding of the key terms Potential Difference, Current and Resistance and to be to apply the mathematical relationship between these quantities • To be able to apply Ohms Law **Required Practical 15: Investigate resistance in a wire** **6.1 Energy** • Understanding the main energy resources available in the world • Be able to differentiate between renewable and non-renewable sources and describe their usage and reliability • Discuss the environmental impact of the energy sources and their social, political, ethical and economic implications **6.3 Atomic Structure** • Structure of the atom and be able to interpret atomic & mass number • Describe the history of the development of the atom • Describe alpha, beta, gamma and background radiation and their properties, applications and associated dangers. • Explain half-life and be able to determine it • Differentiate between radioactive contamination and irradiation **4.2 Organisation** • That organisms are built from cells, which form tissues, organs and organ systems and working together form organisms. • The human digestive Students should be able to describe the nature of enzyme molecules and relate their activity to temperature and pH changes. **Required practical activity 3: use qualitative reagents to test for a range of carbohydrates, lipids and proteins.** **Required practical activity 4: investigate the effect of pH on the rate of reaction of amylase enzyme.**

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	5.9 Chemistry of the atmosphere. • To state the proportions of different gases in the Earth's atmosphere. • To suggest theories about how the Earth's atmosphere has changed over time, linking these theories to events that have occurred since the formation of Earth. • To be able to state the names of greenhouse gases and understand the purpose of these greenhouse gases in order to support life on Earth. • Understand the effect that human activities have on the levels of greenhouse gases in the atmosphere and the problems these can cause with regards to global climate change. • Understand how burning fuels can increase atmospheric pollutants and being aware of the issues these pollutants bring. **6.1 Energy** • Understanding of the key principles of energy stores and how energy can be transferred using a pathway between energy stores • To be able to recall and apply equations to calculate the amount of Kinetic, Gravitational Potential and Elastic Potential • To understand that an energy transfer can result in energy being wasted, and that efficiency is a measure of how much energy is usefully transferred. • An appreciation of how energy resources can be used, and the potential environmental impacts associated with their use.	**5.10 Using Resources** • Define and give examples of finite and renewable resources • Discuss products that can be replaced by agricultural and synthetic products • Distinguish between pure and potable water and explain how potable water is obtained, including the differences in treatment of ground and salty water. • **Required practical 13: Analyse and purify water samples from different sources**	
Key Technical Vocabulary	Sedimentary, Igneous, Metamorphic, Weathering, Element, Compound, Mixture Atom, Proton, Neutron, Electron, Shell/ Energy level, Energy, Energy Transfer, Energy Pathway, Energy Store, Gravitational Potential Energy, Kinetic Energy, Elastic Potential Energy, Spring Constant, Extension, Power, Random Error, Systematic Error, Solid, Liquid, Gas, Evaporation, Condensation, Sublimation, Density, Eureka Can, Conduction, Convection, Infrared Radiation, Specific Heat Capacity, Specific Latent Heat, ecosystem, pollination, fertilisation, flower, respiration, photosynthesis, starch, variation, evolution, biodiversity, competition, population, species, natural selection, inheritance	Filtration, Evaporation, Chromatography, Soluble, Insoluble, Solute, Solvent, Solution, Mobile phase, Stationary phase, Isotope, Displacement, Group, Period, Inert, Ion, Charge, Mass, Ionic, Covalent, Metallic, Lattice, Delocalised electrons, Alloy, Fullerenes, Polymer, Monomer, Ductile, Malleable, Tensile, Bucky ball, Graphene, Nanotube, Atmosphere, Photosynthesis, Greenhouse gases, Carbon footprint, Pollutant, Combustion, Eukaryotic cell, prokaryotic cell, nucleus, cell membrane, mitochondria, ribosomes, cell wall, permanent vacuole, chloroplasts, cellulose, plasmid, magnification, resolution, standard form, objective lens, fine adjustment knob, stem cells, differentiate, specialised cell, mitosis, cell division, chromosomes, therapeutic cloning, diffusion, osmosis, active transport, partially permeable membrane, concentration gradient, surface area	Electricity, Current, Potential Difference, Resistance, Series, Parallel, Ohms, Alternating Current, Direct Current, Electrical Power, Efficiency, Pressure, Atom, Nucleus, Proton, Neutron, Electron, Electron Shell, Radiation, Alpha, Beta, Gamma, Charge, Half-life, Ionising, Kinetic, Gravitational Potential, Elastic Potential, efficiency, transfer, renewable, non-renewable, tissue, organ, organ system, organism, enzymes, catalysts, active site, substrate, denatured, monomers, polymers, small/large intestine, stomach, salivary glands, liver, Benedict's test, Biuret test, Sudan III
Opportunities for Reading	Ecosystems https://www.bbc.co.uk/bitesize/topics/zxhhvcw Adaptation & inheritance https://www.bbc.co.uk/bitesize/topics/zxhhvcw 5.1 Atomic structure & the periodic table https://www.bbc.co.uk/bitesize/topics/zcckk2p 5.9 Chemistry of the atmosphere https://www.bbc.co.uk/bitesize/topics/zysvv9q 6.1 Energy https://www.bbc.co.uk/bitesize/topics/z89ddxs Science Squad Explains: Key science concepts made simple and fun, Robert Winston Women in Science, Rachel Ignotofsky Operation Ouch: The Humanual, Puffin Home Lab, Robert Winston The Secret beneath my Feet- Charlotte Guillian The Story of Life (Evolution) - Ruth Symons The Bee Book- Charlotee Milner The Scientific Secrets of Dr Who – Simon Guerrier	6.3 Particle model of matter https://www.bbc.co.uk/bitesize/topics/z3ybb82 4.1 Cell Biology https://www.bbc.co.uk/bitesize/topics/z2mttv4 5.2 Bonding, structure & the properties of matter https://www.bbc.co.uk/bitesize/topics/z33rrwx 5.10 Using resources https://www.bbc.co.uk/bitesize/topics/zptnng8 Science Squad Explains: Key science concepts made simple and fun, Robert Winston Women in Science, Rachel Ignotofsky Operation Ouch: The Humanual, Puffin Home Lab, Robert Winston The Periodic Table – Primo Levi Chemistry – Tom Whipple & James Davies	6.2 Electricity https://www.bbc.co.uk/bitesize/topics/zcg44qt 6.1 Energy https://www.bbc.co.uk/bitesize/topics/z89ddxs 6.4 Atomic structure https://www.bbc.co.uk/bitesize/topics/zshssrd 4.2 Organisation (Enzymes and digestion section) https://www.bbc.co.uk/bitesize/topics/zwj22nb Science Squad Explains: Key science concepts made simple and fun, Robert Winston Women in Science, Rachel Ignotofsky Operation Ouch: The Humanual, Puffin Home Lab, Robert Winston Inventor Lab, Awesome Builds for Smart Makers- DK (Dr Lucy Rogers).
Developing Cultural Capital	Rocks have been used and studied by humans for centuries, and the way they are formed is a great introduction to a recurring theme in Science, and indeed in life - cycles. Linking ecosystems to social, moral, ethical issues surrounding environmental impact and current affairs 6.1 - The concept of energy emerged in the 19th century. The idea was used to explain the work output of steam engines and then generalised to understand other heat engines. It also became a key tool for understanding chemical reactions and biological systems. *Careers Link: Geologist, Environmental consultant, Molecular geneticist, genetic counsellor, forensic scientist, environmental consultant.*	Students look at ways to reduce their own carbon footprint and learning about the consequences of global warming. They will develop an understanding of the behaviour of cells and how this has led to development of stem cell technology. This is a new branch of medicine that allows doctors to repair damaged organs by growing new tissue from stem cells. 6.3 - The particle model is widely used to predict the behaviour of solids, liquids and gases and this has many applications in everyday life. It helps us to explain a wide range of observations and engineers use these principles when designing vessels to withstand high pressures and temperatures, such as submarines and spacecraft. It also explains why it is difficult to make a good cup of tea high up a mountain. *Career Links: Research Scientists and a female studying for a PhD. Linking cells, microbes and DNA; analytical technician, environmental health officer in the Royal Navy.*	6.2 - Electric charge is a fundamental property of matter everywhere. Understanding the difference in the microstructure of conductors, semiconductors and insulators makes it possible to design components and build electric circuits. Many circuits are powered with mains electricity, but portable electrical devices must use batteries of some kind. Electrical power fills the modern world with artificial light and sound, information and entertainment, remote sensing and control. Educating younger people on issues surrounding not leading a healthy lifestyle can reduce risk of developing disease such as coronary heart disease. Many interventions such as surgical procedures would not be necessary if individuals reduced their risks through improved diet and lifestyle. *Careers Links; Solar panel researcher.*

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Wider-curricular opportunities	• Weekly STEM club • Royal Society of Chemistry's Top of the Bench School's Quiz	• Weekly STEM club • Engaging in Science week competitions and challenges • Guest speakers from university and STEM careers within Science week • Engineering Extravaganza visit	• Weekly STEM club
Cross Curricular Links (Authentic Connections)	• PHSE links to leading a healthy lifestyle and factors that can inhibit this • Geography links regarding weathering of rocks • Numeracy links for all calculations and manipulation of formula • Literacy links for describing states of matter	• Numeracy links in balancing equations & predictions of number patterns • Numeracy links in balancing charges for the ions in an ionic compound as well as working out the formula of a compound from the given diagram. • Numeracy links with ratios, percentages and fractions • Links with biology and physics. • PHSE- Discussion around the equity of availability of clean water around the world • Business – financial viability of water purification methods • Numeracy links when practising magnification calculations • Numeracy links with converting between units smaller than a millimetre • PHSE when debating the ethical issues surrounding use of stem cells • Numeracy links when calculating surface area to volume ratio in order to compare rates of diffusion	• History - describing the history of the development of the atom • Literacy – description of the properties, uses and dangers of radiation.
Key Assessment	• Earth, Ecosystems, and look back KS3 content assessment.	• Atomic structure, periodic table, bonding structure & properties of matter, Chemistry of the atmosphere, using resources, energy formative assessment	• Atomic structure, periodic table, bonding structure & properties of matter, Chemistry of the atmosphere, using resources, energy, particle model of matter, cell biology, chemical bonding, using resources, electricity and energy formative assessment

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Year 10	Biology	Chemistry	Physics
Unit(s) – As outlined in 39 week plans	4.1 Cells 4.2 Organisation 4.3 Infection and response 4.4 Bioenergetics 4.5 Homeostasis 4.6 Inheritance, variation & evolution	5.9 Chemistry of the atmosphere 5.10 Using resources 5.3 Quantitative Chemistry 5.4 Chemical Changes 5.5 Energy Changes 5.6 Rate and extent of chemical changes	6.2 Electricity 6.1 Energy 6.4 Atomic structure 6.5 Forces 6.6 Waves
Key Retainable Knowledge & Skills	**4.1 Cells** • Diffusion and how different factors affect the rate. • Osmosis and active transport and relate these to the uptake of substances by living organisms. **Required practical activity 1: use a light microscope to observe, draw and label a selection of plant and animal cells. A magnification scale must be included.** **Required practical activity 2: investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue.** **4.2 Organisation** • That organisms are built from cells, which form tissues, organs and organ systems and working together form organisms. • The human digestive Students should be able to describe the nature of enzyme molecules and relate their activity to temperature and pH changes. • Structure and functioning of the human heart and lungs • Blood is a tissue consisting of plasma, in which the red blood cells, white blood cells and platelets are suspended. • How coronary heart disease and is caused and treated. Evaluating the advantages and disadvantages of treating cardiovascular diseases • Describe the relationship between health and disease and the interactions between different types of disease. • Describe cancer as the result of changes in cells that lead to uncontrolled growth and division. • Explain how the structures of plant tissues are related to their functions. • Explain the effect of changing temperature, humidity, air movement and light intensity on the rate of transpiration. **Required practical activity 3: use qualitative reagents to test for a range of carbohydrates, lipids and proteins.** **Required practical activity 4: investigate the effect of pH on the rate of reaction of amylase enzyme.** **4.3 Infection and response** • To recall the different mirco-organisms and their structure • Understand the differences between communicable and non-communicable diseases and name specific examples • To describe how the human body defends itself against pathogens • To discuss the disease malaria, the causes, symptoms and treatments • The role of vaccinations and their impact • Students should be able to compare and contrast antibiotics and painkillers • Discuss how new drugs are developed.	**5.9 Chemistry of the atmosphere.** • To state the proportions of different gases in the Earth's atmosphere. • To suggest theories about how the Earth's atmosphere has changed over time, linking these theories to events that have occurred since the formation of Earth. • To be able to state the names of greenhouse gases and understand the purpose of these greenhouse gases in order to support life on Earth. • Understand the effect that human activities have on the levels of greenhouse gases in the atmosphere and the problems these can cause with regards to global climate change. • Understand how burning fuels can increase atmospheric pollutants and being aware of the issues these pollutants bring. **5.10 Using Resources** • Define and give examples of finite and renewable resources • Discuss products that can be replaced by agricultural and synthetic products • Distinguish between pure and potable water and explain how potable water is obtained, including the differences in treatment of ground and salty water. • **Required practical 13: Analyse and purify water samples from different sources** **5.3 Quantitative Chemistry** • How Chemists use quantitative analysis to determine the formulae of compounds and the equations for reactions • To understand how quantitative methods can be used to determine the purity of chemical samples and to monitor the yield from chemical reactions. • To recall how chemical reactions can be classified in various ways. • Identifying different types of chemical reaction to establish patterns and to make predictions about the behaviour of other chemicals. • The ability to write and formulate chemical equations to represent chemical reactions **5.4 Chemical Changes** • To understand chemical changes began when people began experimenting with chemical reactions in a systematic way and organising their results logically. • Students should be able to predict what new substances would be formed in chemical reactions and how this knowledge can be used to develop a wide range of different materials and processes. • Have an awareness and knowledge of the reactivity series and predict and write equations based upon this for a variety of reactions. • To have an appreciation of how the extraction of important resources from the earth makes use of the way that some elements and compounds react with each other and how easily they can be 'pulled apart'. • Students should be able to: predict products from given reactants and use the formulae of common ions to deduce the formulae of salts. **Required practical 8:** Preparation of a pure, dry sample of a soluble salt from an insoluble oxide or carbonate	**6.2 Electricity** • An understanding of the key terms Potential Difference, Current and Resistance and the relationship between them. • Identify electrical components from their current – potential difference graphs • To be able to apply circuit rules to Series and Parallel circuits so that Potential Difference and Current can be calculated • To be able to identify the difference between AC and DC electricity, and to be able to describe the characteristics of UK mains electricity • To understand how a UK plug is wired and the colours of the Live, Neutral and Earth wires. An appreciation of the dangers of main electricity. • To understand that electricity can be used to transfer energy, recall and apply equations to calculate the work done and power of an electrical appliance. **Required Practical 15: Investigate resistance in a wire and in series and parallel** **Required Practical 16: Investigate the characteristic graphs of a Resistor, Filament Lamp and Diode.** **6.4 Atomic Structure** • Describe the structure of the atom and be able to interpret atomic and mass number • Describe the history of the development of the atom • Describe alpha, beta, gamma and background radiation and their properties, applications and associated dangers. • Explain half-life and be able to determine it • Explain and differentiate between radioactive contamination and irradiation **6.1 Energy** • Understanding the main energy resources available in the world • Be able to differentiate between renewable and non-renewable sources and describe their usage and reliability • Discuss the environmental impact of the energy sources and their social, political, ethical and economic implications **6.3 Particle Model of Matter** • Describe the different states of matter and how substances change state, how their internal energy changes accordingly and be able to calculate the amount of energy required (using the relevant equation). • Define and calculate (using the relevant equation) how the amount of thermal energy required to change the temperature of a material varies dependent on its specific heat capacity. • Explain how particles behave in gases and how pressure is affected by temperature and volume. **Required practical 14: an investigation to determine the specific heat capacity of one or more materials**

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4.4 Bioenergetics

- Students should be able to describe photosynthesis as an endothermic reaction in which energy is transferred from the environment to the chloroplasts by light.
- Students should be able to explain the effects of temperature, light intensity, carbon dioxide concentration, and the amount of chlorophyll on the rate of photosynthesis.
- Students should be able to describe the uses of glucose produced in photosynthesis.
- Students should be able to describe cellular respiration as an exothermic reaction which is continuously occurring in living cells.
- The energy transferred supplies all the energy needed for living processes.
- Respiration in cells can take place aerobically (using oxygen) or anaerobically (without oxygen), to transfer energy.
- During exercise the human body reacts to the increased demand for energy and the heart rate, breathing rate and breath volume increase during exercise to supply the muscles with more oxygenated blood.
- Students should be able to explain the importance of sugars, amino acids, fatty acids and glycerol in the synthesis and breakdown of carbohydrates, proteins and lipids.

