Year 10 Separate 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 Radioactivity	Genetics Calculations involving masses Astronomy	Natural selection and genetic modification Electrolytic processes Dynamic Equilibria Separates chemistry 1 Electricity and static electricity	Continue with topics started in Spring 1	Ecosystems Rates of reaction Magnetism and induction	Continue with topics started in Summer 1 Energy Changes

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 ● Describe the function of embryonic stem cells, stem cells in animals and meristems in plants ● Discuss the potential benefits and risks associated with the use of stem cells in medicine ● Describe the structures and functions of the brain including the cerebellum, cerebral hemispheres and medulla oblongata ● **Explain how the difficulties of accessing brain tissue inside the skull can be overcome by using CT scanning and PET scanning to investigate brain function** ● **Explain some of the limitations in treating damage and disease in the brain and other parts of the nervous system, including spinal injuries and brain tumours** ● Explain the structure and function of sensory receptors, sensory neurones, relay neurones in the CNS, motor neurones and synapse in the transmission of electrical impulses, including the axon, dendron, myelin sheath and the role of neurotransmitters ● Explain the structure and function of a reflex arc including sensory, relay and motor neurones ● Explain the structure and function of the eye as a sensory receptor including the role of a) the cornea and lens b) the iris c) road and cone cells in the retina ● Describe defects of the eye including cataracts, long-sightedness, short-sightedness and colour blindness ● Explain how cataracts, long-sightedness and short-sightedness can be corrected In Genetics students will: ● Explain some of the advantages and disadvantages of asexual reproduction, including the lack of need to find a mate, a rapid reproductive cycle, but no variation in the population. ● Explain some of the advantages and disadvantages of sexual reproduction, including variation in the population, but the require,emt tp fomd a mate.

	• 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. • 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 how the order of bases in a section of DNA decides the order of amino acids in the protein and that these fold to produce specifically shaped proteins such as enzymes.** • **Describe the stages of protein synthesis, including transcription and translation: a RNA polymerase binds to non-coding DNA located in front of a gene b RNA polymerase produces a complementary mRNA strand from the coding DNA of the gene c the attachment of the mRNA to the ribosome d the coding by triplets of bases (codons) in the mRNA for specific amino acids e the transfer of amino acids to the ribosome by tRNA f the linking of amino acids to form polypeptides** • **Describe how genetic variants in the non-coding DNA of a gene can affect phenotype by influencing the binding of RNA polymerase and altering the quantity of protein produced** • **Describe how genetic variants in the coding DNA of a gene can affect phenotype by altering the sequence of amino acids and therefore the activity of the protein produced** • Describe the work of Gregor Mendel in discovering the basis of genetics and recognise the difficulties of understanding inheritance before the mechanism was discovered. • 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 • Describe the inheritance of the ABO blood groups with reference to codominance and multiple alleles • **Explain how sex-linked genetic disorders are inherited** • 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: • Describe the work of Charles Darwin and Alfred Wallace in the development of the theory of evolution by natural selection and explain the impact of these ideas on modern biology • 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 the anatomy of the pentadactyl limb provides scientists with evidence for evolution • 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 the process of tissue culture and its advantages in medical research and plant breeding programmes • 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** • Explain the advantages and disadvantages of genetic engineering to produce GM organisms including the modification of crop plants, including the introduction of genes for insect resistance from *Bacillus thuringiensis* into crop plants • Evaluate the benefits and risks of genetic engineering and selective breeding in modern agriculture and medicine, including practical and ethical implications. In Ecosystems students will: • Describe the different levels of organisation from individual organisms, populations, communities, to the whole ecosystem • Explain how communities can be affected by abiotic and biotic factors, including: a temperature, light, water, pollutants b competition, predation • Describe the importance of interdependence in a community • Describe how the survival of some organisms is dependent on other species, including parasitism and mutualism • Core Practical: Investigate the relationship between organisms and their environment using field-work techniques, including quadrats and belt transects

