SCIENCE

Year 10

What are the aims and intentions of this curriculum?

The aim of our Key Stage 4 Curriculum is to ensure that the topics taught at KS3 are covered in progressively greater depth over the course of this key stage. GCSE study in Separate and Combined Sciences provide the foundations for understanding the material world. Scientific understanding is changing our lives and is vital to the world's future prosperity, that all students should be taught essential aspects of the knowledge, methods, processes and uses of science. They should be helped to appreciate how the complex and diverse phenomena of the natural world can be described in terms of a small number of key ideas relating to the sciences which are both inter-linked, and are of universal application.

Students will be able to:

- Develop skills, independent learning, curiosity, taking risks and learning new things.
- Explore the link between science and the relevance to everyday life.

Content covered by Separate Science Only is bolded

Highlighted in green are links to PSHE in the curriculum

Highlighted in blue are links to Careers in the curriculum

Term	Topics	Knowledge and key terms	Skills developed	Assessment
Autumn 1	Chemistry Atoms, Bonding and Moles • Atomic structure • The periodic Table • Structure and bonding • Chemical Calculations	Students will learn about: Atom, atomic nucleus, atomic number, chromatography, compound, crystallisation, displacement, electron, electron shell, compound, displacement, electron, electron shell, element, filtration, fractional distillation, group, halogens, ion, isotope, mass number, metals, mixture, neutron, noble gases, non-metals, nuclear model, periodic table, plum pudding model, proton relative atomic mass, simple distillation, **transition metals** **Coarse particles,** conductor, covalent bond, diamond, electrostatic forces, empirical formula, **fine particles,** Fullerenes, gas, graphene, graphite, ion, ionic bond, ionic compound, intermolecular forces, lattice, liquid, metallic bond, metals, molecular formula, **nanoparticles, nanoscience,** non-metals, particle theory, polymers, repeat unit, solid, state symbols **Actual yield, atom economy,** Avogadro constant, **Avogadro's law,** concentration, conservation of mass, limiting reactant, mole**, percentage by mass, percentage**	Students are able to: • Describe the atom as a positively charged nucleus surrounded by negatively charged electrons, with the nuclear radius much smaller than that of the atom and with most of the mass in the nucleus • Explain how the position of an element in the Periodic Table is related to the arrangement of electrons in its atoms and hence to its atomic number. • **Recall the properties of transition elements and compare them with the alkali metals.** • Recall and explain the main features of the particle model in terms of the states of matter and change of state, distinguishing between physical and chemical changes. • Describe and compare the nature and arrangement of chemical bonds in ionic compounds, simple molecules, giant covalent structures, polymers and metals. • **Describe how the properties of nanoparticulate materials are related to their uses.** • Explain how the mass of a given substance is related to the amount of that substance in moles and vice versa. • Use a balanced equation to calculate masses of reactants or products.	Formative: • Practical activities • Debates • Presentations • Self/ peer assessments • Problem solving activities Summative: • SMART TEST • Required Practical to be written up after each investigation