Required practical 5: Investigating effect of light intensity on photosynthesis

4.5 Homeostasis and Response

- An understanding that homeostasis is the regulation of internal conditions of a cell or organism to maintain optimum conditions for function in response to internal and external changes.
- Explanation of how the structure of the nervous system is adapted to its function.
- Understanding of the importance of reflexes and a description of a reflex arc, understanding of the importance of the CNS and responses that different effectors can produce.
- Knowledge of the endocrine system and organs involved, as well as an understanding of the effects of various hormones around the body.
- Knowledge of the control of blood glucose levels in terms of insulin and glucagon.
- Understanding of type 1 and type 2 diabetes and the consequences of such diseases.
- Understanding of reproductive hormones, paying particular attention to the roles of hormones involved in the menstrual cycle.
- Description of the different types of contraception and the advantages and disadvantages associated with each.
- Awareness of the role hormones play in modern reproductive technologies.
- Understanding of negative feedback systems and the roles of thyroxine and adrenaline.

Required Practical 6: Plan and carry out an investigation into the effect of a factor on human reaction time.

4.6 Inheritance, variation and evolution (Biology Only)

- Understanding that meiosis leads to the production of non-identical cells and the production of variation in offspring in comparison to identical cells being produced in mitosis.
- Be able to describe what is involved in fertilisation in plants and animals as well as be able to describe asexual reproduction.
- A description of how the number of chromosomes change during meiosis in order to form gametes.
- Description of the structure of DNA and definition of the genome and genes.
- Define key terminology associated with inheritance.

Required practical 9: Investigate what happens when aqueous solutions are electrolysed using inert electrodes.

5.5: Energy changes

- Understanding that energy cannot be created or destroyed; only transferred to or from the surroundings.
- Stating the differences between an exothermic and an endothermic reaction and stating everyday examples of both.
- An understanding of how to identify weather a reaction is exothermic or endothermic from temperature changes to the surroundings
- Drawing reaction profiles and using these to identify the energy change
- Calculating overall energy change from bond energy data

Required practical 10: investigate the variables that affect temperature changes in reacting solutions

5.6 The rate and extent of chemical change

- Calculating the rate of a chemical reaction by measuring the quantity of a reactant used or the quantity of product formed over time
- Draw tangents to the curves on these graphs and use the slope of the tangent as a measure of the rate of reaction. calculate the gradient of a tangent to the curve on these graphs as a measure of rate of reaction at a specific time.
- State the basis for the collision theory and collate an understanding of the relationship between concentration, pressure and surface area in relation to the collision theory and how they can influence the rate of reaction and equilibrium.
- Stating the effect a catalyst has on the activation energy and representing this in a reaction profile
- Comprehension that in some chemical reaction the products may react to produce the original reactants and that the direction of these reactions may be changed by changing conditions
- An understanding that if a reaction is exothermic in one direction it will be endothermic in the opposite direction.

Required practical 11: investigate how changes in concentration affect the rates of reactions

6.6 Waves

- Transverse and longitudinal wave & description of waves in terms of properties: amplitude, wavelength, frequency and period.
- Know, apply and rearrange calculations
- Know the standard units for: period, frequency, wave speed, wavelength.
- Measuring the speed of sound waves in air and ripples on surface water.
- Types of electromagnetic waves,; their properties, their uses and their risks.

Required Practical 20: Make observations to identify the suitability of apparatus to measure the frequency, wavelength and speed of waves in a ripple tank and waves in a solid and take appropriate measurements.

6.5 Forces

- Key terms: scalar, vector, contact force, non-contact force, resultant force, elasticity, distance, displacement, speed, velocity, acceleration, momentum.
- Recall the standard units of: mass, weight, gravitational field strength, force, work done, distance, spring constant, extension (of a spring), speed, velocity, time, acceleration, momentum.
- Know, apply and rearrange calculations
- Describe how energy transfers are involved when work is done.
- Elasticity in terms of interpretation of force vs. extension graphs.

Required Practical 18: Investigate the relationship between force and extension for a spring.

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	• Understand how characteristics are controlled by genes and a wider understanding of the control of gene expression in terms of dominant and recessive alleles. • Predicting the results of genetic crosses through the completion of punnet squares and express the probability of results. • Knowledge of genetic disorders and how they are inherited as well as sex determination. • Describe how variation can be caused. • Understanding of what evolution is and the theory of natural selection. • Explanation of selective breeding and its impact. • Description of what genetic engineering is and state the benefits and risks. • State the evidence for evolution and explain how fossils are formed. • Understanding of extinction and its causes. • Understanding of how bacteria can become resistant and how to reduce the rate of development of antibiotic resistant strains.		
Key Technical Vocabulary	Photosynthesis, chloroplasts, chlorophyll, cell wall, cellulose, lipids, starch, amino acids, respiratory system, respiration, breathing, oxygen, carbon dioxide, oxygen, gas exchange, aerobic respiration, anaerobic respiration, mitochondria, exothermic, heart rate, glucose, red blood cells, breathing rate, oxygen debt, lactic acid, fermentation, yeast, ethanol, metabolism, metabolic rate, urea, homeostasis, blood glucose, body temperature, senses, receptors, stimulus, control centres, central nervous system, spinal cord, brain, effectors, muscle, glands, pancreas, hormones, synapse, endocrine system, pituitary gland, thyroid, testes, ovaries, insulin, glucagon, adrenaline, contraception, follicle stimulating hormone, luteinising hormone, oestrogen, progesterone, ovulation, menstrual cycle, menstruation, type 1 and type 2 diabetes, infertility, in vitro fertilisation, asexual reproduction, clones, sexual reproduction, gametes, variation, mitosis, meiosis, fertilisation, chromosomes, DNA, genome, human genome, allele, genotype, phenotype, dominant, recessive, heterozygous, homozygous, cystic fibrosis, polydactyly evolution, Darwin, natural selection, speciation, selective breeding, genetic engineering, plasmid, enzyme, micro-organisms, communicable, non-communicable, antibiotics, pain killers, treatment, malaria.	Exothermic, endothermic, activation energy, energy profile, reactants, products, reversible reactions, equilibrium, dynamic equilibrium, tangent, collision theory, catalyst, Le Chateliers' principle, concentration, temperature, hydrocarbon, alkane, alkene, homologous series, fractional distillation, cracking, covalent bonding, petrochemicals, boiling point, viscosity, flammability, complete combustion, incomplete combustion, purity, formulations, chromatography, soluble, insoluble, mixture, stationary phase, mobile phase, conservation, mass, balance, reactant, product, moles, symbols, mass, balancing, concentration, volume, reactivity, series, prediction, metal, oxides, displacements, oxidation, reductions, acids, metals, neutralisation, salts, electrolysis, molten,	Kinetic, Gravitational Potential, Elastic Potential, efficiency, transfer, renewable, non-renewable, battery, cell, resistor, fuse, light dependent resistor, diode, LED, thermistor, ammeter, voltmeter, voltage, potential difference, current, charge, coulomb, resistance, ohms, direct current, alternating current, alpha, beta, gamma radiation, proton, neutron, electron, nucleus, nucleons, half-life, isotope, contamination, irradiation, scalar, vector, contact force, non-contact force, resultant force, elasticity, distance, displacement, speed, velocity, acceleration, momentum, transverse, longitudinal, oscillation, perpendicular, parallel, transfer, frequency, time period, wavelength, amplitude, electromagnetic, spectrum, infrared, microwave, radio, ultra-violet, gamma/x rays
Opportunities for Reading	The following sections of the CGP revision cards and revision guides: 4.2 Organisation 4.3 Infection and response 4.4 Bioenergetics 4.5 Homeostasis 4.6 Inheritance, variation & evolution Marie Curie: Little people, Big dreams, Maria Isabel Sanchez Vegara Women in Science, Rachel Ingnotofsky ASAP Science, M. Moffit & G. Brown Bad Science, Ben Goldacre Evolution: The Human Story, Dr Alice Roberts The Greatest Show on Earth, Richard Dawkins The Mould in Dr Floreys Coat: The Remarkable True Story of the Penicillin Miracle – Reic Lax	The following sections of the CGP revision cards and revision guides: 5.9 Chemistry of the atmosphere 5.10 Using resources 5.3 Quantitative Chemistry 5.4 Chemical Changes 5.5 Energy Changes 5.6 Rate and extent of chemical changes The Periodic Table – Primo Levi Bad Science – Ben Goldacre Chemistry – Tom Whipple & James Davies Secret Science The Amazing World Beyond Your Eyes – Dara O'Briain Science Squad – Robert Winston Get Ahead In Chemistry – Tom Whipple	The following sections of the CGP revision cards and revision guides: 6.2 Electricity 6.1 Energy 6.4 Atomic structure 6.5 Forces 6.6 Waves The Right Stuff Paperback, Tom Wolfe Stuff Matters, Mark Miodownik Storm in a Teacup: The Physics of Everyday Life Hardcover, Helen Czerski Hidden Figures, Margot Lee Shetterly The Sky at Night: Book of the Moon, Maggie Aderin-Pocock Physics of the Impossible: A Scientific Exploration of the World of Phasers, Force Fields, teleportation and Time Travel, Michio Kaku Human Universe, Professor Brian Cox
Developing Cultural Capital	In this section we will explore how plants harness the Sun's energy in photosynthesis in order to make food. This process liberates oxygen which has built up over millions of years in the Earth's atmosphere. Cells in the body can only survive within narrow physical and chemical limits. Variation generated by mutations and sexual reproduction is the basis for natural selection; this is how species evolve. An understanding of these processes has allowed scientists to intervene through selective breeding to produce livestock with favoured characteristics. Scientists have now discovered how to take genes from one species and introduce them in to the genome of another by a process called genetic engineering. In spite of the huge potential benefits that this technology can offer, genetic modification still remains highly controversial. *Career Links:* • *Video of clinical engineer role, as well as written descriptors.* • *medical microbiologist who works to diagnose, treat and prevent the spread of infection in hospitals and the community.* • *Exercise physiologist*	Exothermic and endothermic reactions are used in a range of everyday objects which students will use on a day to day basis. Organic chemistry has huge implications in the world we live, with the petrochemical industry being extremely useful as it provides us with polymers (plastics), pharmaceuticals, perfumes and flavourings, dyes and detergents. Chemical analysis is important in the forensic world and in the production of everyday products including prescription drugs, make up and paints. These topics relate to the world students live in and link to careers many of them may progress into. *Careers Links:* • *Environmental Consultant* • *Environmental Health Office – Royal Navy* • *Analytical Chemist* • *Principal Chemist – Food Industry* • *Catalytical Chemist*	In this section, students will learn about the applications of forces to everyday situations and how to use approximate speed to estimate journey times/distance for everyday transport. Students will appreciate the application of motion graphs to various situations e.g. world record 100m sprint race, application of variable resistors to dimmer switches for lights, the uses of fuses in use boxes and applications of LDR's and thermistors to sensors. *Careers Links:* • *Building engineer producing energy efficient stores* • *Solar Panel researcher* • *Lighting Technician Role* • *Production of gases for commercial use* • *Diagnostic radiographer*

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	• *Endocrinologist who works to identify problems associated with the endocrine system and hormonal control of the body.*		
Wider-curricular opportunities	• Guest speakers from university and STEM careers within Science week • Science Live lectures – visit • Big Bang fair – Birmingham NEC - visit	• Engaging in Science week competitions and challenges • Royal Society of Chemistry's Top of the Bench School's Quiz • Chemistry Week activities • Guest speakers from university and STEM careers within Science week • Science Live lectures – visit	• Guest speakers from university and STEM careers within Science week • Science Live lectures – visit • Big Bang fair – Birmingham NEC - visit
Cross Curricular Links (Authentic Connections)	• Numeracy links in the calculation of reaction times • SMSC – ethics surrounding the use of fertility treatments • Numeracy links in the calculation of probability within genetic crosses.	• Numeracy in the balancing of equations. • Literacy in the recall of methods.	• History - describing the history of the development of the atom • Literacy – description of the properties, uses and dangers of radiation. • Numeracy links throughout with calculation described above. • Graph interpretations, understanding of linear/non-linear relationships and gradient calculations
Key Assessment	• - Assessments will assess all topics areas covered in addition to the Cell Biology topic covered in Y9.	• Assessments will assess all topics areas covered in addition to the Atomic structure, the periodic table and bonding topics covered in Y9.	• Assessments will assess all topics areas covered in addition to topics covered in Y9.
Year 11	**Biology**	**Chemistry**	**Physics**
Unit(s) – As outlined in 39 week plans	4.6 Inheritance, variation & evolution 4.7 Ecology	5.7 Organic Chemistry 5.8 Chemical Analysis 5.9 Chemistry of the atmosphere 5.10 Using resources	6.6 Waves 6.5 Forces 6.7 Magnetism & Electromagnetism
Key Retainable Knowledge & Skills	**4.6 Inheritance, variation and evolution** • Understanding that meiosis leads to the production of non-identical cells and the production of variation in offspring in comparison to identical cells being produced in mitosis. • Be able to describe what is involved in fertilisation in plants and animals as well as be able to describe asexual reproduction. • A description of how the number of chromosomes change during meiosis in order to form gametes. • Description of the structure of DNA and definition of the genome and genes. • Define key terminology associated with inheritance. • Understand how characteristics are controlled by genes and a wider understanding of the control of gene expression in terms of dominant and recessive alleles. • Predicting the results of genetic crosses through the completion of punnet squares and express the probability of results. • Knowledge of genetic disorders and how they are inherited as well as sex determination. • Describe how variation can be caused. • Understanding of what evolution is and the theory of natural selection. • Explanation of selective breeding and its impact. • Description of what genetic engineering is and state the benefits and risks. • State the evidence for evolution and explain how fossils are formed. • Understanding of extinction and its causes. • Understanding of how bacteria can become resistant and how to reduce the rate of development of antibiotic resistant strains. • Be able to classify living organisms through the knowledge of classification systems. **4.7 Ecology** • Description of the levels of organisation in an ecosystem and importance of interdependence and competition. • Suggest factors for competition and how organisms are adapted as well as describe what extremophiles are.	**5.7 Organic chemistry** • Define what crude oil is and how it was created. • Recall the first four members of the alkane family and identify these from the displayed formulae. • Understanding of the process of fractional distillation in relation to evaporation and condensation. • Stating the importance of fractional distillation for everyday life and the large demand we have for small chain alkanes. • Explaining the bromine water test for alkanes and defining what a positive result would be. • Explaining the trends in alkanes in relation to the length of the carbon chain (viscosity, flammability, and boiling points) • Stating the various methods of cracking (catalytic and steam) and why they are carried out. • Balancing chemical equations as examples of cracking given the formulae of the reactants and products. **5.8 Chemical analysis** • Define what is a "pure substance" and how it can be identified using experimental data (boiling and melting points) • Identification of formulations • Recall the method for chromatography including its limitations • Calculate the Rf value and explain its uses in identifying substances **Required practical 12: Investigate how paper chromatography can be used to separate and tell the difference between coloured substances. Students should calculate Rf values.** **5.9 Chemistry of the atmosphere.** • To state the proportions of different gases in the Earth's atmosphere. • To suggest theories about how the Earth's atmosphere has changed over time, linking these theories to events that have occurred since the formation of Earth.	**6.6 Waves** • Understanding the differences and similarities between transverse and longitudinal waves. • Proficient in description of waves in terms of properties: amplitude, wavelength, frequency and period. • Know, apply and rearrange calculations to find: - Period = 1 / frequency - Wave speed = frequency x wavelength - Force = spring constant x extension - Speed = distance travelled / time - Acceleration = change in velocity/ time taken - Resultant force = mass x acceleration - Momentum = mass x velocity • Know the standard units for: period, frequency, wave speed, wavelength. • Understanding of experimental design to measure the speed of sound waves in air and ripples on surface water. • Recall and apply the types of electromagnetic waves,; their properties, their uses and their risks. **Required Practical 20: Make observations to identify the suitability of apparatus to measure the frequency, wavelength and speed of waves in a ripple tank and waves in a solid and take appropriate measurements.** **Required practical 10 – IR absorption and radiation verses surface nature** **6.5 Forces** • Understanding and application of key terms: scalar, vector, contact force, non-contact force, resultant force, elasticity, distance, displacement, speed, velocity, acceleration, momentum. • Recall the standard units of: mass, weight, gravitational field strength, force, work done, distance, spring constant, extension (of a spring), speed, velocity, time, acceleration, momentum. • Know, apply and rearrange calculations to find: - Weight = mass x gravitational field strength

