St Cuthbert's RC High School
Curriculum Map - Science

SUBJECT Curriculum Map	
St. Cuthbert's Curriculum Vision 	Here at St. Cuthbert's, our curriculum is rooted in our Catholic faith and the principles laid out in Catholic Social Teaching. Our goal is to help every child shine, feel valued, and make a positive mark in the world. With our core CARE values—Catholicity, Aspiration, Respect, and Excellence—guiding us, we aim to nurture each child's academic, social, emotional, and spiritual growth. We strive to foster an environment where every student feels secure, included, and supported, both inside the classroom and out. Complete curriculum vision.docx
Subject statement of intent	In Science we are committed to nurturing curious minds and inspiring future scientists who will shape a future that hasn't been decided yet. Through engaging and inquiry-based learning, we empower students to develop essential scientific skills, explore the impact of science on the world, and prepare them for a future where science is vital. We strive to create an inclusive environment where all students can thrive, connect science to their lives, and become confident, critical thinkers.

Curriculum Icons Key				
Catholic Mission	**Careers (CEIAG)**	**Cultural Capital and Enrichment Opportunities**	**Preparing for life in modern Britain**	**Skills for Life**
				

	KS3 Science 'at a glance'		
	AUTUMN	**SPRING**	**SUMMER**
Y7	How Science Works The Human Body Acids and Alkali's Forces and Motion	Nutrition and Digestion Particle Theory Light and Sound	Ecology Earth and Atmosphere Space

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Y8	How Science Works States of Matter The Periodic Table Reproduction Forces- Stretching and Squashing	Atoms, Elements and Compounds Electricity Gas Exchange and Respiration	Energy Chemical Reactions Magnetism
Y9	Genetics Materials Pressure and Moments Cells and Control	States of Matter and Separating Techniques Motion Plant Structures and Functions Atomic Structure	Forces Health, Disease and Development of Medicines
	KS4 Science 'at a glance'		
	AUTUMN	**SPRING**	**SUMMER**
Y10	Groups in the Periodic Table and Energy Changes Conservation of Energy Genes Bonding	Waves Cell Division and Nervous System Acids and Alkali's *Astronomy* **Separate Science only*	Radioactivity Forces Doing Work and Their Effects Calculations, Electrolysis and Equilibria Ecosystems and Material Cycles *Separate Chemistry 1*
Y11	Exchange and Transport in Animals Organic Chemistry and Earth's Atmosphere Electricity and Circuits Magnets and Electromagnetic Induction	Homeostasis Particle Model/Stretching *Separate Chemistry 2*	Revision Programme

Y7 Map

YEAR 7		AUTUMN	SPRING	SUMMER
Year 7	**Theme**	**How Science Works, The Human Body, Acids and Alkalis, Forces and motion**	**Nutrition and Digestion, Particle Theory, Light and Sound**	**Ecology, Earth and Atmosphere, Space**

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	Knowledge	**<u>How Science works</u>** Safety Equipment Observations Practical planning hypothesis Methods and diagrams Results and graphs Conclusion and evaluation		**<u>Nutrition and digestion</u>** Introductory lesson Diet and food groups Testing foods Daily allowances - link to roles Unbalanced diet (diseases) Digestive system (recap organs) Gums to bums demonstration Biological catalysts		**<u>Ecology</u>** Introductory lesson Habitats and adaptation Food chain Food web Plant reproduction (pollination, seed dispersal and food security) Bioaccumulation Photosynthesis Photosynthesis equation (gas tests) Leaf adaptation Testing a leaf for starch Stoma and microscopes	
		Substantive Knowledge • How to work safely in a science lab. • The names of pieces of practical equipment used in science and what they are used for. • How to make scientific observations. • How to write a scientific hypothesis and how to investigate this scientifically.	**Disciplinary Knowledge** • How to work safely in a science lab. • The names of pieces of practical equipment used in science and what they are used for. • How to make scientific observations. • How to write a scientific hypothesis and how to investigate this scientifically.	**Substantive Knowledge** • The different nutrients in foods and how to test for them. • The role of each nutrient in the body. • The parts of the digestive system and their functions. • The importance of a balanced diet. • How malnutrition can lead to problems in the body.	**Disciplinary Knowledge** • How to test for different nutrients in food.	**Substantive Knowledge** • What the terms 'habitat', 'ecosystem', 'community', 'population' mean. • Adaptations of organisms in different habitats (including camel, polar bear, cactus and owl). • What food chains are and how to identify producers, consumers, predators and prey.	**Disciplinary Knowledge** • How to interpret food webs. • Produce pyramids of number of pyramids of biomass.

		• How to write a scientific method and draw scientific diagrams. • How to interpret results and scientific data and graphs. • How to write a scientific conclusion and evaluate a method.	• How to write a scientific method and draw scientific diagrams. • How to interpret results and scientific data and graphs. • How to write a scientific conclusion and evaluate a method.	• The role of enzymes in the digestive system and why each type of enzyme only works with one nutrient.		• What food webs are and how to identify herbivores, carnivores and omnivores. • The interdependence of organisms in food webs. • The difference between a pyramid of number and a pyramid of biomass. • The stages of plant reproduction. • How bioaccumulation occurs and causes eutrophication. • What happens in photosynthesis and the photosynthesis equation. • How plants are adapted for photosynthesis. • How to test for the presence of starch in leaves. • The role of stomata in leaves.	
		Rationale: **Previous Links:**		**Rationale:** **Previous Links:**		**Rationale:** **Previous Links:**	

		Builds on skills from KS2 where they used observations; may have used pieces of scientific equipment and carried out scientific investigations. **Future Links:** Links into every practical all subsequent Science lessons.	Build on prior learning from KS2 - Name and describe the functions of the main parts of the digestive musculoskeletal and circulatory systems; and describe and compare different reproductive processes and life cycles in animals. **Future Links:** • Gas exchange and respiration in year 8. • Enzymes and Health and Disease in year 9. • Exchange and Transport in year 11.	Build on prior learning from KS2 – Living things and their habitats - □ describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird □ describe the life process of reproduction in some plants and animals □ describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals □ give reasons for classifying plants and animals based on specific characteristics. **Future Links:** • Earth and atmosphere in year 7. • Ecosystems and material cycles in year 10.
		<u>Human Body</u> Introductory lesson Living organisms Skeletal system Muscles Organs Plant and animal cells Microscopes x2 Unicellular and multicellular organisms Adapted cells	**<u>Particle theory</u>** Introductory lesson Solids liquids gases Changes of state (salol) Mixtures and pure substances Filtration Evaporation Chromatography Distillation	**<u>Earth and Atmosphere</u>** Introductory lesson Composition and structure of the Earth Types of rock The rock cycle Fossils The atmosphere Renewable and non-renewable resources Recycling Carbon cycle Climate change