- Explain how to determine the number of organisms in a given area using raw data from field-work techniques, including quadrats and belt transects
- Explain how some energy is transferred to less useful forms at each trophic level and that this affects the number of organisms at each trophic level, limits the length of a food chain and determines the shape of a pyramid of biomass in an ecosystem
- Calculate the efficiency of energy transfers between trophic levels and percentage calculations of biomass
- Explain the positive and negative human interactions within ecosystems and their impacts on biodiversity, including: a) fish farming b) introduction of non-indigenous species c) eutrophication
- Explain the benefits of maintaining local and global biodiversity, including the conservation of animal species and the impact of reforestation
- Describe the biological factors affecting levels of food security, including: a increasing human population b increasing animal farming and the increased meat and fish consumption c the impact of new pests and pathogens d environmental change caused by human activity e sustainability issues, e.g. use of land for biofuel production and the cost of agricultural inputs
- Describe how different materials cycle through the abiotic and biotic components of an ecosystem
- Explain the importance of the carbon cycle, including the processes involved and the role of microorganisms as decomposers
- Explain the importance of the water cycle, including the processes involved and the production of potable water in areas of drought including desalination
- Explain how nitrates are made available for plant uptake, including the use of fertilisers, crop rotation and the role of bacteria in the nitrogen cycle
- **Evaluate the use of indicator species as evidence to assess the level of pollution, including: a) polluted water – bloodworm, sludgeworm b) clean water – freshwater shrimps, stonefly c) air quality – different species of lichen, blackspot fungus on roses**
- Explain the effects of temperature, water content and oxygen availability on the rate of decomposition in food preservation
- Explain the effects of temperature, water content and oxygen availability on the rate of decomposition in composting
- Calculate rate changes in the decay of biological material

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. Dynamic 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 how the position of a dynamic equilibrium is affected by changes in temperature, pressure and concentration. • **How to predict the rate of attainment of equilibrium is affected by changes in temperature, pressure, the use of catalysts and concentration.** • **How, in industrial reactions, including the Haber process, conditions used are related to: the availability and cost of raw materials and energy supplies and the control of temperature, pressure and catalyst used produce an acceptable yield in an acceptable time.** • That fertilisers may contain nitrogen, phosphorus and potassium compounds to promote plant growth. • How ammonia reacts with nitric acid to produce a salt that is used as a fertiliser. • How to describe and compare the laboratory preparation of ammonium sulfate from ammonia solution and dilute sulfuric acid on a small scale with the industrial production of ammonium sulfate, used as a fertiliser, in which several stages are required to produce ammonia and sulfuric acid from their raw materials and the production is carried out on a much larger scale (details of the industrial production of sulfuric acid are not required). Separates chemistry 1 • That most metals are transition metals and that their typical properties include: high melting point, high density, the formation of coloured compounds and catalytic activity. • That the oxidation of metals results in corrosion. • How rusting of iron can be prevented. • How electroplating can be used to improve the appearance and/or the resistance to corrosion of metal objects. • Why Iron is alloyed. • Using models, why converting pure metals into alloys often increases the strength of the product. • How the uses of metals are related to their properties (and vice versa), including aluminium, copper and gold and their alloys including magnalium and brass. • **How to calculate the concentration of solutions in mol dm–3 and convert concentration in g dm–3 into mol dm–3 and vice versa.** • How to carry out a acid-alkali titration.

