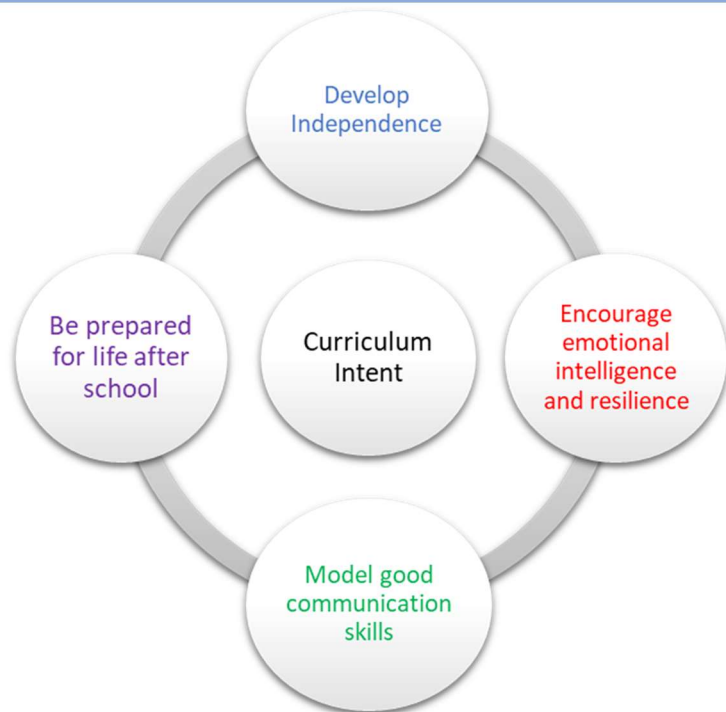


## Year 10 Science Long Term Plan 2021-22



### School Pedagogy:

Penkford School has a child centred pedagogy. The school adopts an inclusive, transformative pedagogy as we believe that a child's 'capacity to learn can change and be changed for the better as a result of what happens and what people do in the present' (*Hart et al. 2004, P166*). Learning is about shared communication between staff and pupils. Implementation of our curriculum intent is underpinned by Rosenshine's 10 Principles of Instruction (*Rosenshine, 2012*). All learning sessions include the following elements; reference to curriculum intent, recap of knowledge and skills, assessment for learning and pupil voice.

### Subject Specific Pedagogy:

Pedagogical approach in science lessons at Penkford is underpinned by Rosenshine's Principles of Instruction (*Rosenshine, 2012*). EHCP documentation is used to inform planning within science and we are flexible in our approach to content coverage and delivery. Disciplinary knowledge progression is planned in conjunction with appropriate substantive knowledge topic areas

### Subject Intent:

KS2: Recognise the presence of Science in the world around them and its significance in their daily lives. Pupils will be supported with their learning whilst also being equipped to develop as independent learners.

KS3: Promote a lifelong interest and awareness of how science can be used to understand and explain natural phenomena, and also recognition of the potential for human impact within this.

KS4: Pupils will have an enthusiasm for learning about scientific phenomena with an appreciation of how accreditation for their learning is relevant in securing employment, including an awareness of the range of careers which having a science education can be the starting point for.

All KS4 pupils will follow the Edexcel 9-1 Combined Science Course, with the opportunity to achieve Edexcel Entry Level Science qualification as the course progresses. **Detailed information on the learning aims of the topics below are taken from the GCSE Specification Document, we then tailor delivery and content in line with our curriculum intent and pupil learning needs.**

