Year 10 Combined Science Curriculum – 2025-2026						
	Autumn Term		**Spring Term**		**Summer Term**	
	1	**2**	**1**	**2**	**1**	**2**
Key Concepts	Cells and Control Bonding and types of substances	Genetics Radioactivity	Natural selection and genetic modification Calculations involving masses	Electrolytic processes Equilibria	Electricity and circuits Energy and Forces	Rates of reaction Electricity and circuits continued
Knowledge & Understanding (National Curriculum) *Skills are across the whole year.*	Items marked in **bold** indicate higher tier only content. In Biology students will:: Cells and Control: • Describe mitosis as part of the cell cycle, including the stages interphase, prophase, metaphase, anaphase and telophase and cytokinesis • Describe the importance of mitosis in growth, repair and asexual reproduction • Describe the division of a cell by mitosis as the production of two daughter cells, each with identical sets of chromosomes in the nucleus to the parent cell, and that this results in the formation of two genetically identical diploid body cells • Describe cancer as the result of changes in cells that lead to uncontrolled cell division • Describe growth in organisms, including: a) cell division and differentiation in animals b) cell division, elongation and differentiation in plants • Explain the importance of cell differentiation in the development of specialised cells • Demonstrate an understanding of the use of percentiles charts to monitor growth • Discuss the potential benefits and risks associated with the use of stem cells in medicine • Explain the structure and function of a reflex arc including sensory, relay and motor neurones In Genetics students will: • Explain the role of meiotic cell division, including the production of four daughter cells, each with half the number of chromosomes, and that this results in the formation of genetically different haploid gametes. The stages of meiosis are not required.					

	• Describe DNA as a polymer made up of: a two strands coiled to form a double helix b strands linked by a series of complementary base pairs joined together by weak hydrogen bonds c nucleotides that consist of a sugar and phosphate group with one of the four different bases attached to the sugar. • Describe the genome as the entire DNA of an organism and a gene as a section of a DNA molecule that codes for a specific protein • Explain how DNA can be extracted from fruit • Explain why there are differences in the inherited characteristics as a result of alleles • Explain the terms: chromosome, gene, allele, dominant, recessive, homozygous, heterozygous, genotype, phenotype, gamete and zygote • Explain monohybrid inheritance using genetic diagrams, Punnett squares and family pedigrees • Describe how the sex of offspring is determined at fertilisation, using genetic diagrams • Calculate and analyse outcomes (using probabilities, ratios and percentages) from monohybrid crosses and pedigree analysis for dominant and recessive traits • State that most phenotypic features are the result of multiple genes rather than single gene inheritance • Describe the causes of variation that influence phenotype, including: a genetic variation – different characteristics as a result of mutation and sexual reproduction b environmental variation – different characteristics caused by an organism's environment (acquired characteristics) • Discuss the outcomes of the Human Genome Project and its potential applications within medicine • State that there is usually extensive genetic variation within a population of a species and that these arise through mutations • State that most genetic mutations have no effect on the phenotype, some mutations have a small effect on the phenotype and, rarely, a single mutation will significantly affect the phenotype. In Natural Selection and genetic modification students will study: • Explain Charles Darwin's theory of evolution by natural selection • Explain how the emergence of resistant organisms supports Charles Darwin's theory of evolution including antibiotic resistance in bacteria • Describe the evidence for human evolution, based on fossils, including: a Ardi from 4.4 million years ago b Lucy from 3.2 million years ago c Richard Leakey's discovery of fossils from 1.6 million years ago • Describe the evidence for human evolution based on stone tools, including: a the development of stone tools over time b how these can be dated from their environment • Describe how genetic analysis has led to the suggestion of the three domains rather than the five kingdoms classification method • Explain selective breeding and its impact on food plants and domesticated animals • Describe genetic engineering as a process which involves modifying the genome of an organism to introduce desirable characteristics • **Describe the main stages of genetic engineering including the use of: a restriction enzymes b ligase c sticky ends d vectors**