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	• Explain what abiotic and biotic factors are and interpret associated data in relation to how these factors can affect a given community. • Knowledge of food chains biomass. • Understanding and application of practical methods to collect data to show the abundance of species within an ecosystem. • Knowledge of how materials are cycled in the carbon and water cycle and importance of microorganisms within the carbon cycle. • Understanding of the term biodiversity and its importance as well as awareness of what activities can reduce biodiversity i.e. waste management, land use, deforestation and global warming and the impacts this has. • Awareness of how biodiversity can be maintained. **Required Practical 7: Measure the population size of a common species in a habitat. Use sampling techniques to investigate the effect of a factor on the distribution of this species.**	• To be able to state the names of greenhouse gases and understand the purpose of these greenhouse gases in order to support life on Earth. • Understand the effect that human activities have on the levels of greenhouse gases in the atmosphere and the problems these can cause with regards to global climate change. • Understand how burning fuels can increase atmospheric pollutants and being aware of the issues these pollutants bring. <u>5.10 Using Resources</u> • Define and give examples of finite and renewable resources • Discuss products that can be replaced by agricultural and synthetic products • Distinguish between pure and potable water and explain how potable water is obtained, including the differences in treatment of ground and salty water. **Required practical 13: Analyse and purify water samples from different sources**	- Work done = force x distance - Force = spring constant x extension - Speed = distance travelled / time - Acceleration = change in velocity/ time taken - Resultant force = mass x acceleration - Momentum = mass x velocity • Describe how energy transfers are involved when work is done. • Understand the term elasticity • Calculate velocity from a distance-time graph; and acceleration from a velocity-time graph. • Recall and apply Newton's Laws. • Describe stopping distances and explain how factors affect stopping-distances. • Describe and explain examples of momentum (HT) **Required Practical 18: Investigate the relationship between force and extension for a spring.** **Required Practical 19: Investigate the effect of varying the force on the acceleration of an object of constant mass, and the effect of varying the mass of an object on the acceleration produced by a constant force.** **<u>6.7 Magnetism and Electromagnetism</u>** • Recall magnetic materials and an understanding of the nature of attraction between magnets and magnetic materials. • Understanding of magnetic fields, and how the strength of magnetic field depends on the distance from the magnet. • Draw a magnetic field pattern with strength and direction change. • Describe how electromagnets can be generated and used. Understand the factors that increase the strength of the magnetic field. • Application of Fleming's left hand rule to determine orientation of force, current and magnetic field and an understanding of factors that affect the size of the force. (HT) • Understanding of how the force on a conductor in a magnetic field causes the rotation of a coil in an electric motor. (HT)
Key Technical Vocabulary	Variation, inherited characteristic, environmental characteristic, mutation, evolution, Darwin, natural selection, speciation, selective breeding, genetic engineering, plasmid, enzyme, genetic modification, vector, fossils, decay, minerals, extinction, evolutionary tree, predators, diseases, competition, bacterial evolution, resistance bacteria, MRSA antibiotics, agriculture, classification, Linnaeus, kingdom, phylum, class, order, family, genus, species, domains, archaea, bacteria, eukaryotes, communities, ecosystem, biotic, abiotic, interdependence, ecosystem, sun, energy, photosynthesis, food chain, adaptation, extremophile, quadrat, line transect, biomass, producers, primary consumers, secondary consumers, tertiary consumers, predators, prey, predator-prey cycle, decomposers, carbon cycle, respiration, water cycle, combustion, biodiversity, ecosystem, pollution, land use, building, quarrying, farming, peat bogs, deforestation, global warming, habitat, climate change, breeding programmes, protection and regeneration, recycling.	Hydrocarbon, alkane, alkene, homologous series, fractional distillation, cracking, covalent bonding, petrochemicals, boiling point, viscosity, flammability, complete combustion, incomplete combustion, purity, formulations, chromatography, soluble, insoluble, mixture, stationary phase, mobile phase, atmosphere, carbon dioxide, oxygen, nitrogen, methane, greenhouse gases, global warming, deforestation, photosynthesis, short and long wavelength radiation, carbon footprint, pollutants, particulates, global dimming, potable water, desalination, phytomining, bioleaching, life cycle assessment	Scalar, vector, contact force, non-contact force, resultant force, elasticity, distance, displacement, speed, velocity, acceleration, momentum, transverse, longitudinal, oscillation, perpendicular, parallel, transfer, frequency, time period, wavelength, amplitude, electromagnetic, spectrum, infrared, microwave, radio, ultra-violet, gamma/x rays, pole, compass, repel, attract, induced magnetism, magnetised, permanent magnet, electromagnet, solenoid, core. magnetic flux density, split-ring commutator.
Opportunities for Reading	The following sections of the CGP revision cards and revision guides: 4.6 Inheritance, variation & evolution 4.7 Ecology Marie Curie: Little people, Big dreams, Maria Isabel Sanchez Vegara Women in Science, Rachel Ingnotofsky Our Planet, Matt Whyman ASAP Science, M. Moffit & G. Brown Bad Science, Ben Goldacre Evolution: The Human Story, Dr Alice Roberts The Greatest Show on Earth, Richard Dawkins Why Do Penguins Feet Freeze – Mick O'Hare	The following sections of the CGP revision cards and revision guides: 5.7 Organic Chemistry 5.8 Chemical Analysis 5.9 Chemistry of the atmosphere 5.10 Using resources The Periodic Table – Primo Levi Bad Science – Ben Goldacre Chemistry – Tom Whipple & James Davies Secret Science The Amazing World Beyond Your Eyes – Dara O'Briain Science Squad – Robert Winston Get Ahead In Chemistry – Tom Whipple	The following sections of the CGP revision cards and revision guides: 6.6 Waves 6.5 Forces 6.7 Magnetism & Electromagnetism Thing Explainer: Complicated Stuff in Simple Words, Randall Munroe Six Easy Pieces: Essentials of Physics Explained by its Most Brilliant Teacher, Richard P. Feynman Large Hadron Collider Pop-Up Book, Anton Radevsky & Emma Sanders Forces and Motion: Investigating a Car, Ian Graham An Astronaut's Guide to Life on Earth, Chris Hadfield In Search Of Schrodinger's Cat, John Gribbin How to Teach Quantum Mechanics to your Dog, Chad Orzel The Universe in your Hand, Christophe Galfard The Big Bang, Simon Singh
Developing Cultural Capital	In this section we will discover how the number of chromosomes are halved during meiosis and then combined with new genes from the sexual partner to produce unique offspring. An understanding of these processes has allowed scientists to intervene through selective breeding to produce livestock with favoured characteristics.. Scientists have now discovered	Y11 content enables students to see the impact they can have on the world in which they live, with emphasis on global warming from the use of organic compounds. Students are also made aware of how everyday items that they may use, make up, prescription drugs etc., are formulated by scientists. These topics relate to the world students live in and link to careers many of them may progress into. The	Students will study the uses and dangers of electromagnetic waves, develop an awareness of stopping distances for cars and the factors that might effect it. Application of centre of mass to toppling objects in transport and sport and the application of momentum to collisions in sport and on the road will also be developed.

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	how to take genes from one species and introduce them in to the genome of another by a process called genetic engineering. In spite of the huge potential benefits that this technology can offer, genetic modification still remains highly controversial. Ecosystems provide essential services that support human life and continued development. In order to continue to benefit from these services humans need to engage with the environment in a sustainable way. In this section we will explore how humans are threatening biodiversity as well as the natural systems that support it. We will also consider some actions we need to take to ensure our future health, prosperity and well-being. *Careers Links* • *Research scientist who is working towards a PhD, by researching microbes that would have existed before plants and animals.* • *Conservation Biologist*	department also runs a week of activities in Chemistry week, highlighting some of the broader areas of chemistry for students. *Careers Links* • *Crime Scene Investigator* • *Environmental Consultant* • *Environmental Health office – Royal Navy*	*Careers Links* • *Using EM waves in medical physics* • *Electronics engineer* • *Mechanical engineers at BAE systems* • *Space scientist*
Wide-curricular opportunities	• Weekly Science revision opportunities • Engaging in Science week competitions and challenges • Guest speakers from university and STEM careers within Science week	• Weekly Science revision opportunities • Chemistry Week • RSC – Top of the Bench Quiz • Engaging in Science week competitions and challenges • Guest speakers from university and STEM careers within Science week	• Weekly Science revision opportunities • Engaging in Science week competitions and challenges • Guest speakers from university and STEM careers within Science week
Cross Curricular Links (Authentic Connections)	• Numeracy links in the calculation of probability within genetic crosses. • Numeracy links in the calculation mean, mode and median as well as utilisation of graph skills. • Geography in terms of the process of global warming and land use and its impacts.	• Numeracy links with ratios, percentages and fractions • Links with biology and physics. • PHSE- Discussion around the equity of availability of clean water around the world • Business – financial viability of water purification methods	• Numeracy links throughout with calculation described above. • Graph interpretations, understanding of linear/non-linear relationships and gradient calculations. • Numeracy links through calculations. • Link to chemistry part of speciation with metals (iron, cobalt and nickel) • Link to science 4.1 in terms of dangers of radiation and cancer.
Key Assessment	• Prelim papers that cover the full course content	• Prelim papers that cover the full course content	• Prelim papers that cover the full course content

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Year 12 Biology	Term 1	Term 2	Term 3
Unit(s) – As outlined in 39 week plans	3.1 Biological Molecules 3.2 Cells (exc. 3.2.4) 3.3 Organisms exchange substances with their environment	3.2.4 Cell recognition and Immune System 3.3 Organisms exchange substances with their environment 3.4 Genetic Information, variation and relationships between organisms	3.4 Genetic Information, variation and relationships between organisms 3.5 Energy transfers in and between organisms
Key Retainable Knowledge & Skills	3.1 Biological Molecules • Describe what monomers and polymers are, with named examples. Explain polymers can be formed and broken down. • Recognise the structure of isomers of glucose, saturated and unsaturated fatty acids, amino acids and nucleotides. • Recall the disaccharides, and describe how they're formed. • Describe large molecular structures and link to function. • Describe the biochemical tests for carbohydrates, lipids, and proteins. • Describe and explain how the structure and properties of lipids relate to their functions. • Explain how polypeptides are formed and describe the four levels of protein structure, with named examples and roles. • Explain the important of activation energy in enzyme catalysis and describe the induced-fit model of enzyme action, comparing this to the lock and key theory. • State the properties of enzymes and link these to the structure of proteins. • State and explain the factors affecting enzymes. • Describe the process of DNA replication and how it ensures genetic continuity between generations. • Evaluate the work of Watson and Crick and apply your knowledge to explain their experimental results. • Recall the function and structure of DNA and describe the structure of nucleotides and how they form the DNA structure. • Describe the structure of ATP and explain the role of enzymes in hydrolysing and synthesising ATP, linking to the significance of ATP in numerous processes within organisms, as a supplier of energy or phosphate. • Describe the properties that are important in water and explain how these link to the polar nature of the molecule, and the significance of these properties to living organisms and processes. • Explain the term inorganic ion and state where they are found in the body. • Explain the specific role of hydrogen, iron, sodium and phosphate ions. • Relate the role of each ion to their properties. **Required practical 1: Investigation into the effect of a named variable on the rate of an enzyme-controlled reaction.** 3.2 Cells • Describe the structure and function of named organelles. • Apply knowledge of these organelles and cell structure and organisation in explaining adaptations of eukaryotic cells. • Comparison of eukaryotic and prokaryotic cells. • Describe the components of a virus. • Describe the principles and limitations of different types of microscopes. • Describe how cell components can be separated.	3.2.4 Cell recognition and immune system • The nature of the antigen and its relevance in immune responses, including phagocytosis and how antibody structure links to its role. • Discuss ethical issues associated with the use of vaccines and monoclonal antibodies. 3.3 Organisms exchange substances with their environment • Explain how haemoglobin carries oxygen. • Recognise and describe the gross structure of the human heart and linking this to pressure and volume changes and associated valve movements during the cardiac cycle that maintain a unidirectional flow of blood. • Recall the structure of arteries, arterioles and veins in relation to their function. • Recall the structure of capillaries and the importance of capillary beds as exchange surfaces, using these ideas to explain the formation of tissue fluid and its return to the circulatory system. • Analyse and interpret data relating to pressure and volume changes during the cardiac cycle. Analyse and interpret data associated with specific risk factors and the incidence of cardiovascular disease. • Evaluate conflicting evidence associated with risk factors affecting cardiovascular disease. • Describe the role of the xylem as the tissue that transports water in the stem and leaves of plants and using cohesion-tension theory of water transport in the xylem to explain its role. • Explain how the phloem transports organic substances in plants. • Interpret evidence from tracer and ringing experiments and to evaluate the evidence for and against the mass flow hypothesis. **Required practical 5: Dissection of animal or plant gas exchange system or mass transport system or of organ within such a system.** 3.4 Genetic information, variation and relationships between organisms • The genetic basis of comparison between prokaryotic cells and eukaryotic cells, including genetic components of named organelles. • Recall the function of a gene and explain how it is able to carry out this function through transcription and subsequent translation. • Describe the nature of DNA base sequences, including the importance of exons, introns and the importance of a universal, non-overlapping, degenerate genetic code. • Relate the base sequence of nucleic acids to the amino acid sequence of polypeptides, when provided with suitable data about the genetic code. • Interpret data from experimental work investigating the role of nucleic acids. • Describe the nature of genetic mutations. • Describe meiosis to illustrate how: two nuclear divisions result usually in the formation of four haploid daughter cells from a single diploid parent cell; genetically different daughter cells result from the independent; segregation of homologous chromosomes;	3.4 Genetic information, variation and relationships between organisms • Explain the term species. • Interpret phylogenetic classification systems. • Use universally identified by a binomial names consisting of genus and species. • Recall of different taxonomic systems, such as the three domain or five kingdom systems, will not be required. • Appreciate that advances in immunology and genome sequencing help to clarify evolutionary relationships between organisms. • Explain the term biodiversity. • Apply an index of diversity describes the relationship between the number of • species in a community and the number of individuals in each species. • Calculate index of diversity (d) from the formula $d = \frac{N(N-1)}{\Sigma n(n-1)}$ • Describe how genetic diversity within, or between species, can be made. • Interpret data relating to similarities and differences in the base sequences of DNA and in the amino acid sequences of proteins to suggest relationships between different organisms within a species and between species. • Appreciate that gene technology has caused a change in the methods of investigating genetic diversity; inferring DNA differences from measurable or observable characteristics has been replaced by direct investigation of DNA sequences. • Design and evaluate quantitative investigations of variation within a species involving: collecting data from random samples; calculating a mean value of the collected data and the standard deviation of that mean interpreting mean values and their standard deviations. 3.5 Energy transfers in and between organisms • Describe the light-dependent reaction in such detail as to show that: chlorophyll absorbs light, leading to photoionisation of chlorophyll; some of the energy from electrons released during photoionisation is conserved in the production of ATP and reduced NADP; the production of ATP involves electron transfer associated with the transfer of electrons down the electron transfer chain and passage of protons across chloroplast membranes and is catalysed by ATP synthase embedded in these membranes (chemiosomotic theory); photolysis of water produces protons, electrons and oxygen. • Describe the light-independent reaction in such detail as to show that: carbon dioxide reacts with ribulose bisphosphate (RuBP) to form two molecules of glycerate 3-phosphate (GP). This reaction is catalysed by the enzyme rubisco; ATP and reduced NADP from the light-dependent reaction are used to reduce GP to triose phosphate; some of the triose phosphate is used to regenerate RuBP in the Calvin cycle; some of the triose phosphate is converted to useful organic substances.