Year 10 Science Long Term Plan	Topic/Learning Pathway	Key Vocabulary	Links to previous learning (Component Skills)	Links to wider curriculum
Autumn 1	<p><b>CP4 and CP5: 'Waves' and 'Light and the Electromagnetic Spectrum'</b></p> <p><b>CP4:</b></p> <ul style="list-style-type: none"> <li>Understand that waves transfer energy.</li> <li>Describe the characteristics of waves.</li> <li>The speed of a wave is related to wavelength and frequency.</li> <li>How waves refract at different boundaries.</li> </ul> <p><b>CP5 EMS:</b></p> <ul style="list-style-type: none"> <li>That light is part of the EMS, with common properties</li> <li>Some uses of the EMS</li> <li>Some dangers of the EMS</li> </ul> <p><b>Core practical investigations:</b></p> <ul style="list-style-type: none"> <li>Waves</li> <li>Investigating Refraction</li> </ul>	Wavelength, frequency, amplitude, oscillation, particle, vibration, transverse, longitudinal, medium, reflection, incident ray, reflected ray, diffuse, refraction.	<p><b>CP4 Waves/CP5 EMS:</b></p> <ul style="list-style-type: none"> <li>Yr9 Waves and Radiation topic</li> <li>How sound and light waves can be described</li> <li>How sound waves are detected by our ear</li> <li>Some uses of sound waves</li> <li>how light can be absorbed scattered and reflected</li> <li>That light can transfer energy</li> <li>About colours and their properties</li> </ul>	<p><b>CP4 and CP5 Use of mathematics</b></p> <ul style="list-style-type: none"> <li>Make calculations using ratios and proportional reasoning to convert units and to compute rates</li> <li>Apply formulae relating velocity, frequency and wavelength</li> <li>Apply the relationships between frequency and wavelength across the electromagnetic spectrum</li> </ul> <p><b>CP4 Music:</b> Understanding pitch, amplitude and resonance</p> <p><b>CP4 Geography:</b> Science in nature, p-waves and s-waves in earthquakes</p> <p><b>CP5 Art and Design:</b> Properties of light and refraction – colour dispersal</p> <p><b>CP5 Citizenship/PSHE:</b> use of EM spectrum technology in public safety e.g. X-ray machines, infrared cameras used by the police and armed forces – ethical discussion around such uses.</p>

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	<p><b>CP6: 'Radioactivity'</b></p> <ul style="list-style-type: none"> <li>• how the particles inside an atom are arranged.</li> <li>• how to represent atoms using symbols.</li> <li>• about the different types of radiation and how they affect atoms.</li> <li>• about the background radiation that is all around us.</li> <li>• about the dangers of radiation and how we can protect ourselves.</li> </ul>	<p>Radiation, atom, radioactive, nucleus, proton, neutron, electron, emission, alpha, beta, gamma, Geiger-Muller, decay, half-life</p>	<p><b>CP6: Radioactivity:</b></p> <ul style="list-style-type: none"> <li>• Y7 Atoms and the Periodic Table topic</li> <li>• about the particle model of matter</li> <li>• atoms contain smaller charged particles called electrons.</li> </ul>	<p><b>CP6 Use of mathematics</b></p> <ul style="list-style-type: none"> <li>• Balance equations representing alpha-, beta- or gamma-radiations in terms of the masses and charges of the atoms involved</li> <li>• [H] Calculate the net decline, expressed as a ratio, in a radioactive emission after a given number of half-lives</li> </ul>
Autumn 2	<p><b>CB5: 'Health, Disease and the Development of Medicines'</b></p> <ul style="list-style-type: none"> <li>• How we define health – both mental and physical</li> <li>• The difference between communicable and non-communicable diseases</li> <li>• Describe the main types of pathogen and the diseases they cause</li> <li>• Transmission of communicable diseases</li> <li>• how the spread of pathogens can be reduced or prevented</li> <li>• how the body is protected against infection</li> <li>• The immune system</li> <li>• how antibiotics work</li> <li>• how new medicines are developed</li> <li>• Non-communicable diseases including</li> </ul>	<p>Communicable, non-communicable, pathogen, transmission, infection, immunity, antigen, phagocyte, phagocytosis, engulf, lymphocyte, antibodies, memory cells, vaccination, antibiotic, agar, zone of inhibition, pre-clinical, clinical, efficacy, toxicity, dosage.</p>	<p><b>CB5: Health, Disease and the Development of medicines:</b></p> <ul style="list-style-type: none"> <li>• Yr7 Cells and Organisation topic</li> <li>• Yr9 Health and Disease topic</li> <li>• Understand that imbalances in the diet can lead to obesity and deficiency diseases</li> <li>• The structure of bacteria</li> </ul>	<p><b>CB5 Use of mathematics</b></p> <ul style="list-style-type: none"> <li>• Construct and interpret frequency tables and diagrams, bar charts and histograms</li> <li>• Understand the principles of sampling as applied to scientific data</li> <li>• Use a scatter diagram to identify a correlation between two variables</li> <li>• Calculate cross-sectional areas of bacterial cultures and clear agar jelly using <math>\pi r^2</math></li> </ul> <p><b>CB5 PSHE:</b> features of a healthy lifestyle, personal hygiene</p> <p><b>CB5 Careers:</b> Highlight the diverse roles and careers within the NHS related to content covered in the</p>