	• Evaluate the benefits and risks of genetic engineering and selective breeding in modern agriculture and medicine, including practical and ethical implications. In Chemistry students will study: Bonding and types of substances • How ionic bonds are formed by the transfer of electrons between atoms to produce cations and anions, including the use of dot and cross diagrams. • That an ion is an atom or group of atoms with a positive or negative charge. • How to calculate the numbers of protons, neutrons and electrons in simple ions given the atomic number and mass number. • How to explain the formation of ions in ionic compounds from their atoms, limited to compounds of elements in groups 1, 2, 6 and 7. • The use of the endings –ide and –ate in the names of compounds. • The formulae of ionic compounds (including oxides, hydroxides, halides, nitrates, carbonates and sulfates) given the formulae of the constituent ions. • The structure of an ionic compound as a lattice structure consisting of a regular arrangement of ions held together by strong electrostatic forces (ionic bonds) between oppositely-charged ions. • How a covalent bond is formed when a pair of electrons is shared between two atoms. • That covalent bonding results in the formation of molecules. • The typical size (order of magnitude) of atoms and small molecules. • The formation of simple molecular, covalent substances, using dot and cross diagrams, including: Hydrogen, Hydrogen Chloride, Water, Methane, Oxygen and Carbon Dioxide. • Why elements and compounds can be classified as: Ionic, Simple molecular (covalent), Giant Covalent, Metallic and how the structure and bonding of these types of substances results in different physical properties, including relative melting point and boiling point, relative solubility in water and ability to conduct electricity (as solids and in solution). • The properties of ionic compounds are limited to: High melting and Boiling points, in terms of intermolecular forces and whether or not they conduct electricity as solids, when molten or in aqueous solutions. • The properties of typical covalent, simple molecular compounds limited to: Low melting and Boiling points, in terms of intermolecular forces and poor conduction of electricity. • That graphite and diamond are different forms of carbon and that they are examples of giant covalent substances. • The structures of graphite and diamond. • In terms of structure and bonding, why graphite is used to make electrodes and as a lubricant, whereas diamond is used in cutting tools. • The properties of fullerenes. • Using poly(ethene) as the example, simple polymers consist of large molecules containing chains of carbon atoms.

	• The properties of metals, including malleability and the ability to conduct electricity. • The limitations of particular representations and models, to include dot and cross, ball and stick models and two- and three-dimensional representations. • To describe most metals as shiny solids which have high melting points, high density and are good conductors of electricity whereas most non-metals have low boiling points and are poor conductors of electricity. Calculations involving masses • To calculate relative formula mass given relative atomic masses and percentage by mass of an element in a compound given relative atomic masses • How to calculate the formulae of simple compounds from reacting masses or percentage composition and understand that these are empirical formulae. • How to deduce the empirical formula of a compound from the formula of its molecule and the molecular formula of a compound from its empirical formula and its relative molecular mass. • An experiment to determine the empirical formula of a simple compound such as magnesium oxide. • How the law of conservation of mass applied to: a closed system including a precipitation reaction in a closed flask and a non-enclosed system including a reaction in an open flask that takes in or gives out a gas. • How to calculate masses of reactants and products from balanced equations, given the mass of one substance. • How to calculate the concentration of solutions in g dm^{-3} • **That one mole of particles of a substance is defined as the Avogadro constant number of particles (6.02×10^{23} atoms, molecules, formulae or ions) of that substance.** • **How to calculate the number of moles of particles of a substance in a given mass of that substance and vice versa, the number of particles of a substance in a given number of moles of that substance and vice versa and the number of particles of a substance in a given mass of that substance and vice versa.** • **Why, in a reaction, the mass of product formed is controlled by the mass of the reactant which is not in excess.** • **The stoichiometry of a reaction from the masses of the reactants and products.** Electrolytic processes • That electrolytes are ionic compounds in the molten state or dissolved in water. • Electrolysis as a process in which electrical energy, from a direct current supply, decomposes electrolytes. • The movement of ions during electrolysis, in which: positively charged cations migrate to the negatively charged cathode and negatively charged anions migrate to the positively charged anode.