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	• Recognise the stages of the cell cycle: interphase, prophase, metaphase, anaphase and telophase (including cytokinesis) and explain the appearance of cells in each stage of mitosis. Describe binary fission. • Explain the adaptations of specialised cells in relation to the rate of transport across their internal and external membranes and link this to how surface area, number of channel or carrier proteins and differences in gradients of concentration or water potential affect the rate of movement across cell membranes. **Required practical 2: Preparation of stained squashes of cells from plant root tips; set-up and use of an optical microscope to identify the stages of mitosis in these stained squashes and calculation of a mitotic index.** **Required practical 3: Production of a dilution series of a solute to produce a calibration curve with which to identify the water potential of plant tissue.** **Required practical 4: Investigation into the effect of a named variable on the permeability of cell-surface membranes.** 3.3 Organisms exchange substances with their environment • Describe adaptations of gas exchange surfaces, shown by gas exchange: across the body surface of a single-celled organism; in the tracheal system of an insect; across the gills of fish; and by the leaves of dicotyledonous plants. • Explain adaptations of xerophytic plants. • Describe the relationship between surface area to volume ratio and metabolic rate. • Describe of the mechanism of breathing. • Interpret information relating to the effects of lung disease on gas exchange and/or ventilation, using knowledge of the gross structure of the human gas exchange system and essential features of the alveolar epithelium as a surface over which gas exchange takes place. • Interpret data relating to the effects of pollution and smoking on the incidence of lung disease. • Analyse and interpret data associated with specific risk factors and the incidence of lung disease. • Evaluate the way in which experimental data led to statutory restrictions on the sources of risk factors. • Recognise correlations and causal relationships. • The role of enzymes and hydrolysis in digestion. • Describe the mechanisms of absorption of small molecules.	crossing over between homologous chromosomes results in further genetic variation among daughter cells. • Use diagrams showing the chromosome content of cells after the first and second meiotic division, when given the chromosome content of the parent cell. • Explain the different outcome of mitosis and meiosis. • Recognise where meiosis occurs when given information about an unfamiliar life cycle • Explain how random fertilisation of haploid gametes further increases genetic variation within a species. • Describe genetic diversity as the number of different alleles of genes in a • population. • Apply knowledge of genetic diversity to explain the principles of natural selection, linking this to allele frequency. • Describe directional selection, exemplified by antibiotic resistance in bacteria. • Describe stabilising selection, exemplified by human birth weights. • Use unfamiliar information to explain how selection produces changes within a population of a species. • Interpret data relating to the effect of selection in producing change within populations. • Show understanding that adaptation and selection are major factors in evolution and contribute to the diversity of living organisms. **Required practical 6: Use of aseptic techniques to investigate the effect of antimicrobial substances on microbial growth.** 6. Mathematical Requirements • Recognise and make use of appropriate units in calculations. • Convert between units, e.g. as part of volumetric calculations. • Suggest units for a rate, eg breathing rate. • Recognise and use expressions in decimal and standard form. • Use an appropriate number of decimal places in calculations, eg for a mean • Understand standard form when applied to areas such as size of organelles. • Convert between numbers in standard and ordinary form. • Analyse random data collected by an appropriate means, eg use Simpson's index of diversity to calculate the biodiversity of a habitat. • Understand the terms mean, median and mode • Calculate and compare the mean, median and mode of a set of data, eg height/mass/size of a group of organisms. • Interpret a scattergram, eg the effect of lifestyle factors on health. • Make order of magnitude calculations. • Select and use a statistical test Students may be tested on their ability to select and use: the chi-squared test to test the significance of; the difference between observed and expected results; the Student's t-test; the correlation coefficient. • Understand measures of dispersion, including standard deviation and range • Identify uncertainties in measurements and use simple techniques to determine uncertainty when data are combined. Calculate percentage error where there are uncertainties in measurement. • Understand and use the symbols: =, <, <<, >>, >, ∝, . • Change the subject of an equation Students may be tested on their ability to use and manipulate equations, eg magnification. • Substitute numerical values into algebraic equations using appropriate units for physical quantities. • Solve algebraic equations; solve equations in a biological context, • Use logarithms in relation to quantities that range over several orders of magnitude. • Translate information between graphical, numerical and algebraic forms • Plot two variables from experimental or other data and determine the intercept of a graph. • Calculate rate of change from a graph showing a linear relationship and draw and use the slope of a tangent to a curve as a measure of rate of change. • Calculate the circumferences, surface areas and volumes of regular shapes.	• Identify environmental factors that limit the rate of photosynthesis Evaluate data relating to common agricultural practices used to overcome the effect of these limiting factors. **Required practical 7: Use of chromatography to investigate the pigments isolated from leaves of different plants, eg, leaves from shade-tolerant and shade-intolerant plants or leaves of different colours.** **Required practical 8: Investigation into the effect of a named factor on the rate of dehydrogenase activity in extracts of chloroplasts.** • Recall that respiration produces ATP. • Describe glycolysis • Describe alternate routes If respiration is undergone aerobically or anaerobically. • Describe aerobic respiration in such detail as to show that: pyruvate is oxidised to acetate, producing reduced NAD in the process; acetate combines with coenzyme A in the link reaction to produce acetylcoenzyme A; acetylcoenzyme A reacts with a four-carbon molecule, releasing coenzyme A and producing a six-carbon molecule that enters the Krebs cycle in a series of oxidation-reduction reactions, the Krebs cycle generates reduced coenzymes and ATP by substrate-level phosphorylation, and carbon dioxide is lost synthesis of ATP by oxidative phosphorylation is associated with the transfer of electrons down the electron transfer chain and passage of protons across inner mitochondrial membranes and is catalysed by ATP synthase embedded in these membranes (chemiosomotic theory) other respiratory substrates include the breakdown products of lipids and amino acids, which enter the Krebs cycle. **Required practical 9: Investigation into the effect of a named variable on the rate of respiration of cultures of single-celled organisms.** • Describe what is meant by biomass and link this to how it can be measured in plant growth and reproduction and used to calculate net primary production, using gross primary production and respiratory loss data. • Calculate the net production of consumers (N), such as animals: N = I – F + R • Recall that primary and secondary productivity is the rate of primary or secondary production, respectively. It is measured as biomass in a given area in a given time eg kJ ha–1 year–1. • Appreciate the ways in which production is affected by farming practices designed to increase the efficiency of energy transfer by: simplifying food webs to reduce energy losses to non-human food chains; reducing respiratory losses within a human food chain. • Calculate the efficiency of energy transfers within ecosystems. • Calculate percentage yields. • Explain how nutrients are recycled within natural ecosystems, exemplified by the nitrogen cycle and the phosphorus cycle. • Describe the role of microorganisms in recycling chemical elements such as phosphorus and nitrogen. • Describe the role of saprobionts in decomposition. • Describe the role of mycorrhizae in facilitating the uptake of water and inorganic ions by plants. • Describe the role of bacteria in the nitrogen cycle in sufficient detail to illustrate the processes of saprobiotic nutrition, ammonification, nitrification, nitrogen fixation and denitrification. • Evaluate the use of fertilisers, explaining the environmental issues arising from the use of fertilisers including leaching and eutrophication.
Key Technical Vocabulary	Carbohydrates; Proteins; Lipids; Hydrolysis and condensation reactions; Enzymes; Nucleic acids; DNA replication; ATP; Water; Ionic Bond; Hydrogen Bond; Polar Molecule; Monomer; Polymer; Polymerisation; Condensation; Hydrolysis; Studying Cells; Eukaryotic Cells; Cell specialisation	Atria; Ventricles; Vena Cava; Pulmonary Artery; Pulmonary Vein; Aorta; Atrioventricular Valves; Semilunar valves; ultrafiltration; Clonal Selection; TH cells (helper T cell); TC cells (cytotoxic T cells); Humoral Immunity; Reverse transcriptase; Retrovirus; translation, splicing, intron, exon, codon	Biomass, species, biodiversity, index of biodiversity, biomass, intercropping, directional selection, stabilising selection, polygenes, chiasmata, recombination, photolysis, NADP, NADPH, thylakoid, stroma, ATP synthase, calvin cycle, glycolysis, oxidative phosphorylation; eutrophication

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Opportunities for Reading	AQA Biology, Oxford A Level Biology for AQA, CGP CGP Biology Revision Guides Origins (how the nine months before birth shape the rest of our lives), Annie Murphy Paul Life from an RNA world, Michael Yarus The Selfish Gene, Richard Dawkins March of the Microbes, John Ingrham A planet of Viruses, Carl Zimmer Here comes the Sun, Steve Jones The Epigenetics Revolution, Nessa Carey Blossoms: And the genes that make them, Maxine F. Singer Buzz: The Nature and Necessary of Bees, Thor Hanson 10% Human: How Your Body's Microbes Hold the Key to Health and Happiness, Alanna Collen This is Going to Hurt: Secret Diaries of a Junior Doctor: Adam Kay Biological Science Review, Hodder What a Plant Knows (A field guide to the senses), Daniel Chamovitz	AQA Biology, Oxford A Level Biology for AQA, CGP CGP Biology Revision Guides Biological Science Review (Student Journal) Origins (how the nine months before birth shape the rest of our lives), Annie Murphy Paul Life from an RNA world, Michael Yarus The Selfish Gene, Richard Dawkins March of the Microbes, John Ingrham A planet of Viruses, Carl Zimmer Here comes the Sun, Steve Jones The Epigenetics Revolution, Nessa Carey Blossoms: And the genes that make them, Maxine F. Singer Buzz: The Nature and Necessary of Bees, Thor Hanson 10% Human: How Your Body's Microbes Hold the Key to Health and Happiness, Alanna Collen This is Going to Hurt: Secret Diaries of a Junior Doctor: Adam Kay Biological Science Review, Hodder What a Plant Knows (A field guide to the senses), Daniel Chamovitz	AQA Biology, Oxford A Level Biology for AQA, CGP CGP Biology Revision Guides Biological Science Review (Student Journal) Origins (how the nine months before birth shape the rest of our lives), Annie Murphy Paul Life from an RNA world, Michael Yarus The Selfish Gene, Richard Dawkins March of the Microbes, John Ingrham A planet of Viruses, Carl Zimmer Here comes the Sun, Steve Jones The Epigenetics Revolution, Nessa Carey Blossoms: And the genes that make them, Maxine F. Singer Buzz: The Nature and Necessary of Bees, Thor Hanson 10% Human: How Your Body's Microbes Hold the Key to Health and Happiness, Alanna Collen This is Going to Hurt: Secret Diaries of a Junior Doctor: Adam Kay Biological Science Review, Hodder What a Plant Knows (A field guide to the senses), Daniel Chamovitz
Developing Cultural Capital	All life on Earth shares a common chemistry; and this helps us appreciate our place in the Natural world. Correlation does not always suggest a causal relationship, this is poignant in a world rife with misused statistics for various political gains. Careers: medical, R & D	Correlation does not always suggest a causal relationship, this is poignant in a world rife with misused statistics for various political gains. Careers: medical, R & D	World politics and economy and how that links to environmental regulation, especially in terms of food poverty and agriculture. Careers: zoology; ecology; scientific advisory/consultant roles.
Wider-curricular opportunities	• Weekly Biology clinic	• Weekly Biology clinic • Engaging in Science week competitions and challenges • Guest speakers from university and STEM careers within Science week • Science Live lecture series- visit	• Weekly Biology clinic
Cross Curricular Links	Chemistry: catalysis theory, different types of bonds, valency.	Maths: maths unit, including data handling, algebra and statistics.	Geography, Ecology, Environmental Studies: compromise of agriculture and conservation.
Key Assessment	• Regular internal assessments. • Regular assessed home learning activities	• Regular internal assessments. • Regular assessed home learning activities • Trial Exam (AS paper)	• Regular internal assessments. • Regular assessed home learning activities • Trial Exam (A level)

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Year 13 Biology	Term 1	Term 2	Term 3
Unit(s) – As outlined in 39 week plans	3.5 Energy transfers in and between organisms 3.6 Stimulus and Response 3.7 Genetics, Populations and Ecosystems	3.8 Control of Gene Expression 3.8.4 DNA technology 3.7Genetics, Populations and Ecosystems	Examination and Essay Preparation
Key Retainable Knowledge & Skills	**3.5 Energy transfers in and between organisms** 3.4 Genetic information, variation and relationships between organisms • Explain the term species. • Interpret phylogenetic classification systems. • Use universally identified by a binomial names consisting of genus and species. • Recall of different taxonomic systems, such as the three domain or five kingdom systems, will not be required. • Appreciate that advances in immunology and genome sequencing help to clarify evolutionary relationships between organisms. • Explain the term biodiversity. • Apply an index of diversity describes the relationship between the number of • species in a community and the number of individuals in each species. • Calculate index of diversity (d) from the formula • Describe how genetic diversity within, or between species, can be made. • Interpret data relating to similarities and differences in the base sequences of DNA and in the amino acid sequences of proteins to suggest relationships between different organisms within a species and between species. • Appreciate that gene technology has caused a change in the methods of investigating genetic diversity; inferring DNA differences from measurable or observable characteristics has been replaced by direct investigation of DNA sequences. • Design and evaluate quantitative investigations of variation within a species involving: collecting data from random samples; calculating a mean value of the collected data and the standard deviation of that mean interpreting mean values and their standard deviations. 3.6 Energy transfers in and between organisms • Describe the light-dependent reaction in such detail as to show that: chlorophyll absorbs light, leading to photoionisation of chlorophyll; some of the energy from electrons released during photoionisation is conserved in the production of ATP and reduced NADP; the production of ATP involves electron transfer associated with the transfer of electrons down the electron transfer chain and passage of protons across chloroplast membranes and is catalysed by ATP synthase embedded in these membranes (chemiosomotic theory); photolysis of water produces protons, electrons and oxygen. • Describe the light-independent reaction in such detail as to show that: carbon dioxide reacts with ribulose bisphosphate (RuBP) to form two molecules of glycerate 3-phosphate (GP). This reaction is catalysed by the enzyme rubisco; ATP and reduced NADP from the light-dependent reaction are used to reduce GP to triose phosphate; some of the triose phosphate is used to regenerate RuBP in	**3.7 Genetics, populations, evolution and ecosystems** • 3.7.1 Inheritance – Be able to use genetic crosses to describe and explain the principles of Monohybrid inheritance: Dihybrid inheritance, Codominance and multiple alleles, Sex linkage, Autosomal linkage, Epistasis • 3.7.2 Populations – be able to use the Hardy-Weinberg equation to predict frequency of alleles in the population. • 3.7.4 Populations in ecosystems – be able to describe the process of succession, be able to sample an environment to estimate the number of individuals in a population. Be able to explain the importance of conservation. **Required Practical 12 – Investigation into the effect of a named environmental factor on the distribution of a given species.** • 3.7.3 Evolution may lead to speciation - be able to explain how natural selection can be the driving force behind allopatric and sympatric speciation. • 3.7.4 Populations in ecosystems – be able to describe the process of succession, be able to sample an environment to estimate the number of individuals in a population. Be able to explain the importance of conservation. **3.7 Control of Gene Expression** • Alteration of the sequence of bases in DNA can alter the structure of proteins – be able to explain how mutations can lead to a change in the primary structure of a protein, these can be beneficial, neutral or harmful. Mutations can lead to tumours and cancer. • 3.8.2.1 Most of a cell's DNA is not translated – be able to describe the structure of DNA in terms of introns and exons. • 3.8.2.2 Regulation of transcription and translation – be able to describe how we can control transcription using transcription factors and we can control translation using siRNA molecules. • 3.8.2.3 Gene expression and cancer – be able to explain that mutations in protooncogenes and tumour suppressor genes can lead to uncontrolled cell division. This can lead to the development of tumours and cancer. • 3.8.3 Using genome projects – how DNA technology and information regarding the genome can be used, for example in detecting individuals who are predisposed to developing a particular disease and the ethical issues associated with this. **3.8.4 Gene technologies allow the study and alteration of gene function allowing a better understanding of organism function and the design of new industrial and medical processes (DNA Technology)**	**Revisit and consolidate** the following areas using a variety of revision techniques including past paper questions; • 3.1 Biological molecules • 3.2 Cells • 3.3 Organisms exchange substances with their environment • 3.4 Genetic information, variation and relationships between organisms • 3.5 Energy transfers in and between organisms • 3.6 Stimulus and Response • 3.7 Genetics, Populations and Ecosystems • 3.8 Control of Gene Expression **Develop skills**; • Mathematical requirements and exemplifications • Essay skills required for paper 3 • A-level practical assessments