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	<p><b>CC2: 'States of Matter and Mixtures'</b></p> <ul style="list-style-type: none"> <li>• how to use information to predict the state of a substance.</li> <li>• how the arrangement, movement and energy of particles change during a change in state.</li> <li>• how to use melting point to tell the difference between pure and impure substances.</li> <li>• how to identify substances using melting points and chromatography.</li> <li>• how different methods of separation work.</li> <li>• how to choose a separation method based on the properties of the substances in a mixture.</li> </ul> <p><b>Core practical:</b></p> <ul style="list-style-type: none"> <li>• Separating Inks (Chromatography)</li> </ul>	<p>Solute, soluble, solution, solubility, impure, physical state, particle, arrangement, solid, liquid, gas, melting, evaporation, condensation, freezing, room temperature, distillation, chromatography, Rf value, solvent line, separation</p>	<p><b>CC2: States of Matter and Mixtures</b></p> <ul style="list-style-type: none"> <li>• Yr7 States of Matter topic</li> <li>• how particles are arranged in solids, liquids and gases and how their energy changes with changes of state.</li> </ul>	<p>topic e.g. mental health nurse, biomedical scientist, dietician, phlebotomist, medical secretary, decontamination technician etc.</p> <p><b>CC2 Use of mathematics</b></p> <ul style="list-style-type: none"> <li>• Translate information between diagrammatic and numerical forms</li> <li>• Interpret charts</li> </ul> <p><b>CC2 Careers/Cultural Capital:</b> Use of chromatography by forensic scientists who work for the police force – how forensic chromatography can be used on samples from crime scenes.</p> <p><b>C4.4</b> discuss the skills involved in managing your own career  <b>C4.8</b> recognise and challenge stereotyping, discrimination and other barriers to equality, diversity and inclusion and know your rights and responsibilities in relation to these issues</p>
Spring 1	<p><b>CC1: Key Concepts in Chemistry</b></p> <ul style="list-style-type: none"> <li>• How our ideas about atoms have changed</li> <li>• What relative atomic mass is.</li> </ul>	<p>Atom, proton, neutron, electron, atomic number, mass number, relative atomic mass</p>	<p><b>C1: Key Concepts in Chemistry:</b></p> <ul style="list-style-type: none"> <li>• Yr9 Atoms and the Periodic Table topic</li> <li>• the particle model of matter</li> </ul>	<p><b>CC1 Use of mathematics</b></p> <ul style="list-style-type: none"> <li>• Relate size and scale of atoms to objects in the physical world</li> <li>• Estimate size and scale of atoms</li> </ul>

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	<ul style="list-style-type: none"> <li>● What is RAM (Relative Atomic Mass)</li> <li>● [H] calculate RAM</li> <li>● How Mendeleev arranged the elements around known elements</li> <li>● How he predicted undiscovered elements</li> <li>● How elements are arranged in the modern periodic table</li> <li>● How electrons are arranged in atoms</li> <li>● How ionic, covalent and metal bonds are formed</li> <li>● About the formation of lattices and molecular structures</li> <li>● how the physical properties of a substance are linked to its bonds and structures</li> <li>● Calculations involving masses</li> </ul> <p><b>CC3: Chemical Changes</b></p> <ul style="list-style-type: none"> <li>● about ions in acids and alkali, and how their concentrations are linked to pH</li> <li>● what happens in the reactions between acids and different types of bases.</li> </ul>	<p>(RAM), period, group, element, properties, ion, ionic bonding, covalent bonding, metallic, lattice, molecular, bonding</p> <p>Ion, acidic, base, basic, alkali, neutralisation, titration, dilute, concentrated, soluble, insoluble, burette, corrosive, residue</p>	<ul style="list-style-type: none"> <li>● How elements are arranged in the periodic table</li> <li>● Chemical symbols for elements</li> <li>● About periods and groups</li> <li>● position of metals and non-metals</li> </ul> <p><b>CC3: Chemical Changes</b></p> <ul style="list-style-type: none"> <li>● Yr8 Chemical Reactions topic</li> <li>● Yr9 Acids and Metals topic</li> <li>● How to test for hydrogen and carbon dioxide gas</li> <li>● CC1 Key Concepts in Chemistry topic</li> </ul>	<ul style="list-style-type: none"> <li>● Represent three dimensional shapes in two dimensions and vice versa when looking at chemical structures</li> <li>● Translate information between diagrammatic and numerical forms</li> <li>● Arithmetic computation and ratio when determining empirical formulae, balancing equations</li> <li>● Arithmetic computation, ratio, percentage and multistep calculations permeates quantitative chemistry</li> <li>● [H] Calculations with numbers written in standard form when using the Avogadro constant</li> <li>● Change the subject of a mathematical equation</li> <li>● Provide answers to an appropriate number of significant figures</li> <li>● Convert units where appropriate particularly from mass to moles</li> </ul> <p><b>CC3 Careers:</b> Use of pH knowledge and sampling techniques used by Environmental Scientists and Food Standards Agency inspection roles</p>