		Substantive Knowledge	Disciplinary Knowledge	Substantive Knowledge	Disciplinary Knowledge	Substantive Knowledge	Disciplinary Knowledge
		• The seven life processes. • The role of the organs and systems in the human body. • The parts of animal and plant cells and state their functions. • Various specialised cells in plants and animals and how they are adapted for their function. • The difference between unicellular and multicellular organisms. • The parts of a light microscope and how to use them to view samples under a microscope.	• How to set up and use a light microscope to view the cells using a microscope. • Label diagrams of cells.	• The arrangement and movement of particles in solids, liquids and gases. • The changes of state and what happens, in terms of energy and bonds. • The difference between a pure substance and an impure substance. • The different methods of separating mixtures and how they work.	• How to draw particle diagrams for solids, liquids and gases. • How to separate mixtures using filtration; crystallisation; chromatography and distillation. • How to interpret a chromatogram.	• The layers of the Earth. • The three rock types, how they are formed and characteristics of each. • The stages of the rock cycle. • What fossils are and how they are formed. • The difference between renewable and non-renewable energy resources; examples of each and their advantages and disadvantages. • How acid rain occurs and the effect it has on aquatic life in ponds/lakes; forests and buildings. • How climate change occurs and the effect it has on the planet. • The composition of the Earth's	• Label the layers of the Earth. • Identify rock types based on observations and characteristics.

						atmosphere and how and why it has changed over the last 4 billion years. • The carbon cycle. • The importance of recycling.	
		Rationale: **Previous Links:** Build on prior learning from KS2 - Name, locate and describe the functions of the main parts of plants, including those involved in reproduction and transporting water and nutrients. **Future Links:** • Digestion and leaf adaptations in year 7. • Reproduction and respiration in year 8. • Cells and control, plant structures and functions and health and disease in year 9. • Genes in year 10. • Exchange and Transport in Animals in year 11.		**Rationale:** **Previous Links:** Build on prior learning from KS2 – Identify and describe what happens when dissolving occurs in every-day situations; and describe how to separate mixtures and solutions into their components; identify, with reasons, whether changes in materials are reversible or not. **Future Links:** • States of Matter and Separating Techniques in year 9. • Particle Model and Stretching in year 11.		**Rationale:** **Previous Links:** Build on prior learning from KS2 – Rocks: compare and group together different kinds of rocks on the basis of their appearance and simple physical properties; describe in simple terms how fossils are formed when things that have lived are trapped within rock; recognise that soils are made from rocks and organic matter. **Future Links:** • Plant structures and functions in year 9. • Ecosystems and material cycles in year 10.	
		<u>Acids and Alkalis</u> Introductory lesson pH scale Acids and alkalis Making an indicator Acids and metals - gas tests		**<u>Light and Sound</u>** Introductory lesson Wave structure Transverse - longitudinal Structure of the ear and audible range Sound circus		**<u>Space</u>** Introductory lesson Solar system Mass, weight and gravity The moon Day and night and the night sky	

		Neutralisation		Light waves Absorption, refraction, reflection Pinhole cameras The eye and convex lenses Colours of light - mixing and prisms Ray boxes Visible, UV, IR dangers and uses		Seasons The sun and a light year Models of the universe	
		Substantive Knowledge • The names and formulas of some common acids and alkalis. • How indicators are used to identify acids, alkalis and neutral solution. • How to use the pH scale to identify strong and weak acids, neutral solutions and strong and weak alkalis. • How to make red cabbage indicator. • The hazard symbols associated with different chemicals, their meanings and how	**Disciplinary Knowledge** • The meaning of different hazard symbols and how to use chemicals safely. • How to use the pH scale to identify strong and weak acids, neutral solutions and strong and weak alkalis. • How to test for hydrogen gas.	**Substantive Knowledge** • The parts of a wave and how these parts are affected by changes in pitch and volume. • The differences between transverse and longitudinal waves. • The structure of the ear and how we hear. • How to calculate wave speed using the equations: Speed = distance / time Wave speed = frequency x wavelength • How light and sound waves travel.	**Disciplinary Knowledge** • How to label a diagram of a wave. • How to calculate wave speed. • How to investigate reflection and refraction.	**Substantive Knowledge** • The order of astronomical objects: comet; planet; star; solar system; galaxy; Universe. • The names of the components of our solar system. • The difference between mass and weight and why weight would change on different planets / the moon but mass wouldn't. • What happens in one day and one year in terms of the Sun and the Earth. • The different phases of the moon and why it appears different shapes at each stage of the lunar cycle.	**Disciplinary Knowledge** • How to calculate mass and weight given a defined gravitational field strength.

		to handle them safely. • The reaction a metal and an acid. • How to test for hydrogen gas. • What happens in a neutralisation reaction.		• The structure of the eye and how we see. • How waves are reflected and refracted. • How we see in colour.		• The different models that have been used to describe the Universe over time and why models have changed. • The different methods of exploring the Universe, including telescopes; rockets; probes and landers. • What a light year is.	
		Rationale: **Previous Links:** Build on prior learning from KS2 - to understand how to test chemicals and the way they react with each other; how to identify hazard symbols and stay safe with chemicals in the home; identify and describe what happens when dissolving occurs in everyday situations; and describe how to separate mixtures and solutions into their components. **Future Links:** • Enzymes in year 9. • Acids, alkalis and neutralisation in year 10. • Gas tests in year 9, 10 and 11.		**Rationale:** **Previous Links:** Build on prior learning from KS2 – Sight is purely an active human process 'I am looking at something, which is why I can see it'. Eyes give out a form of light to enable us to see. Reflective surfaces emit light. Only shiny surfaces or water reflect light. 0paque objects do not reflect light. Opaque surfaces give out colour or 'darkness'. Sounds can be produced without using any material objects. Hitting an object harder changes the pitch of the sound produced. Human voice sounds are produced by a large number of vocal cords that all produce different sounds. Loudness and pitch of sounds are the same things.		**Rationale:** **Previous Links:** Build on prior learning from KS2 – describe the movement of the Earth, and other planets, relative to the Sun in the solar system; describe the movement of the Moon relative to the Earth; describe the Sun, Earth and Moon as approximately spherical bodies; use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky. **Future Links:** • Energy in year 9. • Forces and their Effects in year 10. • *Triple - Astronomy*	