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	the Calvin cycle; some of the triose phosphate is converted to useful organic substances. • Identify environmental factors that limit the rate of photosynthesis Evaluate data relating to common agricultural practices used to overcome the effect of these limiting factors. **Required practical 7: Use of chromatography to investigate the pigments isolated from leaves of different plants, eg, leaves from shade-tolerant and shade-intolerant plants or leaves of different colours.** **Required practical 8: Investigation into the effect of a named factor on the rate of dehydrogenase activity in extracts of chloroplasts.** • Recall that respiration produces ATP. • Describe glycolysis • Describe alternate routes If respiration is undergone aerobically or anaerobically. • Describe aerobic respiration in such detail as to show that: pyruvate is oxidised to acetate, producing reduced NAD in the process; acetate combines with coenzyme A in the link reaction to produce acetylcoenzyme A; acetylcoenzyme A reacts with a four-carbon molecule, releasing coenzyme A and producing a six-carbon molecule that enters the Krebs cycle in a series of oxidation-reduction reactions, the Krebs cycle generates reduced coenzymes and ATP by substrate-level phosphorylation, and carbon dioxide is lost synthesis of ATP by oxidative phosphorylation is associated with the transfer of electrons down the electron transfer chain and passage of protons across inner mitochondrial membranes and is catalysed by ATP synthase embedded in these membranes (chemiosomotic theory) other respiratory substrates include the breakdown products of lipids and amino acids, which enter the Krebs cycle. **Required practical 9: Investigation into the effect of a named variable on the rate of respiration of cultures of single-celled organisms.** • Describe what is meant by biomass and link this to how it can be measured in plant growth and reproduction and used to calculate net primary production, using gross primary production and respiratory loss data. • Calculate the net production of consumers (N), such as animals: N = I – F + R • Recall that primary and secondary productivity is the rate of primary or secondary production, respectively. It is measured as biomass in a given area in a given time eg kJ ha–1 year–1. • Appreciate the ways in which production is affected by farming practices designed to increase the efficiency of energy transfer by: simplifying food webs to reduce energy losses to non-human food chains; reducing respiratory losses within a human food chain. • Calculate the efficiency of energy transfers within ecosystems. • Calculate percentage yields. • Explain how nutrients are recycled within natural ecosystems, exemplified by the nitrogen cycle and the phosphorus cycle. • Describe the role of microorganisms in recycling chemical elements such as phosphorus and nitrogen. • Describe the role of saprobionts in decomposition. • Describe the role of mycorrhizae in facilitating the uptake of water and inorganic ions by plants. • Describe the role of bacteria in the nitrogen cycle in sufficient detail to illustrate the processes of saprobiotic nutrition, ammonification, nitrification, nitrogen fixation and denitrification. • Evaluate the use of fertilisers, explaining the environmental issues arising from the use of fertilisers including leaching and eutrophication. • 3.5.3 Energy and ecosystems – be able to describe the flow of energy through the ecosystem and be able to calculate energy transferred between trophic levels. Calculate NPP. • 3.5.4 Nutrient cycles – be able to describe the nutrient cycles including the nitrogen cycle and phosphorus cycle. **3.6 Organisms respond to changes in their internal and external environments** • 3.6.1.1 Survival and response – describe simple responses such as taxis and kinesis in animals and tropisms in plants.	• 3.8.4.1 Recombinant DNA technology – be able to explain how we can genetically modify organisms to both cure diseases and given organisms desired characteristics. Also evaluate the ethical issues associated with such practice. • 3.8.4.2 Differences in DNA between individuals of the same species can be exploited for identification and diagnosis of heritable conditions 3.8.4.3 Genetic fingerprinting – be able to describe how we can genetically fingerprint an organism using sanger sequencing and how recombinant technology can put this back together. Be able to understand how gel electrophoresis separates DNA fragments and how Southern blotting is able to extract this from the agar. **Revisit and consolidate** the following areas using a variety of revision techniques including past paper questions; • 3.1 Biological molecules • 3.2 Cells • 3.3 Organisms exchange substances with their environment • 3.4 Genetic information, variation and relationships between organisms • 3.5 Energy transfers in and between organisms • 3.6 Stimulus and Response • 3.7 Genetics, Populations and Ecosystems • 3.8 Control of Gene Expression **Develop skills**; • Mathematical requirements and exemplifications • Essay skills required for paper 3 • A-level practical assessments	

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	Required Practical 10 – Investigation into the effect of an environmental variable on the movement of an animal using either a choice chamber or a maze. • 3.6.1.2 Receptors – be able to explain how receptors such as Pacinian corpuscle and rod/cone cells in the eye can generate an action potential • 3.6.1.3 Control of heart rate – be able to describe how the heartbeat is initiated and how external control from the cardiac regulatory centre can change heart rate when necessary. • 3.6.2.1 Nerve impulses – be able to describe how a resting potential is created and how an action potential is passed along an axon. Be able to explain the all or nothing response and why the refractory period is important. • 3.6.2.2 Synaptic transmission - be able to describe how an impulse is able to pass across a cholinergic synapse. • 3.6.3 Skeletal muscles are stimulated to contract by nerves and act as effectors - be able to use the sliding filament theory allows muscles to contract. Be able to explain how a neuromuscular junction is able to stimulate a muscle contraction. • 3.6.4.1 Principles of homeostasis and negative feedback • 3.6.4.2 Control of blood glucose concentration – be able to describe the role of the pancreas in controlling blood sugar levels. Explain how the inability of the islets of Langhan to produce insulin leads to type 1 diabetes and how the inability of insulin to have an effect on receptors in the liver leads to type 2 diabetes. **Required Practical 11 – Production of a dilution series of a glucose solution and use of colorimetric techniques to produce a calibration curve with which to identify the concentration of glucose in an unknown 'urine' sample.** • 3.6.4.3 Control of blood water potential – describe how the kidney is able to control the water potential of the blood.		
Key Technical Vocabulary	Taxis, Kinesis and Tropisms , Reflex arc, Receptors Control of heart rate, Nervous control, Resting potential and action potential, Synapse, Muscles, Homeostasis, Feedback, Blood glucose, kidney and osmoregulation, Nitrifying, Denitrifying, Yield, Productivity, Respiration, Photosynthesis, Saprobionts, Decomposition, Allele, Recessive, Dominant, Homozygous, Heterozygous, Genotype, Phenotype, Co-dominance, Epistasis, Dihybrid, Monohybrid, Sex-linked.	Mutations, Stem cells, Totipotency, Pluripotent, Transcription, Translation, Epigenetics, Cancer, Genome project, In vivo cloning, In Vitro cloning, Genetic screening, Counselling, Genetic fingerprinting, Recombinant, Restriction Enzymes, Electrophoresis, Population, Ecosystem, Niche, Community, Abiotic, Biotic, Variable, Productivity, Yield, conservation.	All of the key words from terms 1-3 in Y12 and terms 1-2 in Y13 Describe, Explain, suggest, Precise, Accurate, Variables, Control, Independent, Dependent, Anomalies, Calibration, Error, Range, Resolution, Hypothesis.
Opportunities for Reading	AQA Biology, Oxford A Level Biology for AQA, CGP CGP Biology Revision Guides Origins (how the nine months before birth shape the rest of our lives), Annie Murphy Paul Life from an RNA world, Michael Yarus The Selfish Gene, Richard Dawkins March of the Microbes, John Ingrham A planet of Viruses, Carl Zimmer Here comes the Sun, Steve Jones The Epigenetics Revolution, Nessa Carey Blossoms: And the genes that make them, Maxine F. Singer Buzz: The Nature and Necessary of Bees, Thor Hanson 10% Human: How Your Body's Microbes Hold the Key to Health and Happiness, Alanna Collen This is Going to Hurt: Secret Diaries of a Junior Doctor: Adam Kay Biological Science Review, Hodder What a Plant Knows (A field guide to the senses), Daniel Chamovitz	AQA Biology, Oxford A Level Biology for AQA, CGP CGP Biology Revision Guides Biological Science Review (Student Journal) Origins (how the nine months before birth shape the rest of our lives), Annie Murphy Paul Life from an RNA world, Michael Yarus The Selfish Gene, Richard Dawkins March of the Microbes, John Ingrham A planet of Viruses, Carl Zimmer Here comes the Sun, Steve Jones The Epigenetics Revolution, Nessa Carey Blossoms: And the genes that make them, Maxine F. Singer Buzz: The Nature and Necessary of Bees, Thor Hanson 10% Human: How Your Body's Microbes Hold the Key to Health and Happiness, Alanna Collen This is Going to Hurt: Secret Diaries of a Junior Doctor: Adam Kay Biological Science Review, Hodder What a Plant Knows (A field guide to the senses), Daniel Chamovitz	AQA Biology, Oxford A Level Biology for AQA, CGP CGP Biology Revision Guides Biological Science Review (Student Journal) Origins (how the nine months before birth shape the rest of our lives), Annie Murphy Paul Life from an RNA world, Michael Yarus The Selfish Gene, Richard Dawkins March of the Microbes, John Ingrham A planet of Viruses, Carl Zimmer Here comes the Sun, Steve Jones The Epigenetics Revolution, Nessa Carey Blossoms: And the genes that make them, Maxine F. Singer Buzz: The Nature and Necessary of Bees, Thor Hanson 10% Human: How Your Body's Microbes Hold the Key to Health and Happiness, Alanna Collen This is Going to Hurt: Secret Diaries of a Junior Doctor: Adam Kay Biological Science Review, Hodder What a Plant Knows (A field guide to the senses), Daniel Chamovitz
Developing Cultural Capital	Students will develop a greater appreciation of the environment. They will be able to appreciate the interdependence of different organisms and the consequence of human actions on the ecosystem. Students will be able to develop an appreciation of the need for conservation, and be able to evaluate the different strategies. The knowledge students will develop on this course will allow them to better understand the human body and give them a greater understanding of any illnesses they or a family member will face and will allow them to make more informed decision regarding potential treatments due to their enhanced evaluative skills. There are many links to different careers such as a genetic counsellor, nursing, medicine, environmental officer, etc.	The knowledge students will develop on DNA technology will allow them to better understand the current research. It will give them a greater understanding of cloning and genetic engineering and will allow them to make informed decisions such as buying genetically modified food. It will allow them to better understand any illnesses, such as cancer, that they or a family member will face and will allow them to make more informed decision regarding potential treatments due to their enhanced evaluative skills. This section of the course links to careers in DNA technology and Bioengineering, there are also links to many other such as, nursing, medicine, environmental officer, etc.	A level Biology provides a solid grounding in analytical thinking, writing reports and clear communication, the consolidation of the content together allows students to better develop these life skills. Links to many different careers in many different areas – medicine, nursing, midwifery, bioengineering, cardiology, dentistry, teaching, environmental health, conservation, etc. Students will develop a greater understanding of the world in which we live, how organisms interact with each other and how we have a responsibility to think about the consequences of our actions on the environment. They will be able to make more informed decision regarding life choices.
Wider-curricular opportunities	• Weekly Biology clinic • Ecology residential field trip	• Weekly Biology clinic • Engaging in Science week competitions and challenges • Guest speakers from university and STEM careers within Science week • Science Live lecture series- visit	• Weekly Biology clinic

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Cross Curricular Links (Authentic Connections)	• A Level Psychology - Neurone structure, synapses • Maths • Geography – population studies	• Geography – population studies • Maths • SMSC – ethics surrounding the use DNA technology	• Literacy skills with essay writing and technique • Maths • SMSC
Key Assessment	• Regular internal assessments. • Regular assessed home learning activities • Trial Examination Paper 1 A-level	• Regular internal assessments. • Regular assessed home learning activities • Trial Examination Paper 2 A level	Summer Examinations: Paper 1 – Units 3.1 – 3.4 35% of final grade Paper 2 – Units 3.5 – 3.8 35 % of final grade Paper 3 – Units 3.1 – 3.8 (including a summative essay) 30% of final grade

Year 12 Chemistry	**Term 1**	**Term 2**	**Term 3**
Unit(s) – As outlined in 39 week plans	3.1.1 - Atomic Structure 3.1.2 - Amount of Substance 3.1.3 - Bonding 3.1.4 - Energetics 3.1.6 - Equilibrium 3.1.7 - Oxidation, Reduction and Redox Reactions	3.2.1 - Periodicity 3.2.2 - Group 2, The Alkaline Earth Metals 3.2.3 - Group 7, the Halogens 3.3.1 - Intro to Organic Chemistry 3.3.2 - Alkanes 3.3.3 - Halogenoalkanes	3.3.6 - Organic Analysis 3.1.9 - Rates Equations
Key Retainable Knowledge & Skills	• Students should be able to explain how first and successive ionisation energies in Period 3 (Na–Ar) and in Group 2 (Be–Ba) give evidence for electron configuration in sub-shells and in shells. • Students should be able to carry out calculations using the Avogadro constant, using mass of substance and Mr • Students should be able to carry out calculations using and amount in moles, using concentration, volume and amount of substance in a solution. • Students should be able to use the ideal gas equation in calculations. • Students should be able to predict the charge on a simple ion using the position of the element in the Periodic Table and construct formulas for ionic compounds. • Students should be able to explain the shapes of, and bond angles in, simple molecules and ions with up to six electron pairs (including lone pairs of electrons) surrounding the central atom • Students should be able to define standard enthalpy of combustion (ΔcHΘ) and define standard enthalpy of formation (ΔfHΘ). • Students should be able to use Hess's law to perform calculations, including calculation of enthalpy changes for reactions from enthalpies of combustion or from enthalpies of formation. • Students should be able to use Le Chatelier's principle to predict qualitatively the effect of changes in temperature, pressure and concentration on the position of equilibrium	• Reactions can only occur when collisions take place between particles having sufficient energy. • Draw and interpret Maxwell–Boltzmann distribution curves for different temperatures • Use the Maxwell–Boltzmann distribution to explain why a small temperature increase can lead to a large increase in rate. • Explain how a change in concentration or a change in pressure influences the rate of a reaction. • Use a Maxwell–Boltzmann distribution to help explain how a catalyst increases the rate of a reaction involving a gas. • Bonding in alkenes involves a double covalent bond, a centre of high electron density. • Electrophilic addition reactions of alkenes with HBr, H2 SO4 and Br2 • Addition polymers are formed from alkenes and substituted alkenes. • Typical uses of poly(chloroethene), commonly known as PVC, and how its properties can be modified using a plasticiser. • Alcohols are produced industrially by hydration of alkenes in the presence of an acid catalyst. • Ethanol produced industrially by fermentation is separated by fractional distillation and can then be used as a biofuel. • Write equations to support the statement that ethanol produced by fermentation is a carbon-neutral fuel and give reasons why this statement is not valid • Alcohols are classified as primary, secondary and tertiary. • Primary alcohols can be oxidised to aldehydes which can be further oxidised to carboxylic acids. • Secondary alcohols can be oxidised to ketones • Tertiary alcohols are not easily oxidised.	• Tests for alcohol, aldehyde, alkene and carboxylic acid. • Mass spectrometry can be used to determine the molecular formula of a compound. • use precise atomic masses and the precise molecular mass to determine the molecular formula of a compound. • Bonds in a molecule absorb infrared radiation at characteristic wavenumbers. • use infrared spectra and the Chemistry Data Sheet or Booklet to identify particular bonds, and therefore functional groups, and also to identify impurities. • The rate of a chemical reaction is related to the concentration of reactants by a rate equation of the form: Rate = k[A]m [B]n • The rate constant k varies with temperature as shown by the equation: k = Ae–Ea/RT • The rate equation is an experimentally determined relationship • The orders with respect to reactants can provide information about the mechanism of a reaction. **Required practical 6** **Tests for alcohol, aldehyde, alkene and carboxylic acid** **Required practical 7** **Measuring the rate of reaction: by an initial rate method and by a continuous monitoring method.** **Required practical 10**