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	<ul style="list-style-type: none"> <li>• how different indicators can be used in acid-alkali titrations.</li> <li>• [H] Explain the terms dilute and concentrated, with respect to amount of substances in solution</li> <li>• [H] Explain the terms weak and strong acids, with respect to the degree of dissociation into ions</li> <li>• how different soluble and insoluble salts can be prepared in the laboratory.</li> <li>• Explain the movement of ions during electrolysis</li> <li>• Explain the formation of the products in the electrolysis</li> <li>• [H] Write half equations for reactions occurring at the anode and cathode in electrolysis</li> <li>• [H] Explain oxidation and reduction in terms of loss or gain of electrons</li> <li>• [H] Recall that reduction occurs at the cathode and that oxidation occurs at the anode in electrolysis reactions</li> </ul> <p><b>Core Practicals:</b></p> <ul style="list-style-type: none"> <li>• Preparing Copper Sulphate.</li> <li>• Investigating Neutralisation.</li> <li>• Electrolysis of Copper Sulphate solution</li> </ul>	<p>Electrolysis, electrolyte, cathode, anode, oxidation, reduction</p>		
Spring 2	<p><b>CP2: Motion and Forces</b></p> <ul style="list-style-type: none"> <li>• the difference between vector and scalar quantities.</li> </ul>	<p>Scalar, vector, speed acceleration, velocity, mass, weight,</p>	<p><b>CP2 Motion and Forces</b></p> <ul style="list-style-type: none"> <li>• Yr9 Forces topic</li> </ul>	<p><b>CP2 Use of mathematics</b></p> <ul style="list-style-type: none"> <li>• Make calculations using ratios and proportional reasoning to</li> </ul>

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	<ul style="list-style-type: none"> <li>• how to calculate speed and acceleration.</li> <li>• how to represent and interpret journeys on distance/time and velocity/time graphs.</li> <li>• How to use graphs to calculate speed, acceleration and distance travelled.</li> <li>• Newton’s Laws of Motion</li> <li>• calculate the weight of an object from its mass</li> <li>• about factors that affect the stopping distance of a vehicle</li> <li>• about the dangers of large decelerations</li> <li>• [H] how to calculate momentum and apply ideas of momentum to collisions.</li> <li>• [H] Centrifugal force</li> </ul> <p><b>Core Practical:</b></p> <ul style="list-style-type: none"> <li>• Investigate force, mass and acceleration by varying the masses added to trolleys</li> </ul>	gravitational, thinking distance, braking distance, stopping distance, deceleration, momentum, centrifugal	<ul style="list-style-type: none"> <li>• what forces are and the effects of balanced and unbalanced forces</li> <li>• how average speed, distance and time are related</li> <li>• how to represent a journey on a distance/time graph</li> </ul>	convert units and to compute rates <ul style="list-style-type: none"> <li>• Relate changes and differences in motion to appropriate distance-time, and velocity-time graphs, and interpret lines and slopes</li> <li>• Interpret enclosed areas in velocity-time graphs</li> <li>• Apply formulae relating distance, time and speed, for uniform motion, and for motion with uniform acceleration, and calculate average speed for non-uniform motion</li> </ul> <p><b>CP4 Cultural Capital:</b> How the calculations covered are used by policy writers to inform the writing of the Highway Code and affect laws/regulations to do with child car-seats etc.</p>
<b>Summer 1</b>	<p><b>CB1: Key Concepts in Biology</b></p> <ul style="list-style-type: none"> <li>• how developments in microscopy have allowed us to find out more about the subcellular structures found in animal, plant and bacterial cells.</li> <li>• Demonstrate an understanding of the relationship between quantitative units in relation to cells, including: a milli (<math>10^{-3}</math>) b micro (<math>10^{-6}</math>)</li> </ul>	Magnification, microscopic, Differentiation, specialised, function, stem cells, enzyme, active site, substrate, product, reaction rate, catalysts, diffusion, osmosis, active transport	<p><b>CB1: Key Concepts in Biology</b></p> <ul style="list-style-type: none"> <li>• Understanding of Yr9 Cells topic</li> <li>• how to use a microscope</li> <li>• about the differences between cells from different organisms</li> <li>• how some cells are specialised and adapted to their functions</li> <li>• how enzymes help digest food in the digestive system</li> </ul>	<p><b>CB1 Use of mathematics</b></p> <ul style="list-style-type: none"> <li>• Demonstrate an understanding of number, size and scale and the quantitative relationship between units</li> <li>• Use estimations and explain when they should be used</li> <li>• Carry out rate calculations for chemical reactions</li> </ul>