<table>
<tr><td></td><td></td><td colspan="2"></td><td>Future Links:
• Waves in year 10.</td><td></td></tr>
<tr><td></td><td></td><td colspan="2"><u>Forces and Motion</u>
Introductory lesson
Forces
Force diagrams
Describing motion
Speed = distance/time
Distance- time graphs
Distance/time investigation
Balanced forces</td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td></td><td></td><td>Substantive Knowledge
• Different names of forces and how we measure them.
• The effects of balanced and unbalanced forces on the motion of an object.
• How force diagrams are used to represent the forces acting on an object.
• How to investigate and calculate speed.
• The different parts of distance/time graphs and what they mean.</td><td>Disciplinary Knowledge
• How to produce force diagrams.
• How to calculate speed.
• How to interpret distance/time graphs.</td></tr>
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		Rationale: **Previous Links:** Build on prior learning from KS2 - Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object. Identify the effects of air resistance, water resistance and friction that act between moving surfaces. Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect. **Future Links:** • Space in year 7. • Force in year 9. • Motion in year 9. • Pressure and moments in year 9. • Forces doing work and their effects in year 10.		

<table>
<tr><th colspan="2">YEAR 8</th><th colspan="2">AUTUMN</th><th colspan="2">SPRING</th><th colspan="2">SUMMER</th></tr>
<tr><td rowspan="3">Year 8</td><td>Theme</td><td colspan="2">   States of Matter, The Periodic Table, Reproduction, Forces – Stretching and Squashing    </td><td colspan="2">   Atoms, Elements and Compounds, Electricity, Gas Exchange and Respiration    </td><td colspan="2">  Energy, Chemical Reactions, Magnetism     </td></tr>
<tr><td>Knowledge</td><td colspan="2"><u>States of Matter</u>
Introductory lesson
Solids, liquids and gases and change of state recap
Particle arrangement in solids, liquids and gases recap and internal energy
Physical and chemical changes
Density
Diffusion
Brownian motion</td><td colspan="2"><u>Atoms Elements and Compounds</u>
Introductory lesson
Dalton atomic model
Differences between atoms, elements and compounds
Chemical symbols and formulae
Conservation of mass
Changes of state and chemical reactions
Endothermic and exothermic reactions</td><td colspan="2"><u>Energy</u>
Introductory lesson
Conduction
Convection
Radiation
Insulators
Conservation of energy</td></tr>
<tr><td>Substantive Knowledge
The states of matter in terms of the particle arrangement and movement and the properties of each state of matter.
Changes of state and how they happen, in terms of temperature.
The shape of a heating curve for</td><td>Disciplinary Knowledge
Draw particle models for each state of matter.
Use observations to determine if a physical or chemical change has taken place.
Interpret a heating curve and state whether it is for a pure or impure substance.</td><td>Substantive Knowledge
The atomic model and how it has been created.
The differences between atoms, elements and compounds.
How to write word and symbol equations for chemical reactions.
How chemical compounds can be made.</td><td>Disciplinary Knowledge
Label parts of the atom.
State the number of protons, neutrons and electrons in an atom.
Recognise elements, compounds and mixtures from diagrams.</td><td>Substantive Knowledge
The difference between heat and temperature.
How heat is transferred by conduction.
Why solids are good conductors of heat energy and gases are poor conductors of heat energy.</td><td>Disciplinary Knowledge
How to investigate conduction and convection.
How to use equipment to measure thermal radiation.</td></tr>
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		pure and impure substances. • The difference between physical and chemical changes. • What happens in diffusion. • What happens in Brownian motion. • What density is and how to calculate it.	• Define the term 'diffusion'. • How to calculate density.	• The law of conservation of mass. • What happens in oxidation and thermal decomposition reactions.	• Write word equations for chemical reactions. • Write symbol equations for chemical reactions.	• How heat energy is transferred by convection. • Why convection cannot happen in solids, only in liquids and gases. • How heat energy is transferred by radiation. • The difference between conductors and insulators of heat energy and examples of each. • How energy loss can be reduced from homes and how methods work.	
		Rationale: **Previous Links:** • Build on prior learning from KS2 - Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses. • Builds on knowledge for the particle theory topic in year 7. **Future Links:**		**Rationale:** **Previous Links:** • Build on prior learning from KS2 - Describe the characteristics of different states of matter and group materials on this basis; and describe how materials change state at different temperatures, using this to explain everyday phenomena, identify different properties of metals and non-metals. • Periodic Table topic in year 8. **Future Links:**		**Rationale:** **Previous Links:** Build on prior learning from KS2 - compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets; give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic. **Future Links:**	

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- Materials, states of matter and separating techniques and energy in year 9.
- Particle model in year 11.

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- Materials; Atomic Structure and Bonding in year 9.
- Radioactivity in year 10.
- Particle Model in year 11.

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- Energy changes and conservation of energy in year 10.

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<u>The Periodic Table</u>
Introductory lesson
Physical and chemical properties of elements
Periodic table introduction and Mendeleev
Metals and non-metals and their properties
Periods and Groups
Metal and non-metal oxides and acidity

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<u>Electricity</u>
Introductory lesson
Circuits and components
Current and potential difference
Series and parallel circuits
Resistance
Static electricity
Electricity in the home
Power in Watts and appliance ratings
Energy transfers of electrical appliances
Domestic fuel bills, use and costs

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<u>Chemical reactions</u>
Introductory lesson
Chemical reactions and the arrangement of atoms
Word equations
Symbol equations
Combustion
Thermal decomposition
Oxidation

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Substantive Knowledge

- The work of John Newlands, Johann Dobereiner and Dimitri Mendeleev in creating the periodic table.
- How to use the periodic table.
- How chemical compounds are made.
- The properties of metals and non-metals and how to test for these properties.

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Disciplinary Knowledge

- Identify metals, non-metals, groups and periods on the periodic table.
- Carry out practicals safely.

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Substantive Knowledge

- The symbols used for circuit components and their functions.
- The difference between series and parallel circuits.
- The difference between current and potential difference.
- What resistance is and how it is caused.

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Disciplinary Knowledge

- Build series and parallel circuits.
- How to place ammeters and voltmeters to investigate current and potential difference in circuits.
- Calculate power.
- Complete energy transfer diagrams and Sankey diagrams.
- Calculate the cost of electricity.

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Substantive Knowledge

- The difference between a physical and chemical reaction.
- What happens, in terms of arrangement of atoms, in chemical reactions.
- How to write word equations for chemical reactions.
- How to write symbol equations for chemical reactions.