	• The formation of the products in the electrolysis, using inert electrodes, of some electrolytes, including: copper chloride solution, sodium chloride solution, sodium sulfate solution, water acidified with sulfuric acid and molten lead bromide. • How to predict the products of electrolysis of other binary, ionic compounds in the molten state. • **Writing half equations for reactions occurring at the anode and cathode in electrolysis.** • **Oxidation and reduction in terms of loss or gain of electrons.** • **That reduction occurs at the cathode and that oxidation occurs at the anode in electrolysis reactions.** • The formation of the products in the electrolysis of copper sulfate solution, using copper electrodes, and how this electrolysis can be used to purify copper. • Investigating the electrolysis of copper sulfate solution with inert electrodes and copper electrodes. Equilibria • That chemical reactions are reversible, the use of the symbol ⇌ in equations and that the direction of some reversible reactions can be altered by changing the reaction conditions. • What is meant by dynamic equilibrium. • The formation of ammonia as a reversible reaction between nitrogen (extracted from the air) and hydrogen (obtained from natural gas) and that it can reach a dynamic equilibrium • The conditions of the Haber process. • **How to predict the rate of attainment of equilibrium is affected by changes in temperature, pressure, the use of catalysts and concentration.** Rates of Reaction • The effects of changing the conditions of a reaction on the rates of chemical reactions by: measuring the production of a gas (in the reaction between hydrochloric acid and marble chips) and observing a colour change (in the reaction between sodium thiosulfate and hydrochloric acid). • Practical methods for determining the rate of a given reaction. • How reactions occur when particles collide and that rates of reaction are increased when the frequency and/or energy of collisions is increased. • The effects on rates of reaction of changes in temperature, concentration, surface area to volume ratio of a solid and pressure (on reactions involving gases) in terms of frequency and/or energy of collisions between particles. • How to interpret graphs of mass, volume or concentration of reactant or product against time. • Catalysts as substances that speeds up the rate of a reaction without altering the products of the reaction, being itself unchanged chemically and in mass at the end of the reaction.

	• How the addition of a catalyst increases the rate of a reaction in terms of activation energy. • That enzymes are biological catalysts and that enzymes are used in the production of alcoholic drinks. In Physics students will: Radioactivity • Describe an atom as a positively charged nucleus, consisting of protons and neutrons, surrounded by negatively charged electrons, with the nuclear radius much smaller than that of the atom and with almost all of the mass in the nucleus • Recall the typical size (order of magnitude) of atoms and small molecules • Describe the structure of nuclei of isotopes using the terms atomic (proton) number and mass (nucleon) number • Recall that the nucleus of each element has a characteristic positive charge, but that isotopes of an element differ in mass by having different numbers of neutrons • Recall the relative masses and relative electric charges of protons, neutrons, electrons and positrons • Recall that in an atom the number of protons equals the number of electrons and is therefore neutral • Recall that in each atom its electrons orbit the nucleus at different set distances from the nucleus • Explain that electrons change orbit when there is absorption or emission of electromagnetic radiation • Explain how atoms may form positive ions by losing outer electrons • Recall that alpha, β– (beta minus), β+ (positron), gamma rays and neutron radiation are emitted from unstable nuclei in a random process • Recall that alpha, β– (beta minus), β+ (positron) and gamma rays are ionising radiations • Explain what is meant by background radiation • Describe the origins of background radiation from Earth and space • Describe methods for measuring and detecting radioactivity limited to photographic film and a Geiger–Müller tube • Recall that an alpha particle is equivalent to a helium nucleus, a beta particle is an electron emitted from the nucleus and a gamma ray is electromagnetic radiation • Compare alpha, beta and gamma radiations in terms of their abilities to penetrate and ionise • Describe how and why the atomic model has changed over time including reference to the plum pudding model and Rutherford alpha particle scattering leading to the Bohr model • Describe the process of β– decay (a neutron becomes a proton plus an electron) • Describe the process of β+ decay (a proton becomes a neutron plus a positron) • Explain the effects on the atomic (proton) number and mass (nucleon) number of radioactive decays (α, β, γ and neutron emission) • Recall that nuclei that have undergone radioactive decay often undergo nuclear rearrangement with a loss of energy as gamma radiation • Use given data to balance nuclear equations in terms of mass and charge • Describe how the activity of a radioactive source decreases over a period of time