	• Students should be able to write half-equations identifying the oxidation and reduction processes in redox reactions • Students should be able to explain the trends in atomic radius and first ionisation energy and explain the melting point of the elements in terms of their structure and bonding. • Students should be able to explain the melting point of the group 2 elements in terms of their structure and bonding. • Students should be able to explain the trend in electronegativity and explain the trend in the boiling point of the group 7 elements in terms of their structure and bonding • The characteristics of a homologous series, a series of compounds containing the same functional group. • IUPAC rules for nomenclature • Free-radical mechanisms • E–Z isomerism is a form of stereoisomerism and occurs as a result of restricted rotation about the planar carbon–carbon double bond. • Petroleum is a mixture consisting mainly of alkane hydrocarbons that can be separated by fractional distillation. • Cracking involves breaking C–C bonds in alkanes. Thermal and Catalytic Cracking • The internal combustion engine produces a number of pollutants including NOx, CO, carbon and unburned hydrocarbons. • Halogenoalkanes undergo substitution reactions with the nucleophiles OH–, CN– and NH3 • Chlorine atoms are formed in the upper atmosphere when ultraviolet radiation causes C–Cl bonds in chlorofluorocarbons (CFCs) to break. **Required practical 1 –** **Make up a volumetric solution and carry out a simple acid–base titration.** **Required practical 2 –** **Measurement of an enthalpy change.** **Required practical 4 –** **Carry out simple test-tube reactions to identify cations and anions**	• Alkenes can be formed from alcohols by acid-catalysed elimination reactions • Alkenes produced by this method can be used to product addition polymers without using monomers derived from crude oil. **Required practical 3** **Investigation of how the rate of a reaction changes with temperature** **Required practical 5** **Distillation of a product from a reaction**	**Preparation of a pure organic solid and test of its purity and a pure organic liquid.**
Key Technical Vocabulary	Avogadro, Halogenoalkanes, redox, Lone Pair, Isomerism, Enthalpy, Hess's Law, Isotopes, Relative Atomic Mass, Electronegativity, Hydrogen Bond, Van der Waals Forces, Standard Enthalpy of Combustion, Standard Enthalpy of Formation	Maxwell–Boltzmann distribution, Activation Energy, Electrophilic addition, Alcohols, Alkenes, Primary Alcohols, Secondary Alcohols, Carboxylic acids, aldehydes, Ketones,	Order of Reaction, Rate Constant, NMR, Mass spectrometry, Rate Determining Step,
Opportunities for Reading	AQA Chemistry – Oxford: New A-Level Chemistry for AQA, CGP ChemGuide Website https://www.chemguide.co.uk/ RSC Student page - https://edu.rsc.org/student **Interesting Books** The Disappearing Spoon, Sam Kean Period Tales, Hugh Aldersey-Williams The Poisoner's Handbook, Deborah Blum Napoleon's Buttons, Penny Le Couteur Chemistry^3, Oxford Atkins Molecules, Atkins	AQA Chemistry – Oxford: New A-Level Chemistry for AQA, CGP ChemGuide Website https://www.chemguide.co.uk/ RSC Student page - https://edu.rsc.org/student **Interesting Books** The Disappearing Spoon, Sam Kean Period Tales, Hugh Aldersey-Williams The Poisoner's Handbook, Deborah Blum Napoleon's Buttons, Penny Le Couteur Chemistry^3, Oxford Atkins Molecules, Atkins	AQA Chemistry – Oxford: New A-Level Chemistry for AQA, CGP ChemGuide Website https://www.chemguide.co.uk/ RSC Student page - https://edu.rsc.org/student **Interesting Books** The Disappearing Spoon, Sam Kean Period Tales, Hugh Aldersey-Williams The Poisoner's Handbook, Deborah Blum Napoleon's Buttons, Penny Le Couteur Chemistry^3, Oxford Atkins Molecules, Atkins
Developing Cultural Capital	During this term students will learn about the impact of CFCs on the Ozone Layer and how this has an impact on the atmosphere of the earth. They will also consider the pollutants from the internal combustion engine and the impact they have on the health of the population. Along with methods to reduce the impact of these chemical pollutants. The students will also consider how the chemical equilibrium can be applied to the chemical industry to help increase the yield of useful products which in turn helps to reduce costs. The department also runs a week of activities in chemistry week, highlighting some of the broader areas of chemistry for students. Students also have the opportunity to attend the RSC Christmas Lecture.	Students will investigate the Impact of changing conditions on rate of reaction and what the economic impact of these alterations can be. Students will also production of polymers and their properties, examining the impact that these materials can have on the environment and how they can be safely broken down. The methods of producing alcohols is also looked at in depth, these along with alkenes are common feedstock for organic synthesis and are produced on a large scale.	In this term students will investigate further the Impact of changing conditions on the rate of reaction. This will be again applied to how this can be used to save costs or to run chemical reactions under safer conditions. Students will also undertake a visit to Sheffield university to complete Organic Synthesis practical work.
Wider-curricular opportunities	• Weekly Chemistry clinic • Chemistry Week • Science Live lecture series- visit • RSC Christmas Lecture	• Weekly Chemistry clinic • Engaging in Science week competitions and challenges • Guest speakers from university and STEM careers within Science week • Royal Society of Chemistry - Olympiad competition	• Weekly Chemistry clinic • Visit to Sheffield University for Organic Synthesis work

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Cross Curricular Links (Authentic Connections)	• Physics – Electron configuration • Physics - Calorimetry and specific heat capacity		
Key Assessment	• Regular internal assessments. • Regular assessed home learning activities • Key assessment covering content covered to date.	• Regular internal assessments. • Regular assessed home learning activities • Mock Examination AS Paper 1	• Regular internal assessments. • Regular assessed home learning activities • Mock Examination covering all AS chemistry content.

Year 13 Chemistry	Term 1	Term 2	Term 3
Unit(s) – As outlined in 39 week plans	3.1.8 – Thermodynamics 3.1.9 – Rate Equations 3.1.10 Equilibrium constant Kp for homogeneous systems (A-level only) 3.1.11 Electrode potentials and electrochemical cells (A-level only) 3.1.12 Acids and bases (A-level only) 3.2.4 Properties of Period 3 elements and their oxides (A-level only) 3.2.5 Transition metals (A-level only) 3.3.7 Optical isomerism (A-level only) 3.3.8 Aldehydes and ketones (A-level only) 3.3.9 Carboxylic acids and derivatives (A-level only) 3.3.10 Aromatic chemistry (A-level only) 3.3.11 Amines (A-level only) 3.3.12 Polymers (A-level only) 3.3.13 Amino acids, proteins and DNA (A-level only) 3.3.14 Organic synthesis (A-level only)	3.2.6 Reactions of ions in aqueous solution (A-level only) 3.3.15 Nuclear magnetic resonance spectroscopy (A-level only) 3.3.16 Chromatography (A-level only)	Revision and exam preparation
Key Retainable Knowledge & Skills	• Construct Born–Haber cycles to calculate lattice enthalpies using these enthalpy changes • Use the relationship ΔG = ΔH – TΔS to determine the temperature at which a reaction becomes feasible. • Understand that the equation k = Ae–Ea/RT can be rearranged into the form ln k = –Ea /RT + ln A and know how to use this rearranged equation with experimental data to plot a straight line graph with slope –Ea/R • Derive the rate equation for a reaction from the orders with respect to each of the reactants • Perform calculations involving Kp	• Explain, in terms of the charge/size ratio of the metal ion, why the acidity of [M(H2O)6]3+ is greater than that of [M(H2O)6]2+ • Describe and explain the simple test-tube reactions of:M2+(aq) ions, limited to M = Fe and Cu, and of M3+(aq) ions, limited to M = Al and Fe, with the bases OH–, NH3 and CO32– • Use 1H NMR and 13C NMR spectra and chemical shift data from the Chemistry Data Booklet to suggest possible structures or part structures for molecules • Compare retention times and Rf values with standards to identify different substances.	

	• Calculate the EMF of a cell • Explain how the electrode reactions can be used to generate an electric current • Calculate the pH of a solution of a strong acid from its concentration. • Use KW to calculate the pH of a strong base from its concentration. • Perform calculations relating the pH of a weak acid to the concentration of the acid and the dissociation constant, Ka • Sketch and explain the shapes of typical pH curves • Calculate the pH of acidic buffer solutions. • Explain the trends in the reactions of the oxides with water in terms of the type of bonding present in each oxide • A complex is a central metal atom or ion surrounded by ligands. • Explain the chelate effect, in terms of the balance between the entropy and enthalpy change in these reactions • Transition metal ions commonly form octahedral complexes with small ligands (eg H2O and NH3). • Draw the structural formulas and displayed formulas of enantiomers • Outline the nucleophilic addition mechanism for the reaction with KCN followed by dilute acid • Outline the electrophilic substitution mechanisms • Draw the repeating unit from a section of the polymer chain • Draw the structures of amino acids as zwitterions and the ions formed from amino acids • Explain how hydrogen bonding between base pairs leads to the two complementary strands of DNA • Explain why chemists aim to design processes that do not require a solvent and that use non-hazardous starting materials **Required practical 8** **Measuring the EMF of an electrochemical cell.** **Required practical 9** **Investigate how pH changes when a weak acid reacts with a strong base and when a strong acid reacts with a weak base.**	**Required practical 11** **Carry out simple test-tube reactions to identify transition metal ions in aqueous solution.** **Required practical 12** **Separation of species by thin-layer chromatography**	
Key Technical Vocabulary	Born–Haber, Free energy, EMF, pH, Buffer, Transition Metals, Chelate, nucleophilic addition, amino acids, zwitterions, Equilibrium, delocalisation,	Nuclear Magnetic Resonance, Thin Layer Chromatography, Retention Factor, Ligand, Chelate, precipitation, amphoteric, Hydrogen Ion, Absorption.	
Opportunities for Reading	AQA Chemistry – Oxford: New A-Level Chemistry for AQA, CGP ChemGuide Website https://www.chemguide.co.uk/ RSC Student page - https://edu.rsc.org/student **Interesting Books** The Disappearing Spoon, Sam Kean Period Tales, Hugh Aldersey-Williams The Poisoner's Handbook, Deborah Blum Napoleon's Buttons, Penny Le Couteur Chemistry^3, Oxford Atkins Molecules, Atkins	AQA Chemistry – Oxford: New A-Level Chemistry for AQA, CGP ChemGuide Website https://www.chemguide.co.uk/ RSC Student page - https://edu.rsc.org/student **Interesting Books** The Disappearing Spoon, Sam Kean Period Tales, Hugh Aldersey-Williams The Poisoner's Handbook, Deborah Blum Napoleon's Buttons, Penny Le Couteur Chemistry^3, Oxford Atkins Molecules, Atkins	AQA Chemistry – Oxford: New A-Level Chemistry for AQA, CGP ChemGuide Website https://www.chemguide.co.uk/ RSC Student page - https://edu.rsc.org/student **Interesting Books** The Disappearing Spoon, Sam Kean Period Tales, Hugh Aldersey-Williams The Poisoner's Handbook, Deborah Blum Napoleon's Buttons, Penny Le Couteur Chemistry^3, Oxford Atkins Molecules, Atkins
Developing Cultural Capital	Students will look at how Electro chemical cells are made and how this technology is implemented in the real world especially considering this is a rapid area of development. Students will also look at how Fuel cells are being utilised in more situations including hydrogen powered cars and as energy sources for space craft. In their study of buffers students will look at how these can be used in maintaining pH in food substances. When looking at the Synthesis of organic molecules students will understand the importance of different starting chemicals and how the availability of these compounds has a significant impact on the production of other useful chemicals. In the transition metals topic students will cover why Transition metals	Through this time students will mostly be consolidating there learning. The will still have the opportunity to be involved with Science week and to take part in the Chemistry Olympiad run by the Royal Society of Chemistry.	

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	make good catalysts and how this is important to reduce the cost and improve yield of important chemicals such as ammonia, along with the role the play in the reduction of harmful pollutants form combustion engines. In the further study of Transition Metals they will look at complexes used as Anti-Cancer drugs and the role of complexes in the body as chelate therapy and as Haem in the blood. The department also runs a week of activities in chemistry week, highlighting some of the broader areas of chemistry for students. Students also have the opportunity to attend the RSC Christmas Lecture.		
Wider-curricular opportunities	• Weekly Chemistry clinic • Chemistry Week • Science Live lecture series- visit • RSC Christmas Lecture	• Weekly Chemistry clinic • Engaging in Science week competitions and challenges • Guest speakers from university and STEM careers within Science week • Royal Society of Chemistry - Olympiad competition	• Weekly Chemistry clinic
Cross Curricular Links (Authentic Connections)	• Biology – Structure of DNA • Biology – Anti Cancer drugs and the function of Haem in the body.		
Key Assessment	• Regular internal assessments. • Regular assessed home learning activities • Mock Examination Paper 1 A-level	• Regular internal assessments. • Regular assessed home learning activities • Mock Examination Paper 2 and Paper 3 A-Level	• Final A-Level Examinations Paper 1 – 35% final mark – Relevant Physical Chemistry and Inorganic Chemistry Paper 2 – 35% final mark – relevant Physical chemistry and Organic Chemistry Paper 3 – 30% final mark – all content, focus on practical skills. 30marks Multiple choice
Year 12 Physics	**Term 1**	**Term 2**	**Term 3**
Unit(s) – As outlined in 39 week plans	3.1 Measurements and their errors 3.3 Waves 3.4 Mechanics and materials	3.2 Particles and radiation 3.5 Electricity	3.6.1 Further Mechanics 3.6.2 Thermal Physics
Key Retainable Knowledge & Skills	• Students should be able to use and derive SI units and their prefixes and convert between units. • Students should be able to identify errors and apply key scientific terminology. • Students should be able to calculate uncertainties and explain orders of magnitude. • Students should be able to explain wave properties for longitudinal and transverse waves and be able to perform appropriate calculations. • Students should be able to explain the principle of superposition of waves and formation of stationary waves and use appropriate formula for calculations. • Students should be able to explain the principals of refraction, diffraction and interference, including diffraction using different light sources and calculating refractive index. Students should apply this knowledge to explaining fibre optics. • Students should be able to explain the nature of scalars and vectors and add vectors by calculation or scale drawing. • Students should be able to explain conditions for equilibrium for forces acting at a point and in the context of an object at rest or moving with constant velocity. • Students should be able to explain the Principle of moments and the concept of centre of mass, also that the position of the centre of mass of uniform regular solid is at its centre. • Students need to be able to define displacement, speed, velocity, acceleration and graphically represent their relationship and be able to use the equations of motion. • Students need to be able to explain projectile motion and apply the equations of motion. • Students need to explain friction and lift and drag forces and be able to explain terminal speed.	• Students should be able to explain a simple model of the atom, including the properties of the subatomic particles and isotopes. • Students should be able to explain the strong nuclear force; its role and range. • Students should be able to describe unstable nuclei; alpha and beta decay, including equations for alpha decay, β– decay including the need for the neutrino. • Students should be able to compare particle and antiparticle masses, charge and rest energy. • Students should have knowledge of annihilation and pair production and the energies involved. • Students should be able to describe the four fundamental interactions, explain exchange particles and draw simple diagrams to represent the interactions. • Students should understand the properties of the classes of hadrons, baryon number, how they decay. • Students should be able to explain leptons, lepton number and lepton decay. • Students should understand strange particles and their conservation. • Students should be able to explain the properties of quarks and antiquarks, how they change in decay and be able to combine them. • Students should be able to explain the photon explanation of threshold frequency, work function and stopping potential and perform relevant calculations. • Students should be able to explain ionisation and excitation and show an understanding of ionisation and excitation in the fluorescent tube and be able to interpret line spectra. • Students should be able to explain wave particle duality and describe electron diffraction. • Students should be able to explain current, resistance and potential difference (pd) in circuits and complete related calculations.	• Students should be able to explain circular motion and calculate angular speed and centripetal force and acceleration. • Students should analyse the characteristics or simple harmonic motion (SHM), understand graphical representations and perform relevant calculations. • Students should be able to describe simple harmonic systems and complete associated calculations. • Students should be able to explain forced and free vibrations and resonance in different scenarios • Students should be able to explain internal energy and how it is changed and transferred, students should be able to complete relevant calculations. • Students should explain the relationship between pressure, volume, temperature and mass of a gas and utilise the relevant equations to perform calculations. • Students should be able to explain absolute zero and how they would practically determine it. • Students will consolidate Y12 content in preparation for their internal preliminary examination (equivalent to AS level) and will subsequently analyse areas for improvement. **Required practical 7: Investigation into simple harmonic motion using a mass–spring system and a simple pendulum.** **Required practical 8: Investigation of Boyle's law (constant temperature) and Charles's law (constant pressure) for a gas.**