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Disciplinary Knowledge

- How to recognise if a chemical reaction has happened or not.
- How to write word equations for chemical reactions.
- How to write symbol equations for chemical reactions.

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				• What static electricity is and how it forms. • The different methods of generating electricity, their advantages and disadvantages. • How to calculate power. • Energy transfers in electrical appliances and how to interpret Sankey diagrams. • How to calculate the cost of electricity.		• What happens in a combustion reaction. • What happens in thermal decomposition. • What happens in an oxidation reaction.	
		Rationale: **Previous Links:** • Build on prior learning from KS2 - Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses. • Builds on knowledge for the particle theory topic in year 7 and states of matter in year 8. **Future Links:** • Atomic structure in year 9.		**Rationale:** **Previous Links:** Build on prior learning from KS2 - Use simple apparatus to construct and control a series circuit, and describe how the circuit may be affected when changes are made to it; and use recognised symbols to represent simple series circuit diagrams **Future Links:** • Electrolysis in year 10. • Electricity and Circuits in year 11.		**Rationale:** **Previous Links:** • Build on prior learning from KS2 - demonstrate that dissolving, mixing and changes of state are reversible changes; explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda.	

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- Groups in the Periodic Table in year 10.
- Particle model in year 11.

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- Builds on particle theory from year 7; atoms, elements and compounds and the periodic table in year 8.

Future Links:

- Materials in year 9.
- Bonding and Groups in the Periodic table and Energy Changes in year 10.
- Organic Chemistry in year 11.

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<tr><td></td><td></td><td colspan="2"><u>Reproduction</u>
Introductory lesson
Male and Female reproductive organs
Puberty
Reproduction and gametes
Birth and Pregnancy
Menstrual cycle
Personal hygiene
Plant reproduction and seed dispersal recap and investigation</td><td colspan="2"><u>Gas Exchange and Respiration</u>
Introductory lesson
The lungs
Gas exchange in humans and plants
How exercise, asthma and smoking affects gas exchange
Breathing
Aerobic respiration
Anaerobic respiration
Fermentation
Health
Alcohol and its effects
Recreational drugs and their effects</td><td colspan="2"><u>Magnetism</u>
Introductory lesson
Magnets
Earth's magnetism
Magnetic fields and plotting compasses
Electromagnets
Magnetic effect of a current</td></tr>
<tr><td></td><td></td><td>Substantive Knowledge
• The key changes that happen to males and females during puberty and why puberty happens.
• The parts of the male and female reproductive</td><td>Disciplinary Knowledge
• Label parts of the male and female reproductive systems.
• Interpret graphs for hormone levels and thickness of the lining of the uterus in discussing</td><td>Substantive Knowledge
• The parts of the respiratory system and the function of each part.
• Which gases are exchanged in the alveoli.</td><td>Disciplinary Knowledge
• Label a diagram of the respiratory system and the alveoli, including the direction that O_2 and CO_2 diffuse.
• How to measure heart rate.</td><td>Substantive Knowledge
• The names of the four magnetic materials.
• The shape and direction of a magnetic field around a bar magnet.</td><td>Disciplinary Knowledge
• How to find the shape of a magnetic field around a bar magnet.
• How to find the direction of a magnetic field</td></tr>
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		systems and the cells involved in reproduction. • What happens during fertilisation. • The different stages of pregnancy and the process of giving birth. • Key concepts relating to personal hygiene and why it is important. • The different parts of the menstrual cycle, the hormones involved and where they are produced.	the stages of the menstrual cycle.	• How the alveoli are adapted for gas exchange. • The gases that are exchanged and where in a plant. • The effects of exercise, asthma and smoking on the respiratory system and gas exchange. • The mechanism of breathing. • The differences between aerobic and anaerobic respiration. • What happens in fermentation and how it is used to produce food products. • What 'health' means and factors that affect health. • How health can be improved. • The effects of alcohol on the body. • The different types of drugs and the effects they have on the body.		• The rules of attraction and repulsion between magnets. • How compasses use Earth's magnetic field and how they can be used for navigation. • How to make an electromagnet and what they are used for. • How the strength of an electromagnet can be changed. • The advantages of an electromagnet (induced) to a permanent magnet.	around a bar magnet. • How to make an electromagnet and change the strength of it.
		Rationale: **Previous Links:**		**Rationale:** **Previous Links:**		**Rationale:** **Previous Links:**	

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Build on prior learning from KS2 – Name and describe the functions of the main parts of the digestive musculoskeletal and circulatory systems; and describe and compare different reproductive processes and life cycles in animals
Builds on knowledge for the cells topic from year 7 and human body topic from year 8.

Future Links:

Cells and control in year 9
Genes in year 10.
Homeostasis in year 11

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Build on prior learning from KS2 - Name and describe the functions of the main parts of the digestive musculoskeletal and circulatory systems; and describe and compare different reproductive processes and life cycles in animals
Cells and Nutrition and Digestion in year 7.

Future Links:

Plant Structures and Function and Health and Disease in year 9.
Exchange and Transport in Animals in year 11.

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Build on prior learning from KS2 - Properties and changes of materials - compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets
Builds on Electricity from year 8.

Future Links:

Magnets and Electromagnets in year 11.

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<u>Forces - stretching and squashing</u>
Introductory lesson
Forces recap from year 7
Stretching and squashing
Hooke's Law investigation
Spring deformation
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<th>Substantive Knowledge</th>
<th>Disciplinary Knowledge</th>
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How to identify balanced and unbalanced forces acting on objects and how they affect the object.
How springs work, in terms of forces.
What Hooke's Law is.

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Draw force diagrams.
Investigate Hooke's Law and how adding mass affects the extension of a spring.

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		• What a spring constant is and how it is linked to the use of the spring.			
		Rationale: **Previous Links:** • Build on prior learning from KS2 – Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object. Identify the effects of air resistance, water resistance and friction, that act between moving surfaces. Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect. • Builds on forces and motion topics from year 7. **Future Links:** • Forces in year 9. • Forces doing work in year 10. • Force and extension in year 11.			