	• Recall that the unit of activity of a radioactive isotope is the Becquerel, Bq • Explain that the half-life of a radioactive isotope is the time taken for half the undecayed nuclei to decay or the activity of a source to decay by half • Explain that it cannot be predicted when a particular nucleus will decay but half-life enables the activity of a very large number of nuclei to be predicted during the decay process • Use the concept of half-life to carry out simple calculations on the decay of a radioactive isotope, including graphical representations • Describe the dangers of ionising radiation in terms of tissue damage and possible mutations and relate this to the precautions needed • Explain the precautions taken to ensure the safety of people exposed to radiation, including limiting the dose for patients and the risks to medical personnel • Describe the differences between contamination and irradiation effects and compare the hazards associated with these two Electricity and Circuits • Describe the structure of the atom, limited to the position, mass and charge of protons, neutrons and electrons • Draw and use electric circuit diagrams representing them with the conventions of positive and negative terminals, and the symbols that represent cells, including batteries, switches, voltmeters, ammeters, resistors, variable resistors, lamps, motors, diodes, thermistors, LDRs and LEDs • Describe the differences between series and parallel circuits • Recall that a voltmeter is connected in parallel with a component to measure the potential difference (voltage), in volt, across it • Explain that potential difference (voltage) is the energy transferred per unit charge passed and hence that the volt is a joule per coulomb • Recall and use the equation: energy transferred (joule, J) = charge moved (coulomb, C) × potential difference (volt, V) • Recall that an ammeter is connected in series with a component to measure the current, in amp, in the component • Explain that an electric current as the rate of flow of charge and the current in metals is a flow of electrons • Recall and use the equation: charge (coulomb, C) = current (ampere, A) × time (second, s) • Describe that when a closed circuit includes a source of potential difference there will be a current in the circuit • Recall that current is conserved at a junction in a circuit • Explain how changing the resistance in a circuit changes the current and how this can be achieved using a variable resistor • Recall and use the equation: potential difference (volt, V) = current (ampere, A) × resistance (ohm, Ω) • Explain why, if two resistors are in series, the net resistance is increased, whereas with two in parallel the net resistance is decreased • Calculate the currents, potential differences and resistances in series circuits • Explain the design and construction of series circuits for testing and measuring • Carry out practical work to investigate the relationship between potential difference, current and resistance for a resistor and a filament lamp

	• Carry out practical work to test series and parallel circuits using resistors and filament lamps • Explain how current varies with potential difference for the following devices and how this relates to resistance a filament lamps b diodes c fixed resistors • Describe how the resistance of a light-dependent resistor (LDR) varies with light intensity • Describe how the resistance of a thermistor varies with change of temperature • Explain how the design and use of circuits can be used to explore the variation of resistance in the following devices a) filament lamps b) diodes c) thermistors d) LDRs • Recall that, when there is an electric current in a resistor, there is an energy transfer which heats the resistor • Explain that electrical energy is dissipated as thermal energy in the surroundings when an electrical current does work against electrical resistance • Explain the energy transfer as the result of collisions between electrons and the ions in the lattice • **Explain ways of reducing unwanted energy transfer through low resistance wires** • Describe the advantages and disadvantages of the heating effect of an electric current • Use the equation: energy transferred (joule, J) = current (ampere, A) × potential difference (volt, V) × time (second, s) • Describe power as the energy transferred per second and recall that it is measured in watt • Recall and use the equation: power (watt, W) = energy transferred (joule, J) ÷ time taken (second, s) • Explain how the power transfer in any circuit device is related to the potential difference across it and the current in it • Recall and use the equations: electrical power (watt, W) = current (ampere, A) x potential difference (volt, V) and electrical power (watt, W) = current squared (ampere^2, A$^{2)}$ x resistance (ohm, Ω) • Describe how, in different domestic devices, energy is transferred from batteries and the a.c. mains to the energy of motors and heating devices • Explain the difference between direct and alternating voltage • Describe direct current (d.c.) as movement of charge in one direction only and recall that cells and batteries supply direct current (d.c.) • Describe that in alternating current (a.c.) the movement of charge changes direction • Recall that in the UK the domestic supply is a.c., at a frequency of 50 Hz and a voltage of about 230 V • Explain the difference in function between the live and the neutral mains input wires • Explain the function of an earth wire and of fuses or circuit breakers in ensuring safety • Explain why switches and fuses should be connected in the live wire of a domestic circuit • Recall the potential differences between the live, neutral and earth mains wires • Explain the dangers of providing any connection between the live wire and earth • Describe, with examples, the relationship between the power ratings for domestic electrical appliances and the changes in stored energy when they are in use.