	• Students need to show knowledge and application of Newton's three laws of motion. • Students need to explain momentum in difference situations, use the relevant equations to calculate it and demonstrate understanding of graphical representations. • Students should be able to explain the principle of conservation of energy, be able to calculate energy transferred and be able to show understanding of graphical representations. • Students should be able to explain and calculate material properties, including interpreting graphs • Students should be able to calculate and use a graph to find the Young Modulus **Required practical 1: Investigation into the variation of the frequency of stationary waves on a string with length, tension and mass per unit length of the string.** **Required practical 2: Investigation of interference effects to include the Young's slit experiment and interference by a diffraction grating.** **Required practical 3: Determination of g by a freefall method.** **Required practical 4: Determination of the Young modulus by a simple method.**	• Students should be able to identify the characteristics for specific defined electrical components. • Students should be able to explain and calculate resistivity and relate their understanding to semiconductors. • Students should be able to explain potential dividers and their practical applications. • Students should be able to explain electromotive force (emf) and internal resistance and apply their understanding to circuit calculations. **Required practical 5: Determination of resistivity of a wire using a micrometer, ammeter and voltmeter.** **Required practical 6: Investigation of the emf and internal resistance of electric cells and batteries by measuring the variation of the terminal pd of the cell with current in it.**	
Key Technical Vocabulary	SI Units, random and systematic errors, uncertainty, precision, repeatability, reproducibility, resolution, accuracy. Progressive and stationary waves, amplitude, frequency, wavelength, phase, phase difference, longitudinal, transverse, polarisation, node, antinode, harmonic, path difference, coherence, fringe spacing, diffraction grating, interference, superpose, diffraction, refraction, reflection. Scalar, vector, equilibrium, moment, coplanar, displacement, acceleration, velocity, projectile, static, dynamic, momentum, elastic, inelastic, conservation, tensile stress, tensile strength, elastic limit, breaking stress, Young modulus.	Proton, neutron, electron, nucleon, neutrino, isotope, strong nuclear force, electromagnetic force, weak nuclear force, strong nuclear force, antiparticles, positron, antiproton, antineutron and antineutrino, annihilation, pair production, exchange particles, alpha and beta decay, hadron, baryon, antibaryon, mesons, pion, kaon, lepton, muon, strange particles, quark and antiquark, quark character, photoelectric effect, photoelectrons, threshold frequency, work function, stopping potential, ionisation, excitation, line spectra, wave-particle duality, De Broglie wavelength. Current, potential difference, charge, resistivity, semiconductors, potential divider, electromotive force,	Periodic motion, simple harmonic motion, centripetal force, angular speed, simple harmonic systems, resonance, damping. Internal energy, kinetic energy, potential energy, specific heat capacity, latent heat, ideal gas, molar mass, Brownian motion,
Opportunities for Reading	A Level Physics, Exam Board: AQA, Student Book, The Complete A Level Course, CGP AQA Physics, Jim Breithaupt, Oxford University Press A Level Physics, Exam Board: AQA, Complete revision and practice • Particle Physics Brick by Brick, Dr Ben Still • A-Level Physics, Roger Muncaster • Professor Povey's Perplexing Problems, Thomas Povey • Seven Brief Lessons on Physics, Carlo Rovelli • A Brief History of Time, Stephen Hawking • A Very Short Introduction to Particle Physics, Frank Close • Six Easy Pieces, Richard Feynman • QED: A Strange Theory of Light and Matter, Richard Feynman • The God Particle, Leon Lederman • Fuzzy Thinking, Bart Kosko, • The large, the small and the human mind, Roger Penrose	A Level Physics, Exam Board: AQA, Student Book, The Complete A Level Course, CGP AQA Physics, Jim Breithaupt, Oxford University Press A Level Physics, Exam Board: AQA, Complete revision and practice • Particle Physics Brick by Brick, Dr Ben Still • A-Level Physics, Roger Muncaster • Professor Povey's Perplexing Problems, Thomas Povey • Seven Brief Lessons on Physics, Carlo Rovelli • A Brief History of Time, Stephen Hawking • A Very Short Introduction to Particle Physics, Frank Close • Six Easy Pieces, Richard Feynman • QED: A Strange Theory of Light and Matter, Richard Feynman • The God Particle, Leon Lederman • Fuzzy Thinking, Bart Kosko, • The large, the small and the human mind, Roger Penrose	A Level Physics, Exam Board: AQA, Student Book, The Complete A Level Course, CGP AQA Physics, Jim Breithaupt, Oxford University Press A Level Physics, Exam Board: AQA, Complete revision and practice • Particle Physics Brick by Brick, Dr Ben Still • A-Level Physics, Roger Muncaster • Professor Povey's Perplexing Problems, Thomas Povey • Seven Brief Lessons on Physics, Carlo Rovelli • A Brief History of Time, Stephen Hawking • A Very Short Introduction to Particle Physics, Frank Close • Six Easy Pieces, Richard Feynman • QED: A Strange Theory of Light and Matter, Richard Feynman • The God Particle, Leon Lederman • Fuzzy Thinking, Bart Kosko, • The large, the small and the human mind, Roger Penrose
Developing Cultural Capital	Solid basic measurement analysis and scale drawing - transferable to engineering careers. Appreciation of momentum conservation issues in the context of ethical transport design. Efficiency calculations and understanding of conservation of energy and application of materials engineering in real life situations	Understanding of current cutting edge scientific research around particle physics – CERN. Applications of semiconductors and potential dividers	Understanding of resonance issues and damping in the real world (e.g. the Millennium Bridge, London) and applications of materials with different specific heat capacities and specific latent heat.
Wider-curricular opportunities	• Weekly Physics clinic	• Weekly Physics clinic • Engaging in Science week competitions and challenges • Guest speakers from university and STEM careers within Science week • Science Live lecture series- visit	• Weekly Physics clinic
Cross Curricular Links (Authentic Connections)	Some common section of measurements and their errors with biology, chemistry and maths. Equations of motion - maths Material behaviour and properties - chemistry	Basic particle theory - chemistry	Further mechanics calculations – maths Use of molar and molecular mass - chemistry
Key Assessment	• Regular internal assessments. • Regular assessed home learning activities	• Regular internal assessments. • Regular assessed home learning activities • Trial exam	• Regular internal assessments. • Regular assessed home learning activities • Trial exam

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Year 13 Physics	Term 1	Term 2	Term 3
Unit(s) – As outlined in 39 week plans	3.7 Fields and their consequences 3.8 Nuclear Physics	3.7 Fields and their consequences Option 3.12 Turning Points	Consolidation of content
Key Retainable Knowledge & Skills	• Students should understand that Gravity is a universal force of attraction and the magnitude of the force can be calculated using Newton's universal of Gravitation. • Understand that Gravitational field strength represents the force per unit mass on an object, and how it is calculated for a radial field • Be able to define Gravitational potential, and appreciate why its value is always negative and zero at infinity • Students should know that no work is done if an object moves along a line of equipotential and give examples where this might happen such as satellites • Students should be able to calculate the gravitational potential for an object placed in a radial field be able to calculate the change in gravitational potential energy as it moves through the field • Be able to use a graph of gravitational potential and distance and use the gradient to calculate field strength and use a graph of field strength against distance and use the area to calculate change in gravitational potential • Understand that electric fields are caused by charges and that the force between two charges can be calculated using Coulomb's Law • Compare the relative magnitude of electric and gravitational fields between subatomic particles. • Know that Electric Field strength represents the force per unit charge and be able calculate the magnitude of the electric field strength in both radial and uniform fields and show the direction of the fields using field lines	• Students to be able to calculate the force on a current carrying wire, and apply Fleming's left hand rule • Be able to calculate the force on a moving charge an understand how these forces produce circular paths that can be used in devices such a cyclotron • Define flux linkage in a rectangular coil and how this changes as coil is rotated. • Understand that a change in flux will induce and EMF, be able to calculate its magnitude using Faradays Law and direction using Lenz's law. • To be able to describe an AC current and convert between RMS and peak values • To perform calculations when AC current is being used • To be able to use and oscilloscope to measure the properties of an AC waveform • Be able to describe the structure and function of a Transformer and give examples of their applications, and calculate the PD produced by a transformer. • To describe how transformers waste energy and measure that can be used to reduce these inefficiencies • To understand how cathode rays are produced in discharge tube, and to calculate the work done on an electron that is accelerated through a pd • Understand how experiments can be used to find the specific charge of an electron • To be able to describe the methodology of Millikin's oil drop experiment and perform calculation to determine the charge of an electron • To be able to compare Newtons and Huygens theories of the nature of light and why initially Newton's theory was preferred but later dismissed. • Describe the nature of electromagnetic waves and use Maxwells formula to find the speed of an Electromagnetic wave	• Students will consolidate Y12 and Y13 content in preparation for their external examinations. This will include repeating required practicals as revision, working through past papers and taught lessons to consolidate.

	• Understand the trajectory taken by subatomic particles entering a uniform field at right angles • Be able to define Electric field strength and appreciate that it has a value of zero at infinity • Understand that potential difference is the difference in electric potential between two points be able to calculate work done when moving a charge between difference potentials • To be able to graphically represent the values of Potential and Field strength against distance. • To be able to define capacitance and be able to calculate the capacitance of a parallel plate capacitor and understand how dielectrics can effect capacitance • Students should be able to calculate the energy stored in a capacitor and how this can also be done by using a graph of Charge against pd • Be able to carry out experiments of charging and discharging capacitors, and from graphs and measurements determine the time constant • Students should be able to calculate that charge at any time of a charging/discharging capacitor using the time constant and corresponding equation. • Understand how Rutherford scattering has helped develop the model of the atom • Understand how the type of radiation emitted by an object can be determined using simple experiments and how the intensity of radiation varies over distance • To be able to understand the hazards of radiation and how it can be safely handled • Students should understand that radioactive decay is random and use equations to calculate how activity changes over time and how half-life can be determined from decay curves and log graphs. • Understand how half-life impacts the safe storage of radioactive materials • Know the shape of a N against Z graph and know the possible decay modes of unstable nuclei • Be able to estimate the size of a nucleus using the closest approach of alpha particles, and know that this depends on Nucleon number • Be able to apply E=mc2 for calculations involving mass differences and how this can be applied to fission and fusion • How induced fission can be cause thermal neutrons and how a chain reaction is used in nuclear power. • Be familiar with the basic structure of a nuclear PowerStation and understand the role of the coolant, control rods and moderator and what safety measures are in place when using nuclear energy **Required practical 9 Investigation into the charging and discharging of capacitors** **Required practical 12 Investigate the inverse square law for gamma radiation**	• Discovery of radio waves by Hertz and subsequent measurement of their speed • How photoelectricity and the ultraviolet catastrophe couldn't be explained by classic wave theory and then Einstein's explanation. • How particles exhibit a wave nature and calculation of wavelength using de Broglie's equation. • The principle behind the operation of electron microscopes and their advantages to using light in terms of resolving power • Understand the priniples of the Michelson Morley interferometer and how this can be used to detect absolute motion • Understand the concept of inertial frames of reference • How special relativity causes time dilation and length contraction • How energy and mass are equivalent and how mass and kinetic energy vary with speed **Required practical 10 Investigate the force on a wire in a magnetic field** **Required practical 11 Use a search coil to investigate how magnetic flux linkage changes with angle**	
Key Technical Vocabulary	Field, Mass, Force, Gravity, Potential, Vector, Scalar, Electric, Equipotential, Orbit, Charge, Electrostatic, Uniform, Radial, Capacitance, Dielectric, Permittivity, Time Constant, Alpha, Beta, Gamma, Nucleus, Inverse Square, Fission, Fusion, Half Life, Safety	Tesla, Flux, Field, EMF, AC, RMS, Transformer, Specific Charge, Thermionic, Electron, Cathode, Balanced, Terminal Velocity, Corpuscle, Wave, Electromagnetic, Photoelectric, Duality, Relativity, Dilation	
Opportunities for Reading	A Level Physics, Exam Board: AQA, Student Book, The Complete A Level Course, CGP AQA Physics, Jim Breithaupt, Oxford University Press A Level Physics, Exam Board: AQA, Complete revision and practice AQA definitions list • A-Level Physics, Roger Muncaster • How to Teach Relativity to Your Dog, Chad Orzel • Why does E = mc2?, Brian Cox & Jeff Forshaw • A Very Short Introduction to Relativity, Russell Stannard • A Very Short Introduction to Quantum Theory, John Polkinghorn • Einstein's Universe, Nigel Calder • The origin of the universe, John Barrow • Galileo's Finger, Peter Atkins • In search of Schrodinger's cat, John Gribbin • Masters of Time, John Boslough	A Level Physics, Exam Board: AQA, Student Book, The Complete A Level Course, CGP AQA Physics, Jim Breithaupt, Oxford University Press A Level Physics, Exam Board: AQA, Complete revision and practice AQA definitions list • A-Level Physics, Roger Muncaster • How to Teach Relativity to Your Dog, Chad Orzel • Why does E = mc2?, Brian Cox & Jeff Forshaw • A Very Short Introduction to Relativity, Russell Stannard • A Very Short Introduction to Quantum Theory, John Polkinghorn • Einstein's Universe, Nigel Calder • The origin of the universe, John Barrow • Galileo's Finger, Peter Atkins • In search of Schrodinger's cat, John Gribbin • Masters of Time, John Boslough	A Level Physics, Exam Board: AQA, Student Book, The Complete A Level Course, CGP AQA Physics, Jim Breithaupt, Oxford University Press A Level Physics, Exam Board: AQA, Complete revision and practice AQA definitions list • A-Level Physics, Roger Muncaster • How to Teach Relativity to Your Dog, Chad Orzel • Why does E = mc2?, Brian Cox & Jeff Forshaw • A Very Short Introduction to Relativity, Russell Stannard • A Very Short Introduction to Quantum Theory, John Polkinghorn • Einstein's Universe, Nigel Calder • The origin of the universe, John Barrow • Galileo's Finger, Peter Atkins • In search of Schrodinger's cat, John Gribbin • Masters of Time, John Boslough

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	• Chaos, James Gleick • The last three minutes, Paul Davies • Longitude, Dava Sobel, • A life in science, John Gribin, Richard Feynman • The Road to reality, Roger Penrose • Einstein's miraculous year, John Satchel	• Chaos, James Gleick • The last three minutes, Paul Davies • Longitude, Dava Sobel, • A life in science, John Gribin, Richard Feynman • The Road to reality, Roger Penrose • Einstein's miraculous year, John Satchel	• Chaos, James Gleick • The last three minutes, Paul Davies • Longitude, Dava Sobel, • A life in science, John Gribin, Richard Feynman • The Road to reality, Roger Penrose • Einstein's miraculous year, John Satchel
Developing Cultural Capital	Understanding current cutting edge research such as particle accelerators Applications of particle accelerators e.g. cyclotrons used for proton therapy	Generating interest in the history of physics discoveries and future possibilities	
Wider-curricular opportunities	• Weekly Physics clinic	• Weekly Physics clinic • Engaging in Science week competitions and challenges • Guest speakers from university and STEM careers within Science week • Science Live lecture series- visit	• Weekly Physics clinic
Cross Curricular Links (Authentic Connections)	Calculations using exponentials – Maths Use of log-lin graphs - Maths	Calculations using exponentials - Maths	
Key Assessment	• Regular internal assessments. • Regular assessed home learning activities • Trial exams	• Regular internal assessments. • Regular assessed home learning activities • Trial exam	• Regular internal assessments. • Regular assessed home learning activities