St Cuthbert's RC High School
Curriculum Map - Science

YEAR 9		AUTUMN		SPRING		SUMMER	
Year 9	Theme	**Genetics, Materials, Pressure and Moments, Cells and Control**		**States of Matter and Separating Techniques, Motion, Plant Structures and Functions, Atomic Structure**		**Forces, Health and Disease and Development of Medicines**	
	Knowledge	**<u>Genetics</u>** Introductory lesson Inheritance Genes, Chromosomes and DNA Development of DNA model and Scientists involved Variation Continuous and discontinuous variation Natural selection Extinction Biodiversity and the gene pool		**<u>States of matter and separating techniques</u>** Introductory lesson States of matter Mixtures Filtration and crystallisation Chromatography Distillation Distillation investigation Drinking water		**<u>Forces</u>** Resultant forces Newton's 1st law Mass and weight Newton's 2nd law Acceleration investigation Newton's 3rd law Momentum Stopping distances Crash hazards ***Stopping distance calculations***	
		Substantive Knowledge • The structure of DNA and where it is found in cells. • How DNA is inherited from our parents and how it influences our characteristics. • What variation is and how genetics and the	**Disciplinary Knowledge** • Label diagrams of the structure of DNA. • Write a complimentary sequence of DNA when given a template sequence. • Produce genetic crosses and punnet squares to show	**Substantive Knowledge** • The arrangement, relative energy and movement of particles in each state of matter. • The difference between pure and impure substances. • The meaning of the term: soluble;	**Disciplinary Knowledge** • Predict the physical state of a substance under specified conditions, using data. • Identify states of matter and changes of state for heating/cooling curves for pure and impure substances.	**Substantive Knowledge** • What 'resultant force' is and how to calculate it. • How to use free-body diagrams to represent the forces acting on an object and the overall effect of these forces on the object.	**Disciplinary Knowledge** • How to convert mass into weight and weight into mass. • How to investigate the relationship between force, mass and acceleration.

		environment can cause this. • Why variation within a species is important. • What 'evolution' is and the work of Charles Darwin and Jean Baptiste Lamarck on different theories for evolution. • The process of Natural Selection and the evidence that supports this theory. • How selective breeding is carried out and why it is useful.	the inheritance of certain alleles. • Describe the stages of evolution by natural selection. • How to interpret evidence for evolution by natural selection, including fossil records and stone tools. • How selective breeding is carried out.	insoluble; solvent; solute and solution. • How separation separates mixtures. • How crystallisation separates mixtures. • How chromatography separates mixtures and calculate Rf values for substances. • How distillation can be used to separate mixtures. • What potable water is and how it is produced.	• How to interpret a chromatogram. • How to calculate Rf values. • How to set up and carry out different separation techniques.	• Newton's 3 laws of motion and how they affect objects. • The forces involved in circular motion. • The link between mass and weight. • How to use the formula for Newton's 2nd Law to calculate force, mass and acceleration of an object. • The relationship between mass, force and acceleration by investigating the effect of changing the mass of a trolley. • What 'momentum' is and how to calculate it. • What 'conservation of momentum' means. • How safety equipment can reduce injury in collisions. • What 'stopping distance' is, how to calculate it and	

						factors that affect stopping distance. • How changes in momentum affect impact forces and how to calculate them. • How safety devices in cars reduce injury.	
		Rationale: **Previous Links:** Build on prior learning from KS2 – Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including microorganisms, plants and animals. Give reasons for classifying plants and animals based on specific characteristics. Recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago. Recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents Identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.		**Rationale:** **Previous Links:** Build on prior learning from KS3 – Understand the concept of The Particle Model and describe how it demonstrates the three different states. Explain the term solubility, and link to the other 'S' words – solute; solvent; solution…Identify the different methods of separation. Describe the process of chromatography, what equipment is needed and how the techniques works. Describe the process of filtration and evaporation. Be able to describe the method and identify the different equipment needed. Describe the process of distillation and the equipment required for the process. Apply your knowledge to explain how distillation works. Builds on learning from particle theory in year 7; states of matter in year 8 **Future Links:**		**Rationale:** **Previous Links:** Build on prior learning from KS3 – **Forces -** □ forces as pushes or pulls, arising from the interaction between two objects □ using force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces □ moment as the turning effect of a force □ forces: associated with deforming objects; stretching and squashing – springs; with rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and water □ forces measured in newtons, measurements of stretch or compression as force is changed □ force-extension linear relation; Hooke's Law as a special case □ work done and energy changes on deformation □ non-contact forces: gravity forces acting at a distance on Earth and in	

<table>
<tr><td></td><td></td><td colspan="2">Builds on cells from year 7 and reproduction from year 8
Future Links:
• Health and Disease in year 9.
• Genetics in year 10.</td><td colspan="2">• Organic chemistry and particle model in year 11.</td><td colspan="2">space, forces between magnets and forces due to static electricity.

Builds on learning from forces and motion in year 7 and motion in year 9.
Future Links:
• Forces and work done in year 10.
• Forces and extension in year 11.</td></tr>
<tr><td></td><td></td><td colspan="2"><u>Materials</u>
Introductory lesson
Reactivity series
Reduction of metal oxides
Properties of ceramics, polymers and composite materials</td><td colspan="2"><u>Motion</u>
Introductory lesson
Vectors and scalars
Distance time graphs
Acceleration
Velocity/time graphs</td><td colspan="2"><u>Health, disease and development of medicines</u>
Introductory lesson
Health and disease
Non communicable diseases
Cardiovascular disease
Pathogens
Spreading pathogens
Virus life cycles
Physical & Chemical barriers
The immune system herd immunity
Antibiotics
Aseptic technique- core prac
Monoclonal antibodies</td></tr>
<tr><td></td><td></td><td>Substantive Knowledge
• The physical and chemical properties of materials and the difference between a physical and chemical change.</td><td>Disciplinary Knowledge
• How to use a reactivity series to identify elements that are most and least reactive and also to predict whether a displacement</td><td>Substantive Knowledge
• The difference between scalars and vectors and examples of each.
• How to calculate speed and rearrange the equation to</td><td>Disciplinary Knowledge
• How to calculate speed.
• How to interpret distance/time graphs.
• How to calculate acceleration.</td><td>Substantive Knowledge
• The WHO definition of health.
• The link between pathogens and disease.
• The different types of pathogens and</td><td>Disciplinary Knowledge
• How to calculate BMI and waist : hip ratio.</td></tr>
</table>