		yield, relative formula mass, **theoretical yield,** thermal decomposition, uncertainty. **Key links to other units:** Revisit the units on Elements, The Periodic Table and Types of Reaction in Year 9.	• **Calculate the percentage yield of a chemical reaction.** • **Calculate the atom economy of a reaction to form a desired product from the balanced equation.** • **Describe the relationship between molar amounts of gases and their volumes, and calculate the volumes of gases involved in reactions, using the molar gas volume at room temperature and pressure (24dm^3)** • **Explain the relationship between the volume of a solution of known concentration of a substance and the volume or concentration of another substance that react completely together.** **Working Scientifically** • Separate mixtures using physical processes. • Use experimental data to determine if a compound is ionic, simple covalent or giant covalent. • Required practical: Determine the reacting volumes of solutions of strong acid and strong alkali by titration. **Enrichment opportunities** • Career link https://edu.rsc.org/future-in-chemistry/not-a-student/teachers-and-careers-advisers/linking-curriculum-to-careers	
Autumn 2	**Physics** Energy and Energy Resources • Conservation and dissipation of energy • Energy transfer by heating • Energy resources Particles at Work • Electric circuits • Electricity in the home • Molecules and matter	**Students will learn about:** Closed system, conservation of energy, efficiency, elastic potential energy, fossil fuel, gravitational potential energy, kinetic energy, power, renewable energy resource, specific heat capacity, spring constant, system, thermal conductivity, waste energy, Watt, work done Alternating potential difference, amperes, attraction, coulomb, diode, direct potential difference, earth wire, **electric field lines,** electrical current, electrical work filament lamp, insulation **Light Dependent Resistor (LDR**), live wire, mains electricity, neutral wire, non-contact force, ohmic conductor, Ohms, parallel, potential difference, repulsion, resistance, resistors, series, **static charge**, step-down transformer, step-up transformer, the national grid, thermistor, volt	**Students are able to:** • Calculate the amounts of energy associated with a moving body, a stretched spring, and an object raised above ground level. • Describe and calculate the changes in energy involved when a system is changed by heating (in terms of temperature change and specific heat capacity), by work done by forces and by work done when a current flows. • Calculate energy efficiency for any energy transfer. • Describe the main energy sources available for use on Earth, compare the ways in which they are used and distinguish between renewable and non-renewable sources. • Describe the difference between series and parallel circuits. • Calculate the currents, potential differences and resistances in circuits. • Explain the difference between direct and alternating voltage.	**Formative:** • Practical activities • Debates • Presentations • Self/ peer assessments • Problem solving activities **Summative:** • SMART TEST • Required Practical to be written up after each investigation

		Chemical changes, condensation, evaporation, density, freezing, gas temperature, internal energy, latent heat, melting, Pascal, physical changes, pressure, specific heat capacity, specific latent heat, sublimation **Key links to other units:** Revisit the units on Work and Heating and Cooling in Year 9.	• Explain how the power transfer in any circuit device is related to the p.d. across it and the current, and to the energy changes over a given time. • Recall that, in the national grid, electrical power is transferred at high voltages from power stations, and then transferred at lower voltages in each locality for domestic use. • **Describe the production of static electricity.** • Define density and explain the differences in density between the different states of matter in terms of the arrangements of the atoms or molecules. • Describe how heating a system will change the energy stored within the system and raise its temperature or produce changes of state • **Explain how increasing the volume in which a gas is contained, at constant temperature can lead to a decrease in pressure** **Working Scientifically** • Required practical: Investigate the specific heat capacity of one or more materials. • Required practical: Investigate the effectiveness of different materials as thermal insulators. • Draw circuit diagrams and build electrical circuits in parallel and series using different components. • Required practical: Investigate the factors that affect the resistance of an electrical circuit. • Required practical: Determine the densities of regular and irregular solid objects and liquid. **Enrichment Opportunities** • Black History Month- *Celebrate persons in STEM* • Career link https://careerpilot.org.uk/job-sectors/subject/physics#link-1	
Spring 1	**Biology** Disease and Bioenergetics • Communicable diseases • Preventing and treating diseases • Non-communicable diseases • Photosynthesis • Respiration	**Students will learn about:** Antibiotics, clinical drug testing, communicable disease, double blind trial, gonorrhoea, human Immunodeficiency Virus (HIV), malaria, measles, **monoclonal antibodies,** non-communicable disease, non-specific defence, pathogens, placebo, rose black spot, Salmonella, side effects, Tobacco Mosaic Virus (TMV), vaccination, white blood cell, aerobic respiration, anaerobic respiration,	**Students are able to:** • Describe the relationship between health and disease. • Explain how communicable diseases are spread in animals and plants • **Describe how monoclonal antibodies are produced** • Explain the use of vaccines and medicines in the prevention and treatment of disease. • Explain the effect of lifestyle factors, including exercise, diet, alcohol and smoking, on the incidence of non-communicable diseases	**Formative:** • Practical activities • Debates • Presentations • Self/ peer assessments • Problem solving activities **Summative:** • SMART TEST