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	<p>c nano (<math>10^{-9}</math>) d pico (<math>10^{-12}</math>) e [H] calculations with numbers written in standard form</p> <ul style="list-style-type: none"> <li>about the importance of enzymes in nutrition, growth and development.</li> <li>how enzymes are affected by pH and temperature and why each enzyme only works with a certain type of molecule.</li> <li>how substances are carried by diffusion, osmosis and active transport.</li> </ul> <p><b>Core Practicals:</b></p> <ul style="list-style-type: none"> <li>Microscopes</li> <li>Enzymes</li> <li>Osmosis</li> </ul>		<ul style="list-style-type: none"> <li>how substances move by diffusion</li> </ul>	<ul style="list-style-type: none"> <li>Calculate with numbers written in standard form</li> <li>Translate information between numerical and graphical forms</li> <li>Construct and interpret frequency tables and diagrams, bar charts and histograms</li> <li>Use a scatter diagram to identify a correlation between two variables</li> <li>Understand and use simple compound measures such as the rate of a reaction</li> <li>Calculate the percentage gain and loss of mass</li> <li>Calculate arithmetic means</li> </ul> <p><b>CB1 Careers:</b> Use of microscope in varied roles e.g. Clinical Scientists, Pathologists</p> <p><b>CB1 Food Technology:</b> Nutrition, what constitutes a varied, healthy diet</p>
Summer 2	<p><b>CC4: Extraction of Metals and Equilibria</b></p> <ul style="list-style-type: none"> <li>more about reactivity, oxidation and reduction.</li> <li>The reactivity series of metals</li> <li>about the different ways in which metals and be extracted.</li> <li>about the advantages of recycling metals.</li> </ul>	<p>Oxidation, reduction, reactivity, reactivity series, extraction, recycle, sustainability, equilibria, equilibrium, reversible, yield</p>	<p><b>CC4: Extraction of Metals and Equilibria</b></p> <ul style="list-style-type: none"> <li>Combustion</li> <li>oxidation reactions.</li> <li>displacement reactions.</li> <li>CC1 Key Concepts in Chemistry topic</li> </ul>	<p><b>CC4 Geography:</b> resources from the Earth and atmosphere, sustainability, recycling, life cycle of a product</p>



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	<ul style="list-style-type: none"> <li>● about the factors involved in a life cycle assessment of a product.</li> <li>● to explain what happens during electrolysis.</li> <li>● about equilibria in chemical reactions.</li> <li>● about the Haber process.</li> <li>● [H] how to write half equations.</li> </ul> <p><b>CB6: Plant Structures and their Functions</b></p> <ul style="list-style-type: none"> <li>● Photosynthesis and how different factors affect its rate</li> <li>● How the rate of water uptake by a plant is affected by different factors (transpiration)</li> <li>● How the reactants and the products of photosynthesis are transported</li> <li>● More about specialised cells (including palisade, root hair, xylem and phloem cell)</li> </ul> <p><b>Core Practical:</b></p> <ul style="list-style-type: none"> <li>● Investigating light intensity and rate of photosynthesis</li> </ul>	<p>Photosynthesis, reactant, product, limiting factor, light intensity, temperature, humidity, transpiration, translocation, xylem, lignin, lignified, phloem, end plates, palisade cell, chloroplasts, elongated</p>	<ul style="list-style-type: none"> <li>● how elements are arranged in the periodic table</li> <li>● about anions and cations in ionic compounds</li> <li>● how to write balanced symbol equations with state symbols</li> </ul> <p><b>CB6: Plant Structures and their Functions</b></p> <ul style="list-style-type: none"> <li>● Yr9 Photosynthesis and Respiration topic</li> <li>● That plants make their own food (glucose) using photosynthesis.</li> <li>● How light and chlorophyll are necessary for photosynthesis</li> <li>● CB1 Key Concepts in Biology topic</li> </ul>	<p><b>CB6 Use of mathematics</b></p> <ul style="list-style-type: none"> <li>● Plot, draw and interpret appropriate graphs</li> <li>● Construct and interpret frequency tables and diagrams, bar charts and histograms</li> <li>● Understand the principles of sampling as applied to scientific data</li> <li>● Use a scatter diagram to identify a correlation between two variables</li> <li>● Understand and use simple compound measures such as the rate of a reaction</li> <li>● [H] <b>Understand and use inverse proportion – the inverse square law and light intensity in the context of factors affecting photosynthesis.</b></li> <li>● Use percentiles and calculate percentage gain and loss of mass</li> <li>● Calculate arithmetic means</li> </ul>