		• The order of elements in the reactivity series and how to use it to predict whether displacement reactions will happen or not. • How the reactivity changes in different groups of the periodic table, including the alkali metals, halogens and noble gases. • The different types and uses of polymers and composite materials.	reaction will happen or not. • How to test the reactivity of the alkali metals and the halogens.	calculate time and distance. • How to interpret a distance/time graph. • How to calculate acceleration using the equations: $\frac{(v-u)}{t}$ and $v_2 - u_2 = 2 \times a \times X$ • How to interpret velocity/time graphs and how to calculate the distance travelled on the graph.	• How to interpret velocity/time graphs.	the diseases they can cause. • The difference between communicable and non-communicable disease and the shape of graphs for each type. • What cardiovascular disease is, the causes of it and how it can be treated. • How BMI and waist : hip ratio is used to categorise people. • How pathogens are spread. • *Triple – how viruses replicate in the body in their life cycle.* • Our physical and chemical barriers to infection and how they work. • How antibiotics work. • How new medicines are developed. • How the immune system kills pathogens and the	

						differences between the primary immune response and the secondary immune response. • What vaccines contain and how they help prevent disease. • *Triple – what aseptic technique is and why it is important when culturing bacteria.* • *Triple – what monoclonal antibodies are and their uses.*	
		Rationale: **Previous Links:** • Build on prior learning from KS2 - Distinguish between an object and the material from which it is made. Identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock. Describe the simple physical properties of a variety of everyday materials. Compare and group together a variety of everyday materials on the basis of their simple physical properties.		**Rationale:** **Previous Links:** • Build on prior learning from KS3:- Identify the meaning of speed, and carry out investigations to calculate it. Recall and apply the equation speed=distance/time. Draw and interpret distance/time graphs. Describe the actions and features of balanced and unbalanced forces. Apply your knowledge of forces to explain how moments and levers work. Identify the key concepts of pressure and calculate it.		**Rationale:** **Previous Links:** Build on prior learning from KS3 – content of a healthy human diet: carbohydrates, lipids (fats and oils), proteins, vitamins, minerals, dietary fibre and water, and why each is needed; the consequences of imbalances in the diet, including obesity, starvation and deficiency diseases; the impact of exercise, asthma and smoking on the human gas exchange system. Builds on learning from the human body and nutrition and digestion in year 7. **Future Links:** • Homeostasis in year 11.	

<table>
<tr><td></td><td></td><td colspan="2">

- Builds on learning from particle theory in year 7 and chemical reactions and the periodic table in year 8.

Future Links:

- States of matter in year 9.
- Groups in the periodic table and calculations in year 10.
- Organic chemistry in year 11.

</td><td colspan="2">

- Builds on learning from forces and motion in year 7.

Future Links:

- Forces doing work in year 10.
- Particle model and forces and extension in year 11.

</td><td colspan="2"></td></tr>
<tr><td></td><td></td><td colspan="2"><u>Pressure and Moments</u>
Introductory lesson
Pressure
Pressure in liquids
Calculating pressure
Moments
Levers</td><td colspan="2"><u>Plant structures and functions</u>
Introductory lesson
Photosynthesis leaf structure
Limiting factors
Photosynthesis investigation
Osmosis and active transport
Transporting substances in plants
Plant adaptations
Plant hormones
Plant defences</td><td colspan="2"></td></tr>
<tr><td></td><td></td><td>Substantive Knowledge
• What pressure is and how to calculate it.
• What happens to pressure as you go deeper into a liquid and why.
• What moments are and how they determine whether an object balances or not.</td><td>Disciplinary Knowledge
• How to calculate pressure.
• How to calculate moments.</td><td>Substantive Knowledge
• What photosynthesis is and the photosynthesis equation.
• The structure of a leaf and how it is adapted for photosynthesis.
• The limiting factors of photosynthesis.</td><td>Disciplinary Knowledge
• How to investigate photosynthesis.</td><td>Substantive Knowledge
•</td><td>Disciplinary Knowledge
•</td></tr>
</table>

		• How to calculate moments. • How levers multiple force and how they are used.		• H – Inverse square law. • How substances are transported into and out of cells, including by diffusion, osmosis and active transport. • How the structure of the root hair cells is adapted to absorb water and mineral ions. • How water, mineral ions and sucrose are transported around plants. • The adaptations of xylem and phloem cells for transporting substances around plants. • The processes of transpiration and translocation. • Triple - How hormones control the growth and development of plants, including phototropism and gravitropism. • Triple - The roles of auxins, gibberellins			

				and ethene in plant development. • Triple – How plants defend themselves against attack from pests and pathogens. • Triple – How plant diseases can be detected and identified, in the lab and in the field.			
		Rationale: **Previous Links:** • Build on prior learning from KS2 - Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object. Identify the effects of air resistance, water resistance and friction, that act between moving surfaces. Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect. • Builds on learning from forces – stretching and squashing in year 8. **Future Links:** • Forces doing work in year 10. • Particle model in year 11.		**Rationale:** **Previous Links:** • Build on prior learning from KS3 – Identify the parts of a plant and animal cell including their functions. Identify various specialised cells and describe how they are adapted for their function. Identify organs which can be transplanted. Explain the ethical, financial and moral implications of organ donation. Describe the role of some major organs in the body. Apply your knowledge of organs and link this to which organs are required to make various systems function. Explain how plant and animal cells differ. Explain the function of the parts of a microscope. Apply your knowledge to view samples under the microscope, draw them and calculate total		**Rationale:** **Previous Links:** **Future Links:** •	

<table>
<tr><td></td><td></td><td colspan="2"></td><td colspan="2">magnification. Name, locate and describe the functions of the main parts of plants, including those involved in reproduction and transporting water and nutrients.
• Builds on learning from cell and control in year 9.
Future Links:
• Ecosystems and material cycles in year 10.
• Organic chemistry and Earth's atmosphere in year 11.</td><td colspan="2"></td></tr>
<tr><td></td><td></td><td colspan="2"><u>Cells and control</u>
Introductory lesson
Microscopes
Plant and animal cells
Microscopes investigation- preparing and viewing slides
Specialised Cells
Bacteria cells
Enzymes and nutrition
Investigation - food tests
Enzyme and how they work
Enzymes and conditions
Investigating pH and enzymes
Transporting substances in living things
Osmosis investigation</td><td colspan="2"><u>Atomic Structure</u>
Introductory lesson
Structure of an atom
Atomic number and mass number
Isotopes
Elements and the periodic table
Atomic number and the periodic table
Electronic configuration and the periodic table</td><td colspan="2"></td></tr>
<tr><td></td><td></td><td>Substantive Knowledge</td><td>Disciplinary Knowledge</td><td>Substantive Knowledge</td><td>Disciplinary Knowledge</td><td>Substantive Knowledge</td><td>Disciplinary Knowledge</td></tr>
</table>

		• The parts of a light microscope and how they allow us to see cells. • How to calculate total magnification, image size and actual size of cells. • The advantages of using an electron microscope compared to a light microscope. • How to prepare slides to view under a microscope. • The parts of a cell and the function of each part. • How animal and plant cells differ from each other. • Different types of specialised cells, their functions and how they are adapted for their function. • The structure of bacterial cells (prokaryotes) and how they differ from eukaryotes (animal and plant cells).	• How to set up and use a light microscope and make specimen slides to view under the microscope. • How to calculate total magnification, image size and actual size of cells. • *Triple – how to carry out food tests.* • How to investigate the effect of temperature, pH and substrate concentration on enzyme activity. • How to investigate the effect of osmosis on the mass and size of cells.	• How and why theories on the structure of the atom have changed over time. • The structure of an atom. • What the atomic mass and atomic number tell us about the structure of an atom. • What isotopes are in terms of numbers of sub-atomic particles. • How the Periodic Table was developed over time, in particular the work done by Dimitri Mendeleev. • The structure of the periodic table and how it links to the atomic and electronic structures of atoms of elements.	• Calculate the number of protons, neutrons and electrons in an atom or isotope. • Complete electronic structures for atoms of elements.		