	• **How to carry out simple calculations using the results of titrations to calculate an unknown concentration of a solution or an unknown volume of solution required.** • How to calculate the percentage yield of a reaction from the actual yield and the theoretical yield. • That the actual yield of a reaction is usually less than the theoretical yield and that the causes of this include: incomplete reactions, practical losses and side reactions. • The atom economy of a reaction forming a desired product. • **Why a particular reaction pathway is chosen to produce a specified product, given appropriate data such as atom economy, yield, rate, equilibrium position and usefulness of by-products.** • **The molar volume, of any gas at room temperature and pressure, as the volume occupied by one mole of molecules of any gas at room temperature and pressure.** • **The molar volume and balanced equations in calculations involving the masses of solids and volumes of gases.** • **How to use Avogadro's law to calculate volumes of gases involved in a gaseous reaction, given the relevant equation.** • That a chemical cell produces a voltage until one of the reactants is used up. • That in a hydrogen–oxygen fuel cell hydrogen and oxygen are used to produce a voltage and water is the only product. • The strengths and weaknesses of fuel cells for given uses. 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. Energy Changes

- That changes in heat energy accompany the following changes: salts dissolving in water, neutralisation reactions, displacement reactions, precipitation reactions and that, when these reactions take place in solution, temperature changes can be measured to reflect the heat changes.
- That an exothermic change or reaction as one in which heat energy is given out and an endothermic change or reaction as one in which heat energy is taken in.
- That the breaking of bonds is endothermic and the making of bonds is exothermic.
- That the overall heat energy change for a reaction is: exothermic if more heat energy is released in forming bonds in the products than is required in breaking bonds in the reactants and endothermic if less heat energy is released in forming bonds in the products than is required in breaking bonds in the reactants.
- **How to calculate the energy change in a reaction given the energies of bonds (in kJ mol^{-1}).**
- The term activation energy.
- How to draw and label reaction profiles for endothermic and exothermic reactions, identifying activation energy.

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 $\beta-$ decay (a neutron becomes a proton plus an electron) • Describe the process of $\beta+$ 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 uses of radioactivity, including: a) household fire (smoke) alarms b) irradiating food c) sterilisation of equipment d) tracing and gauging thicknesses e) diagnosis and treatment of cancer • Describe the dangers of ionising radiation in terms of tissue damage and possible mutations and relate this to the precautions needed • Explain how the dangers of ionising radiation depend on halflife 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 • Compare and contrast the treatment of tumours using radiation applied internally or externally • Explain some of the uses of radioactive substances in diagnosis of medical conditions, including PET scanners and tracers • Explain why isotopes used in PET scanners have to be produced nearby • Evaluate the advantages and disadvantages of nuclear power for generating electricity, including the lack of carbon dioxide emissions, risks, public perception, waste disposal and safety issues • Recall that nuclear reactions, including fission, fusion and radioactive decay, can be a source of energy

	• Explain how the fission of U-235 produces two daughter nuclei and the emission of two or more neutrons, accompanied by a release of energy • Explain the principle of a controlled nuclear chain reaction • Explain how the chain reaction is controlled in a nuclear reactor, including the action of moderators and control rods • Describe how thermal (heat) energy from the chain reaction is used in the generation of electricity in a nuclear power station • Recall that the products of nuclear fission are radioactive • Describe nuclear fusion as the creation of larger nuclei resulting in a loss of mass from smaller nuclei, accompanied by a release of energy, and recognise fusion as the energy, and recognise fusion as the energy source for stars • Explain the difference between nuclear fusion and nuclear fission • Explain why nuclear fusion does not happen at low temperatures and pressures, due to electrostatic repulsion of protons • Relate the conditions for fusion to the difficulty of making a practical and economic form of power station • **Calculate the net decline, expressed as a ratio, in a radioactive emission after a given number of half-lives** Astronomy • Explain how and why both the weight of any body and the value of g differ between the surface of the Earth and the surface of other bodies in space, including the Moon • Recall that our Solar System consists of the Sun (our star), eight planets and their natural satellites (such as our Moon); dwarf planets; asteroids and comets • Recall the names and order, in terms of distance from the Sun, of the eight planets • Describe how ideas about the structure of the Solar System have changed over time • Describe the orbits of moons, planets, comets and artificial satellites • Explain for circular orbits how the force of gravity can lead to changing velocity of a planet but unchanged speed • Explain how, for a stable orbit, the radius must change if orbital speed changes (qualitative only) • Compare the Steady State and Big Bang theories • Describe evidence supporting the Big Bang theory, limited to red-shift and the cosmic microwave background (CMB) radiation • Recall that as there is more evidence supporting the Big Bang theory than the Steady State theory, it is the currently accepted model for the origin of the Universe • Describe that if a wave source is moving relative to an observer there will be a change in the observed frequency and wavelength • Describe the red-shift in light received from galaxies at different distances away from the Earth • Explain why the red-shift of galaxies provides evidence for the Universe expanding • Explain how both the Big Bang and Steady State theories of the origin of the Universe both account for red-shift of galaxies • Explain how the discovery of the CMB radiation led to the Big Bang theory becoming the currently accepted model