	Energy and Forces • Describe the changes involved in the way energy is stored when systems change. • Draw and interpret diagrams to represent energy transfers. • Explain that where there are energy transfers in a closed system there is no net change to the total energy in that system. • Identify the different ways that the energy of a system can be changed through work done by forces, in electrical equipment and in heating. • Describe how to measure the work done by a force and understand that energy transferred (joule, J) is equal to work done (joule, J). • Recall the equation: work done (joule, J) = force (newton, N) × distance moved in the direction of the force (metre, m) • Describe and calculate the changes in energy involved when a system is changed by work done by forces. • Recall and use the equation to calculate the change in gravitational PE when an object is raised above the ground: change in gravitational potential energy (joule, J) = mass (kilogram, kg) × gravitational field strength (newton per kilogram, N/kg) × change in vertical height (metre, m). • Recall and use the equation to calculate the amounts of energy associated with a moving object: kinetic energy (joule, J) = 0.5 × mass (kilogram, kg) × (speed)^2 • Explain, using examples, how in all system changes energy is dissipated so that it is stored in less useful ways. • Explain that mechanical processes become wasteful when they cause a rise in temperature so dissipating energy in heating the surroundings. • Define power as the rate at which energy is transferred and use examples to explain this definition. • Recall and use the equation: power (watt, W) = work done (joule, J) ÷ time taken (second, s) • Recall that one watt is equal to one joule per second, J/s. • Recall and use the equation for efficiency. **Use of mathematics:** Use estimations and explain when they should be used Use percentiles and calculate percentage gain and loss of mass Translate information between numerical and graphical forms Use a scatter diagram to identify a correlation between two variables Extract and interpret information from graphs, charts and tables Extract and interpret data from graphs, charts, and tables Understand and use percentiles Use fractions and percentages Understand and use direct proportions and simple ratios in genetic crosses

	Understand and use the concept of probability in predicting the outcome of genetic crosses Calculate arithmetic means Construct and interpret frequency tables and diagrams, bar charts and histograms Plot and draw appropriate graphs, selecting appropriate scales for axes Calculate surface area: volume ratios Understand the principles of sampling as applied to scientific data Calculate percentage of mass Calculate the rate changes in the decay of biological material Make calculations using ratios and proportional reasoning to convert units and to compute rates Arithmetic computation and ratio when determining empirical formulae, balancing equations Arithmetic computation, ratio, percentage and multi step calculations permeates quantitative chemistry Calculations with numbers written in standard form when using the Avogadro constant Change the subject of a mathematical equation Provide answers to an appropriate number of significant figures Convert units where appropriate particularly from mass to moles Arithmetic computation when calculating yields and atom economy Convert units where appropriate particularly from mass to moles Drawing and interpreting appropriate graphs from data to determine rate of reaction Determining gradients of graphs as a measure of rate of change to determine rate Proportionality when comparing factors affecting rate of reaction Balance equations representing alpha, beta or gamma radiations in terms of the masses and charges of the atoms involved Apply the equations relating p.d., current, quantity of charge, resistance, power, energy, and time, and solve problems for circuits which include resistors in series, using the concept of equivalent resistance Use graphs to explore whether circuit elements are linear or non-linear and relate the curves produced to their function and properties Make calculations of the energy changes associated with changes in a system, recalling or selecting the relevant equations for mechanical, electrical, and thermal processes; thereby express in quantitative form and on a common scale the overall redistribution of energy in the system Apply equations linking the p.d.s and number of turns in the two coils of a transformer, to the currents and the power transfer involved, and relate these to the advantages of power transmission at high voltages