		limiting factor, metabolism, **oxygen debt,** photosynthesis. **Key links to other units:** Revisit the unit on Cells, Breathing Respiration and Photosynthesis in Year 9	• Describe cellular respiration as an exothermic reaction which is continuously occurring in all living cells. • Compare the processes of aerobic and anaerobic respiration **(PSHE- Intimate and sexual relationships, including sexual health; Mental wellbeing; Physical health and fitness; Healthy eating; Drugs, alcohol and tobacco; Health prevention)** • Describe the process of photosynthesis and describe photosynthesis as an endothermic reaction. **Working Scientifically** • Required practical: Investigate the effect of antiseptics or antibiotics on bacterial growth. • Required practical: Investigate the effect of light intensity on the rate of photosynthesis. **Enrichment opportunities** • Careers Mentoring with a STEM Ambassador • National Apprenticeship Week • International Day of Women and Girls in Science- Celebrate persons in STEM • NHS presentation- Careers in the NHS • Kew Gardens • Career link https://www.myworldofwork.co.uk/my-career-options/job-categories#job-category-healthcare	• Required Practical to be written up after each investigation
Spring 2	**Chemistry** Chemical Reactions and Energy Changes • Chemical Changes • Electrolysis • Energy changes	**Students will learn about:** Acids, alkali, anode, cathode, crystalisation, displacement, electrolysis, electrolyte, extraction, filtration, neutralisation, oxidation, pH scale, **redox reaction**, reduction, strong acid, reactivity series, weak acid Activation energy, **alkaline batteries, chemical batteries,** endothermic reaction, exothermic reaction, **fuel cell**, reaction profile, **rechargeable batteries** **Key links to other units:** Revisit the units on Types of Reaction and Chemical energy in Year 9	**Students are able to:** • Explain how the reactivity of metals with water or dilute acids is related to the tendency of the metal to form its positive ion. • Recall that acids react with some metals and with carbonates and write equations predicting products from given reactants • Describe neutrality and relative acidity and alkalinity in terms of the effect of the concentration of hydrogen ions on the numerical value of pH. • Describe electrolysis of various molten ionic liquids and aqueous ionic solutions. • Explain reduction and oxidation in terms of gain or loss of electrons, identifying which species are oxidised and which are reduced. • Distinguish between endothermic and exothermic reactions on the basis of the temperature change of the surroundings.	**Formative:** • Practical activities • Debates • Presentations • Self/ peer assessments • Problem solving activities **Summative:** • SMART TEST • Required Practical to be written up after each investigation

			• **Recall that a chemical cell produces a potential difference until the reactants are used up.** **Working scientifically** • Deduce an order of reactivity of metals based on experimental results. • Required practical: Preparation of a pure dry sample of soluble salt. • Required practical: Investigate what happens when aqueous solutions are electrolysed by using inert electrodes. • Required practical: Investigate the variables that affect temperature change in chemical reactions. **Enrichment Opportunities** • Career link • Careers Mentoring with a STEM Ambassador • National Careers Week- *celebrate persons in STEM* • British Science Week • Earth Day https://edu.rsc.org/future-in-chemistry/not-a-student/teachers-and-careers-advisers/linking-curriculum-to-careers	
Summer 1	**Physics** Particles at Work • Radioactivity Forces in Action • Forces in Balance • Motion • Force and motion • Force and Pressure	**Students will learn about:** Activity, alpha particle, atomic number, **background radiation**, Becquerel, beta particle, **chain reaction**, count rate, electrons, energy levels, **fission products**, gamma ray, Geiger-Muller tube, half-life, ions, irradiation, isotopes, mass number, neutron, **nuclear fission, nuclear fusion**, nucleus, plum pudding model, protons, radioactive contamination, radioactive decay, **Sieverts** Acceleration, braking distance, centre of mass, **conservation of momentum**, contact forces, displacement distance, elastic limit, elastic potential energy, equilibrium, **floating, fluid**, forces , inertia, limit of proportionality, **moment**, momentum, non-contact forces, resolution of forces, resultant forces, scalar, **sinking**, stopping distance, thinking distance, up thrust, vector, weight **Key links to other units:** Revisit the units on Magnetism, Contact Forces and Pressure in Year 9	**Students are able to:** • Explain the concept of half-life and how this is related to the random nature of radioactive decay • Recall the differences in the penetration properties of alpha-particles, beta-particles and gamma-rays • **Describe the process of nuclear fission and fusion** • Recall examples of ways in which objects interact: by gravity, electrostatics, magnetism and by contact. • Describe the relationship between force and extension for a spring and other simple systems. • **Recall that the pressure in fluids causes a force normal to any surface, and use the relationship between the force, the pressure, and the area in contact** • **Define and calculate the moment of the force.** • Explain the vector-scalar distinction as it applies to displacement, distance, velocity and speed • Define momentum and describe examples of momentum in collisions • **Explain the factors which affect the distance required for road transport vehicles to come to rest in emergencies and the implications for safety** **Working scientifically**	**Formative:** • Practical activities • Debates • Presentations • Self/ peer assessments • Problem solving activities **Summative:** • SMART TEST • Required Practical to be written up after each investigation