	• Describe the evolution of stars of similar mass to the Sun through the following stages: a) nebula b) star (main sequence) c) red giant d) white dwarf • Explain how the balance between thermal expansion and gravity affects the life cycle of stars • Describe the evolution of stars with a mass larger than the Sun • Describe how methods of observing the Universe have changed over time including why some telescopes are located outside the Earth's atmosphere Electricity and Static Electricity • 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

Magnetism and Induction

- Explain how an insulator can be charged by friction, through the transfer of electrons
- Explain how the material gaining electrons becomes negatively charged and the material losing electrons is left with an equal positive charge

Boldon School
INNOVATE: FOCUS: ACHIEVE

ClassCharts

RAISE

	• Recall that like charges repel and unlike charges attract • Explain common electrostatic phenomena in terms of movement of electrons, including a shocks from everyday objects b lightning c attraction by induction such as a charged balloon attracted to a wall and a charged comb picking up small pieces of paper • Explain how earthing removes excess charge by movement of electrons • Explain some of the uses of electrostatic charges in everyday situations, including insecticide sprayers • Describe some of the dangers of sparking in everyday situations, including fuelling cars, and explain the use of earthing to prevent dangerous build-up of charge • Define an electric field as the region where an electric charge experiences a force • Describe the shape and direction of the electric field around a point charge and between parallel plates and relate the strength of the field to the concentration of lines • Explain how the concept of an electric field helps to explain the phenomena of static electricity • Recall that unlike magnetic poles attract and like magnetic poles repel • Describe the uses of permanent and temporary magnetic materials including cobalt, steel, iron and nickel • Explain the difference between permanent and induced magnets • Describe the shape and direction of the magnetic field around bar magnets and for a uniform field, and relate the strength of the field to the concentration of lines • Describe the use of plotting compasses to show the shape and direction of the field of a magnet and the Earth's magnetic field • Explain how the behaviour of a magnetic compass is related to evidence that the core of the Earth must be magnetic • Describe how to show that a current can create a magnetic effect around a long straight conductor, describing the shape of the magnetic field produced and relating the direction of the magnetic field to the direction of the current • Recall that the strength of the field depends on the size of the current and the distance from the long straight conductor • Explain how inside a solenoid (an example of an electromagnet) the fields from individual coils a) add together to form a very strong almost uniform field along the centre of the solenoid b) cancel to give a weaker field outside the solenoid • **Recall that a current carrying conductor placed near a magnet experiences a force and that an equal and opposite force acts on the magnet** • **Explain that magnetic forces are due to interactions between magnetic fields** • **Recall and use Fleming's left-hand rule to represent the relative directions of the force, the current and the magnetic field for cases where they are mutually perpendicular** • **Use the equation: force on a conductor at right angles to a magnetic field carrying a current (newton, N) = magnetic flux density (tesla, T or newton per ampere metre, N/A m) × current (ampere, A) × length (metre, m) $F = B \times I \times L$** • **Explain how the force on a conductor in a magnetic field is used to cause rotation in electric motors**