		• *Triple – the tests for different nutrients in food.* • How enzymes work, in terms of the lock and key hypothesis, and the factors that affect them. • The enzymes of the digestive system and what they do. • How particles move by diffusion, osmosis and active transport. • How osmosis affects the mass and size of cells.					
		Rationale: **Previous Links:** Build on prior learning from KS3 - Identify the parts of a plant and animal cell including their functions. Identify various specialised cells and describe how they are adapted for their function. Identify organs which can be transplanted. Explain the ethical, financial and moral implications of organ donation. Describe the role of some major organs in the body. Apply your knowledge of organs and link this to which organs are required to make various systems function. Explain		**Rationale:** **Previous Links:** Build on prior learning from KS3 – Explain the importance of Mendeleev's work in creating the periodic table including the input of other scientists. Recall how to use the periodic table and why it is an international tool. Explain how chemical compounds can be made. Recall the properties of metals and non-metals and how to test for these properties. Describe the variables in practical's and how and why these need to be controlled. Apply		**Rationale:** **Previous Links:** **Future Links:**	

		how plant and animal cells differ. Explain the function of the parts of a microscope. Builds on learning from the human body in year 7 and reproduction in year 8. **Future Links:** • Plant structures and functions in year 9. • Health and disease in year 9. • Cell division and the nervous system in year 10. • Genes in year 10. • Exchange and transport in in animals in year 11.	your knowledge to conclude what has happened in an investigation. Builds on particle theory in year 7 and atoms, elements and compounds, and the periodic table in year 8. **Future Links:** • Bonding in year 9. • Radioactivity in year 10. • Particle model in year 11.	

<table>
<tr><th colspan="2">YEAR 10</th><th colspan="2">AUTUMN</th><th colspan="2">SPRING</th><th colspan="2">SUMMER</th></tr>
<tr><td rowspan="3">Year 10</td><td>Theme</td><td colspan="2">  
Groups in the Periodic Table and Energy Changes, Conservation of Energy, Genes, Bonding
    </td><td colspan="2">  
Waves, Cell Division and the Nervous System, Acids and Alkalis, Astronomy
    </td><td colspan="2">  
Radioactivity, Forces Doing Work and Their Effects, Calculations, Electrolysis and Equilibria, Separate Chemistry 1, Ecosystems
    </td></tr>
<tr><td>Knowledge</td><td colspan="2"><u>Groups in the periodic table and energy changes</u>
Introductory lesson
Group 1
Group 7
Halogen reactivity
Group 0
Rates of reaction
Factors affecting reaction rates
Investigating reaction rates
Catalysts
Exo/endothermic
Energy changes in reactions</td><td colspan="2"><u>Waves</u>
Introductory lesson
Describing waves
Wave speeds calculate depth or distance from time and wave velocity
CORE PRAC waves
Refraction ray diagrams and diffuse/specular reflection
Waves crossing boundaries
Ears and hearing
Ultra and infrasound
Colour and lenses
Electromagnetic waves
CORE PRAC refraction
EM spectrum
Uses and dangers of the EM Spectrum
Radiation and temperature</td><td colspan="2"><u>Radioactivity</u>
Introductory lesson
Atomic models
Inside atoms
Electrons and orbits
Background radiation
Types of radiation
Radioactive decay
Half-life
Dangers of radioactivity
Contamination and irradiation
Radioactivity in medicine
Nuclear energy
Nuclear fission
Nuclear fusion</td></tr>
<tr><td></td><td>Substantive Knowledge
• The location, key properties and reactivity of</td><td>Disciplinary Knowledge
• Use experimental results to predict the reactivity of</td><td>Substantive Knowledge
• What waves are and what they do.</td><td>Disciplinary Knowledge
• Label the parts of a wave.</td><td>Substantive Knowledge
• The different models of atomic structure and how and why</td><td>Disciplinary Knowledge
• How to interpret a half-life graph.</td></tr>
</table>

		elements in Group 1, Group 7 and Group 0. • What rate of reaction is, factors that can affect rate of reaction, and how it can be calculated. • The effects of changing the conditions of a reaction on the rates of chemical reactions by: a) measuring the production of a gas (in the reaction between hydrochloric acid and marble chips) b) observing a colour change (in the reaction between sodium thiosulfate and hydrochloric acid) • The role of a catalyst and why they are used • The characteristics of an exothermic and endothermic reaction, what activation energy is, and give	unseen group 1 and group 7 elements. • Core Practical: Investigate the effects of changing the conditions of a reaction on the rates of chemical reactions by: • The effects of changing the conditions of a reaction on the rates of chemical reactions by: a) measuring the production of a gas (in the reaction between hydrochloric acid and marble chips) b) observing a colour change (in the reaction between sodium thiosulfate and hydrochloric acid) • How to identify endothermic and exothermic reactions in practical investigations.	• The features of a wave – amplitude; wavelength; frequency. • The two different types of waves. • How to calculate wave speed. • How to investigate waves using a ripple tank. • How to investigate refraction - what happens and why. • The order of the parts of the EM spectrum. • The uses and dangers of the different parts of the EM spectrum. • How radio waves and gamma rays are produced.	• Calculate wave speed. • How to use a ripple tank to investigate waves. • How to produce a ray diagram to investigate refraction. • Label the parts of the electromagnetic spectrum.	they have changed over time. • The structure of an atom. • How radiation affects the arrangement of electrons in atoms and how atoms can form ions. • How absorption and emission of the visible light spectrum can be used to identify elements. • What 'background radiation' is and the major sources of it. • The structure of alpha, beta and gamma radiation and their penetrating and ionising abilities. • What happens in the nucleus during alpha decay. • What happens in the nucleus during beta – decay. • What happens in the nucleus during beta + decay. • What happens in the nucleus during gamma decay.	• Complete nuclear equations for the different types of radioactive decay. • How to investigate the radioactivity of different samples.