			• Required practical: Investigate the relationship between force and extension of a spring. • Required practical: Investigate the effect of varying the force and mass of an object on the acceleration. **Enrichment Opportunities** • Careers Mentoring with a STEM Ambassador • Career link https://careerpilot.org.uk/job-sectors/subject/physics#link-1	
Summer 2	**Biology** Biological Responses • The human nervous system • Hormonal coordination • Homeostasis in action Genetics and Reproduction • Reproduction	**Students will learn about:** Abstinence, accommodation, **adrenaline, antidiuretic hormone (ADH)**, contraception, coordination centres, **deamination,** diabetes, dialysis, effector, **ethene**, follicle stimulating hormone (FSH), geotropism/ gravitropism, **gibberellins**, gland, **glucagon**, homeostasis, hyperopia, **In Vitro Fertilisation (IVF),** luteinising hormone (LH), myopia, **negative feedback cycle,** oestrogen, phototropism, receptors, reflex action, selective reabsorption, stimuli, target organ, testosterone, the brain, the central nervous system (CNS), the eye, thermoregulatory centre, **thyroxine,** vasoconstriction, vasodilation Alleles, asexual reproduction, chromosome, **complementary**, cystic fibrosis, DNA, dominant, fertilisation, gene, genome, genotype, mitosis, meiosis, **nucleotide**, **protein synthesis**, Punnett square, sexual reproduction, variation **Key links to other units:** Revisit the Units on Cells, Wave Properties, Evolution and Inheritance in Year 9.	**Students are able to:** • Explain how the structure of the nervous system is adapted to its functions. • **Explain how the main structures of the eye are related to their functions.** • **Describe the structure and function of the brain.** • Describe the principles of hormonal coordination and control by the human endocrine system. • **Describe the function of the kidneys in maintaining the water balance of the body.** • **Explain the interactions of FSH, LH, estrogen and progesterone in the control of the menstrual cycle** • Explain the use of hormones in contraception and evaluate hormonal and non-hormonal methods of contraception. • Explain how insulin controls blood sugar levels in the body. **(PSHE- Being safe; Intimate and sexual relationships, including sexual health; Mental wellbeing; Physical health and fitness; Healthy eating; Health and prevention; Changing adolescent body)** • **Explain how plant hormones are important in the control and coordination of plant growth and development, with reference to the role of auxins in phototropism and gravitropism.** • Explain some of the advantages and disadvantages of asexual and sexual reproduction in a range of organisms. • Describe DNA as a polymer made from four different nucleotides. • **Recall a simple description of protein synthesis** • Discuss the potential importance for medicine of our increasing understanding of the human genome **(PSHE- Health and prevention)** **Working scientifically**	**Formative:** • Practical activities • Debates • Presentations • Self/ peer assessments • Problem solving activities **Summative:** • SMART TEST • Required Practical to be written up after each investigation

			• Required practical: Investigate the effect of a factor on human reaction time. • **Required practical: Investigate the effect of light or gravity on the growth of newly germinate seedlings.** Enrichment Opportunities • Contraception workshop with Brook • Stem ambassadors- Career talks • Career link https://www.myworldofwork.co.uk/my-career-options/job-categories#job-category-healthcare	