Skills	**R** *Develop* **RESILIENCE**	★ *Always striving to improve answers by including key vocabulary and backing up thoughts with scientific explanations.* ★ *Working through challenging situations , reflecting as to why a practical might not produce the expected results and adapting their technique to collect accurate results.*
	A *Possess* **AMBITION**	★ *Seeking to answer scientific questions through analysis of experimental results.* ★ *Devising models and analogies for tricky and abstract scientific concepts.* ★ *Write effectively and coherently using Standard English appropriately.* ★ *Using assessment to make progress – designated improvement and reflection time (Green for Growth) is built in following class assessments, summative assessments and any other teacher marked work.*
	I *Demonstrate* **INTEGRITY**	★ *Completing practical work sensibly baring in mind the safety of themselves and others.* ★ *Taking responsibility for their studies and individual revision* ★ *Using problem solving skills to work through scientific models.*

	S *Embed* **Self-Discovery**	★ *Sharing their own ideas of scientific questions during class discussions.* ★ *Asking scientific questions, carrying out investigations to find out the answers to scientific questions.* ★ *Students must reflect upon real world advancements and consequences of science such as genetic modification and catalytic convertors.*
	E *Display* **EMPATHY**	★ *Respecting the laboratory and others during practical experiments by helping to get equipment for others, compare experimental techniques and keeping the laboratory tidy.* ★ *Showing respect for the class teacher and other students by listening to and contributing to class discussions.* ★ *Respecting other people's opinions and ideas.*

Curriculum Links	KS3 Links- The cells and control topic relates to the cells topic and the body systems topics that were taught in year 7 A level links - In biology, the cells and control topic links to A-level biology 3.2. In chemistry the bonding and types of substance	KS3 Links- The Genetics topic relates to the adaptations and inheritance topic taught in year 8. A level links - In physics the radioactivity topic links to A-level physics topic 3.2, 3.8 and 3.10.	KS3 Links- The natural selection topic relates to the adaptations and inheritance topic taught in year 8 A level links - In chemistry the calculations involved in masses topic links to A-level chemistry 3.1.2.	A level links - In chemistry, dynamic equilibria and electrolysis topics link to A-level chemistry 3.1.6, 3.1.11.	KS3 Links- The electricity and circuits topic relates to the electricity topic delivered in year 8. A level links - In physics, electricity and static electricity links to A-level physics topic 3.5.	KS3 Links- The energy and forces topic relates to the forces topic taught in year 7 and the energy topic taught in year 8. The rates of reaction topic relates to the chemical reactions topic taught in year 7. A level links -

	topic links to A-level chemistry 3.1.3 Bonding.	genetics topic links to A-level biology 3.4 Genetic information, variation and relationships between organisms and 3.8	In biology, the Natural selection and Genetic Modification topic links to A-level biology 3.4 and 3.7.			In chemistry, rates of reaction links to 3.1.5 and 3.1.9 of the A-level specification.
Assessment	Students will experience the following assessments: Curriculum Checkpoint 1	Students will experience the following assessments: AP1 Assessment Curriculum Checkpoint 2	Students will experience the following assessments: Curriculum Checkpoint 3	Students will experience the following assessments: Curriculum Checkpoint 4 AP2 Assessment	Students will experience the following assessments: Curriculum Checkpoint 5	Students will experience the following assessments: Curriculum Checkpoint 6
Aspirations & Careers	Every year the Science Faculty at Boldon School hosts a STEM careers fair for all year 10 students during or near to British Science week. During this, students have the opportunity to meet representatives from a wide range of STEM careers and ask any questions they may have about that career path. It is an excellent opportunity to broaden the horizons of students at Boldon School. External workshops continue to be delivered, workshops from Kromek are delivered to support students with the radioactivity topic they will study.					