Year 12 L3 Applied Science	**Term 1**	**Term 2**	**Term 3**
Unit(s) – As outlined in 39 week plans	Unit 1 A1 Structure and bonding in applications in science A2 Production and uses of substances in relation to properties B1 Cell structure and function B2 Cell specialisation C1 Working with waves C2 Waves in communication Unit 2 Learning Aim B Learning Aim A	Unit 1 A2 Production and uses of substances in relation to properties B3 Tissue structure and function C3 Use of electromagnetic waves in communication Unit 2 Learning Aim C	Unit 1 Exam Preparation for Unit 1 All learning Aims Unit 2 Learning Aim C Learning Aim D
Key Retainable Knowledge & Skills	A1 Structure and bonding in applications in science • Understand the electronic structure of atoms: • Understand ionic bonding: • Understand covalent bonding: • Understand metallic bonding: • Understand the following intermolecular forces: • Understand the following: • Understand the quantities used in chemical reactions: A2 Production and uses of substances in relation to properties • Understand the periodic table: • Understand the physical properties of elements: • Understand the chemical properties of elements:	A2 Production and uses of substances in relation to properties • Understand the periodic table: • Understand the physical properties of elements: • Understand the chemical properties of elements: B3 Tissue structure and function • Understand the structure and function of epithelial tissue • Understand the structure and function of endothelial tissue, as illustrated by blood vessels in the cardiovascular system, including the risk factors that damage endothelial cells and affect the development of atherosclerosis. • Understand the structure and function of muscular tissue • Understand the structure and function of nervous tissue	A2 Production and uses of substances in relation to properties • Understand the periodic table: • Understand the physical properties of elements: • Understand the chemical properties of elements: B3 Tissue structure and function • Understand the structure and function of epithelial tissue • Understand the structure and function of endothelial tissue, as illustrated by blood vessels in the cardiovascular system, including the risk factors that damage endothelial cells and affect the development of atherosclerosis. • Understand the structure and function of muscular tissue • Understand the structure and function of nervous tissue

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	B1 Cell structure and function • Know that cell theory is a unifying concept stating that cells are a fundamental unit of structure, function and organisation in all living organisms. • Understand the ultrastructure and function of organelles in the following cells: • Recognise cell organelles from electron micrographs and the use of light microscopes. • Understand the similarities and differences between plant and animal cell structure and function. • Understand how to distinguish between gram-positive and gram-negative bacterial cell walls and why each type reacts differently to some antibiotics. • Calculate magnification and size of cells and organelles from drawings or images. B2 Know the cell specialisation of the following: • palisade mesophyll cells in a leaf • sperm and egg cells in reproduction • root hair cells in plants • white blood cells • red blood cells. C1 Working with waves • Understand the features common to all waves • Recognise the graphical representation of wave features. • Understand the difference between the two main types of wave: • Understand concepts of displacement, coherence, path difference, phase difference, superposition as applied to diffraction gratings. • Understand the industrial application of diffraction gratings • Be able to use the wave equation. • Understand the concept and applications of stationary waves resonance. C2 Waves in communication • Understand the principles of fibre optics: • Understand the applications of fibre optics in medicine to include endoscopes. • Understand the applications of fibre optics in communication, to include analogue and digital signals: analogue-to-digital conversion, broadband. Unit 2 Learning Aim B B.P3 Correctly obtain data using different equipment to construct cooling curves. B.P4 Correctly determine the rate of cooling of substances using cooling curves. B.M2 Analyse the rate of cooling of substances from your data using cooling curves to draw valid conclusions. B.D2 Evaluate the accuracy of practical work in calorimetry in relation to the analysis of the cooling curve. Unit 2 Learning Aim A A.P1 Correctly prepare and standardise solutions for titration and colorimetry. A.P2 Investigate the concentration of unknown solutions, using procedures and techniques in titration and colorimetry. A.M1 Demonstrate skilful application of procedures and techniques in titration and colorimetry to accurately determine the concentration of solutions. A.D1 Evaluate the accuracy of procedures and techniques used in titration and colorimetry in relation to outcomes and suggest improvements.	C3 Use of electromagnetic waves in communication • Understand that all electromagnetic waves travel with the same speed in a vacuum. • Be able to use the inverse square law in relation to the intensity of a wave. • Understand how the regions of the electromagnetic spectrum are grouped according to the frequency. • Understand how the applications of electromagnetic waves in communications are related to frequency, including satellite communication, mobile phones, Bluetooth®, infrared, Wi-Fi. Unit 2 Learning Aim A A.P1 Correctly prepare and standardise solutions for titration and colorimetry. A.P2 Investigate the concentration of unknown solutions, using procedures and techniques in titration and colorimetry. A.M1 Demonstrate skilful application of procedures and techniques in titration and colorimetry to accurately determine the concentration of solutions. A.D1 Evaluate the accuracy of procedures and techniques used in titration and colorimetry in relation to outcomes and suggest improvements. Unit 2 Learning Aim C C.P5 Correctly use chromatographic techniques to produce chromatograms. C.P6 Explain the use of chromatographic techniques to separate mixtures. C.M3 Analyse own chromatograms and relate the factors that affect the separation of mixtures to the quality of results obtained. C.D3 Evaluate the chromatographic techniques used in relation to outcomes and suggest improvements.	C3 Use of electromagnetic waves in communication • Understand that all electromagnetic waves travel with the same speed in a vacuum. • Be able to use the inverse square law in relation to the intensity of a wave. • Understand how the regions of the electromagnetic spectrum are grouped according to the frequency. • Understand how the applications of electromagnetic waves in communications are related to frequency, including satellite communication, mobile phones, Bluetooth®, infrared, Wi-Fi. Unit 2 Learning Aim C C.P5 Correctly use chromatographic techniques to produce chromatograms. C.P6 Explain the use of chromatographic techniques to separate mixtures. C.M3 Analyse own chromatograms and relate the factors that affect the separation of mixtures to the quality of results obtained. C.D3 Evaluate the chromatographic techniques used in relation to outcomes and suggest improvements. Unit 2 Learning Aim D D.P7 Summarise key personal competencies developed in relation to scientific skills undertaken. D.M4 Analyse skills developed and suggest improvements to own practice. D.D4 Evaluate scientific skills developed in terms of potential for future progression.
Key Technical Vocabulary	Assess calculate compare complete criticise deduce derive describe determine devise discuss draw evaluate explain state identify plot predict sketch	Assess calculate compare complete criticise deduce derive describe determine devise discuss draw evaluate explain state identify plot predict sketch	Assess calculate compare complete criticise deduce derive describe determine devise discuss draw evaluate explain state identify plot predict sketch
Opportunities for Reading	www.chemguide.co.uk www.btecrevision.org Biology Mad Course textbook and revision guide.	www.chemguide.co.uk www.btecrevision.org Biology Mad Course textbook and revision guide.	www.chemguide.co.uk www.btecrevision.org Biology Mad Course textbook and revision guide.
Developing Cultural Capital	Developing cognitive and problem-solving skills: use critical thinking, approach non-routine problems applying expert and creative solutions, use systems and technology. Strengthening	BTEC learners can also benefit from opportunities for deep learning where they are able to make connections among units and select areas of interest for detailed study. BTEC Nationals provide a vocational context in which learners can develop the knowledge and skills required for particular degree	All BTEC Nationals provide transferable knowledge and skills that prepare learners for progression to university. The transferable skills that universities value include: • the ability to learn independently

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	intrapersonal skills: communicating, working collaboratively, negotiating and influencing, self-presentation Improving interpersonal skills: self-management, adaptability and resilience, self-monitoring and development.	courses, including: • reading scientific and technical texts • effective writing • analytical skills • practical skills • preparation for assessment methods used in degrees.	• the ability to research actively and methodically • being able to give presentations and being active group members.
Wider-curricular opportunities	• Applied Science weekly clinic	• Applied Science weekly clinic	• Applied Science weekly clinic
Cross Curricular Links (Authentic Connections)	Mathematical calculations for both physics, biology and chemistry. Extended writing for assignments using scientific terminology.	Mathematical calculations for both physics, biology and chemistry. Extended writing for assignments using scientific terminology. Links to psychology where students also study the nervous system and disorders.	Mathematical calculations for both physics, biology and chemistry. Extended writing for assignments using scientific terminology. Links to psychology where students also study the nervous system and disorders.
Key Assessment	Unit 1 – Assessment across topics covered Unit 2 Assignments Cooling Curves Assignment Titration Assignment	Unit 1 Mock Exam Unit 2 Chromatography Assignment	Unit 1 External Exam Unit 2 How am I doing? Assignment
Year 13 L3 Applied Science	**Term 1**	**Term 2**	**Term 3**
Unit(s) – As outlined in 39 week plans	Unit 3 Learning Aims A-H	Unit 3 Exam Preparation covering all Unit 3 content Practical Exam and External Exam Unit 12 Learning Aim A, B, C and D	Unit 12 Learning Aims C and D
Key Retainable Knowledge & Skills	A1 Be able to formulate a hypothesis or a null hypothesis based on relevant scientific ideas. A2 Be able to select and justify the use of equipment/techniques/standard procedures for quantitative and/or qualitative investigations. A3 Understand risks and hazards associated with the investigation. A4 Identify Variables in the investigation A5 Be able to produce a clear, logically ordered method to obtain results. • Be able to select relevant measurements and the range of measurements to be recorded. • Understand the importance of obtaining data accurately/reliably and to appropriate levels of precision. • Understand how variables can be controlled/measured/monitored. • Understand how the data/information can be analysed. B1 Collection of quantitative/qualitative data • Be able to collect data accurately/reliably and to appropriate levels of precision. • Be able to tabulate data in a clear and logical format using correct headings with units where appropriate. • Be able to identify anomalous data and take appropriate action. • Be able to recognise when it is appropriate to take repeats.	Unit 12 Learning Aim A A.P1 Explain the characteristics of the five main types of pathogens and a disease caused by each. A.P2 Explain the causes of non-infectious diseases in humans. A.M1 Assess the effect of a named infectious and non-infectious disease on body systems. A.D1 Analyse how an infectious and a non-infectious disease will progress over time, and the effects this may have on affected individuals. Unit 12 Learning Aim B B.P3 Explain how infectious diseases can be transmitted. B.M2 Assess how infectious diseases can be prevented from spreading. B.D2 Evaluate the role of organisations in limiting the spread of infectious diseases. Unit 12 Learning Aim C C.P4 Describe the method available to treat a type of infectious disease. C.M3 Analyse different treatment methods to combat disease process. C.D3 Evaluate why treatments may not always be accessible, or appropriate, for particular individuals. Unit 12 Learning Aim D	Unit 12 Learning Aim C C.P4 Describe the method available to treat a type of infectious disease. C.M3 Analyse different treatment methods to combat disease process. C.D3 Evaluate why treatments may not always be accessible, or appropriate, for particular individuals. Unit 12 Learning Aim D D.P5 Explain the components of the specific and the non-specific defences, in protecting the body. D.M4 Compare the roles of the specific and non-specific defence mechanisms in the human body. D.D4 Evaluate the roles of the cell-mediated and humoral responses to pathogens.

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	• Be able to make qualitative observations and draw inferences. B2 Processing data • Be able to carry out relevant calculations where appropriate • Be able to display data in an appropriate format C1 Interpretation/analysis of data • Be able to identify trends/patterns in data. • Be able to compare primary and secondary data. • Be able to use data to draw conclusions that are valid and relevant to the purpose of the investigation. • Interpretation of statistical tests using tables of critical values and a 5% significance level, with reference to the null hypothesis. C2 Evaluation • Be able to make any recommendations for improvements to the investigation. • Be able to explain anomalous data. • Be able to determine quantitative and discuss qualitative sources of error. • Be able to discuss evidence of the reliability of the data collected during the investigation. • Be able to identify strengths and weaknesses within method/techniques/standard procedures/equipment used. • Be able to suggest improvements to an investigation. D1 Understand protein structure and peptide linkage and how this relates to enzymes in terms of active sites and denaturation. D2 Understand the role of enzymes as biological catalysts in chemical reactions D3 Know the factors that can affect enzyme activity E1 Know the factors affecting the rate of diffusion E2 Know the arrangement and movement of molecules in liquids and gases and that diffusion takes place along a concentration gradient until dynamic equilibrium is reached. F1 Know the factors that can affect plant growth and/or distribution F2 Sampling techniques • Understand the importance of random sampling in collecting reliable and valid data for analysis. • Select appropriate ecological sampling techniques to investigate the effect of abiotic factors on plant populations F3 Sampling sizes • Select sample sizes for investigation with regards to practical constraints and the need to collect sufficient data to make valid conclusions. G1 Be aware of a range of fuels including petrol, paraffin, food, cooking oil, methanol, ethanol, propan-1-ol, butan-1-ol, pentan-1-ol, wax temperature. G2 Know the hazards associated with fuels G3 Know the units of energy and be able to calculate heat energy released from a fuel in kJ mol- H1 Know the electrical symbols to design circuits H2 Be able to use the equations: Power = VI (voltage × current) and Power = work done Time and Work done = energy supplied or transformed. H3 Consider different domestic appliances to calculate energy usage and relate fuse size to power.	D.P5 Explain the components of the specific and the non-specific defences, in protecting the body. D.M4 Compare the roles of the specific and non-specific defence mechanisms in the human body. D.D4 Evaluate the roles of the cell-mediated and humoral responses to pathogens.	
Key Technical Vocabulary	Assess calculate compare complete criticise deduce derive describe determine devise discuss draw evaluate explain state identify plot predict sketch	Assess calculate compare complete criticise deduce derive describe determine devise discuss draw evaluate explain state identify plot predict sketch	Assess calculate compare complete criticise deduce derive describe determine devise discuss draw evaluate explain state identify plot predict sketch
Opportunities for Reading	www.chemguide.co.uk www.btecrevision.org Biology Mad Course textbook and revision guide.	https://www.nice.org.uk/guidance https://www.nhs.uk/ https://www.cdc.gov/	https://www.nice.org.uk/guidance https://www.nhs.uk/ https://www.cdc.gov/
Developing Cultural Capital	Advancement in science and technology has produced great benefits for society. This advancement depends on research and investigative approaches in science and technology. In research, development, analytical and industrial laboratories, laboratory technicians and scientists are employed to safely carry out practical investigations, or follow prescribed	The prevention and treatment of disease and infection is a key part of the work health professionals around the world. It is important to understand what disease is and the causes of diseases and infections that affect humans. While non-infectious diseases caused by dietary, environmental, genetic and degenerative factors will be briefly studied in this unit, the main focus will be on	The prevention and treatment of disease and infection is a key part of the work health professionals around the world. It is important to understand what disease is and the causes of diseases and infections that affect humans. While non-infectious diseases caused by dietary, environmental, genetic and degenerative factors will be briefly studied in this unit, the main focus will be on causes

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	laboratory procedures. They repeat measurements to obtain consistent, reliable results. They use investigative skills, including planning, recording and interpreting data, analysing and evaluating findings in order to test a hypothesis to inform further research and development.	causes of infectious diseases, and their transmission, prevention and treatment. There will be the opportunity to research the different types of pathogens and diseases they cause. Disease and infections can be caused by a wide range of pathogens and it is the knowledge of how these pathogens interact with the environment and the human body that forms the study of disease, which is also known as epidemiology.	of infectious diseases, and their transmission, prevention and treatment. There will be the opportunity to research the different types of pathogens and diseases they cause. Disease and infections can be caused by a wide range of pathogens and it is the knowledge of how these pathogens interact with the environment and the human body that forms the study of disease, which is also known as epidemiology.
Wider-curricular opportunities	• Applied Science weekly clinic	• Applied Science weekly clinic	• Applied Science weekly clinic
Cross Curricular Links (Authentic Connections)	Statistical calculations, mathematical calculations for working out concentrations and calorimetry.	Extended writing and research for Unit 12	Extended writing and research for Unit 12
Key Assessment	Unit 3 Mock Exam	Unit 3 External Exam Unit 12 Assignments Infectious and non-infectious diseases Transmission of Infectious diseases	Unit 12 Assignments Treatment of Infectious Diseases Body defences