	• **Explain how to produce an electric current by the relative movement of a magnet and a conductor a) on a small scale in the laboratory b) in the large-scale generation of electrical energy** • **Recall the factors that affect the size and direction of an induced potential difference, and describe how the magnetic field produced opposes the original change** • **Explain how electromagnetic induction is used in alternators to generate current which alternates in direction (a.c.) and in dynamos to generate direct current (d.c.)** • **Explain the action of the microphone in converting the pressure variations in sound waves into variations in current in electrical circuits, and the reverse effect as used in loudspeakers and headphones** • **Explain how an alternating current in one circuit can induce a current in another circuit in a transformer** • **Recall that a transformer can change the size of an alternating voltage** • **Use the turns ratio equation for transformers to calculate either the missing voltage or the missing number of turns** • Explain why, in the national grid, electrical energy is transferred at high voltages from power stations, and then transferred at lower voltages in each locality for domestic uses as it improves the efficiency by reducing heat loss in transmission lines • Explain where and why step-up and step-down transformers are used in the transmission of electricity in the national grid • Use the power equation (for transformers with100% efficiency): potential difference across primary coil (volt, V) × current in primary coil (ampere, A) = potential difference across secondary coil (volt, V) × current in secondary coil (ampere, A) • **Explain the advantages of power transmission in high-voltage cables, using the equations** **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

Boldon School
INNOVATE: FOCUS: ACHIEVE
ClassCharts
RAISE

	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. The astronomy topic relates to the space topic delivered in year 7. A level links -	KS3 Links- The natural selection topic relates to the adaptations and inheritance topic taught in year 8 The electricity and circuits topic relates to the electricity topic delivered in year 8. A level links -	A level links - In biology, the Natural selection and Genetic Modification topic links to A-level biology 3.4 and 3.7. In chemistry, dynamic equilibria and electrolysis topics link to A-level chemistry 3.1.6, 3.1.11. In physics, electricity and static electricity	KS3 Links- The ecosystems topic relates to the ecosystem processes topic taught in year 8. The rates of reaction topic relates to the chemical reactions topic taught in year 7. The magnetism and induction topic relates to the magnetism topic taught in year 8.	A level links - In biology, ecosystems links to A-level biology 3.5 and 3.7. In chemistry, energy changes in chemical reactions links to 3.1.4 Energetics of the A-level specification. In physics, magnetism and induction links to A-level physics 3.2.

	topic links to A-level chemistry 3.1.3 Bonding. In physics the radioactivity topic links to A-level physics topic 3.2, 3.8 and 3.10.	In biology, the genetics topic links to A-level biology 3.4 Genetic information, variation and relationships between organisms and 3.8 In chemistry the calculations involved in masses topic links to A-level chemistry 3.1.2. In physics, the astronomy topic links to A-level physics topic 3.9.	In biology, the Natural selection and Genetic Modification topic links to A-level biology 3.4 and 3.7. In chemistry, dynamic equilibria and electrolysis topics link to A-level chemistry 3.1.6, 3.1.11. In physics, electricity and static electricity links to A-level physics topic 3.5.	links to A-level physics topic 3.5.	A level links - In biology, ecosystems link to A-level biology 3.5 and 3.7. In chemistry, rates of reaction links to 3.1.5 and 3.1.9 of the A-level specification. In physics, magnetism and induction links to A-level physics 3.2.	
Assessment	Per each subject students will experience the following assessments: Curriculum Checkpoint 1	Per each subject students will experience the following assessments: Curriculum Checkpoint 2.	Per each subject students will experience the following assessments: Curriculum Checkpoint 3	Per each subject students will experience the following assessments: Curriculum Checkpoint 4 AP2 assessment	Per each subject students will experience the following assessments: Curriculum Checkpoint 5	Per each subject students will experience the following assessments: Curriculum Checkpoint 6.

		AP1 assessment				
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.					