		examples of both types of reaction • Reaction profiles for endothermic and exothermic reactions and calculate overall energy changes.				• What happens in the nucleus during neutron decay. • What 'half-life' is and how to calculate it. • The effects of nuclear radiation on humans. • The different methods or detecting and monitoring exposure to nuclear radiation. • The difference between irradiation and contamination with radioactive materials. • *Triple – how radioactive substances can be used in medicine.* • *Triple – the advantages and disadvantages of nuclear power.* • *Triple – the difference between nuclear fission and nuclear fusion and how they can be used to generate electricity.*	
		Rationale: **Previous Links:** Build on prior learning from KS3 - the varying physical and chemical properties		**Rationale:** **Previous Links:** Build on prior learning from KS3 - waves on water as undulations which travel		**Rationale:** **Previous Links:** Build on prior learning from KS3 - **Atoms, elements and compounds -** □ a simple	

		of different elements; the principles underpinning the Mendeleev Periodic Table; the Periodic Table: periods and groups; metals and non-metals; how patterns in reactions can be predicted with reference to the Periodic Table; the properties of metals and non-metals; the chemical properties of metal and non-metal oxides with respect to acidity; what catalysts do; energy changes on changes of state (qualitative); exothermic and endothermic chemical reactions (qualitative). Identify different chemical properties, the differences between a physical and chemical change. Complete word equations for a range of chemical reactions. Extend this by writing symbol equations and balance them. Understand how atoms are rearranged during chemical reactions, but that mass is conserved, as no atoms are lost or gained. Identify the order of the reactivity series, how the series is organised and used. Describe the reactivity of different groups in the periodic table, such as the alkali metals, halogens, noble gases. Predict the likelihood of a reaction occurring based on the reactivity series, and how a more reactive substance will replace a less reactive substance in a compound	through water with transverse motion; these waves can be reflected, and add or cancel – superposition; frequencies of sound waves, measured in hertz (Hz); echoes, reflection and absorption of sound; sound needs a medium to travel, the speed of sound in air, in water, in solids; sound produced by vibrations of objects, in loud speakers, detected by their effects on microphone diaphragm and the ear drum; sound waves are longitudinal; auditory range of humans and animals; pressure waves transferring energy; use for cleaning and physiotherapy by ultra-sound; waves transferring information for conversion to electrical signals by microphone; the similarities and differences between light waves and waves in matter; light waves travelling through a vacuum; speed of light; the transmission of light through materials: absorption, diffuse scattering and specular reflection at a surface; use of ray model to explain imaging in mirrors, the pinhole camera, the refraction of light and action of convex lens in focusing (qualitative); the human eye; light transferring energy from source to absorber leading to chemical and electrical effects; photo-sensitive material in the retina and in cameras;	(Dalton) atomic model differences between atoms, elements and compounds chemical symbols and formulae for elements and compounds conservation of mass changes of state and chemical reactions. **The Periodic Table -** the varying physical and chemical properties of different elements the principles underpinning the Mendeleev Periodic Table the Periodic Table: periods and groups; metals and non-metals. Builds on knowledge from KS3, Atomic Structure and Cell Division and the Nervous System in year 9, Waves in year 10. **Future Links:** • Revision for mocks and GCSEs

<table>
<tr><td></td><td></td><td colspan="2">(displacement). Explain how the reactivity series can be used to decide on the method of extraction of metals and how it is important to recycle materials. Distinguish between an object and the material from which it is made. Identify and name a variety of everyday materials,
Builds on knowledge from the acid and alkalis topic in year 7; the periodic table topic in year 8; the atomic structure topic in year 9.
Future Links:
• Organic chemistry in Year 11
• Earth's atmosphere in year 11</td><td colspan="2">colours and the different frequencies of light, white light and prisms (qualitative only); differential colour effects in absorption and diffuse reflection.
Builds on knowledge from Light and Sound in year 7 and Conservation of Energy in year 10.
Future Links:
• Radioactivity in year 10</td><td colspan="2"></td></tr>
<tr><td></td><td></td><td colspan="2"><u>Conservation of energy</u>
Introductory lesson
Energy stores and transfers
Efficiency
Keeping warm
Stored energies
Non-renewable resources
Renewable resources</td><td colspan="2"><u>Cell Division and nervous system</u>
Introductory lesson
Mitosis
Growth in animals
Growth in plants
Stem cells
The nervous system
Neurotransmission
The brain
The eye</td><td colspan="2"><u>Forces doing work and their effects</u>
Introductory lesson
Work and power
Objects affecting each other
Vector diagrams
Rotational forces</td></tr>
<tr><td></td><td></td><td>Substantive Knowledge
• The different stores of energy and how energy is</td><td>Disciplinary Knowledge
• How to produce energy transfer diagrams.</td><td>Substantive Knowledge
• The stages of mitosis and meiosis.</td><td>Disciplinary Knowledge
• Use centile charts to comment of human growth.</td><td>Substantive Knowledge
• How the energy of a system can be changed.</td><td>Disciplinary Knowledge
• How to draw free-body diagrams.</td></tr>
</table>

		transferred between stores. • How some energy transfers are useful, and some are wasted. • How to calculate efficiency. • How thermal energy transfers can be reduced and how they work. • The different types of energy resources and which are renewable and non-renewable. • The advantages and disadvantages of different energy resources.	• How to calculate efficiency. • How to investigate how different types of insulate affect energy transfers. • How to interpret graphs showing energy resource use over time.	• The similarities and difference in the products of mitosis and meiosis. • How cancer develops. • Growth in animals and how it can be measured, also, the use of centile charts when comparing growth in humans. • Growth in plants and how it can be measured. • The function of stem cells in animals and meristem cells in plants. • The potential uses of stem cells in medical treatment and their associated risks. • The structure and function of the nervous system. • The difference between a processed response and a reflex response.	• Label parts of the nervous system and the neurones involved. • Produce flow charts showing the pathway for nervous impulses through the nervous system for processed and reflex response.	• What 'work done' is and how it can be measured and calculated. • What 'power' is and how it can be calculated. • The difference between contact and non-contact forces and how they affect objects. • How to produce free-body diagrams to represent the forces acting on an object. • What 'resolving forces' are. • How all the forces acting on a single body combine to affect it.	
		Rationale:		**Rationale:**		**Rationale:**	

		Previous Links: Build on prior learning from KS3 - simple machines give bigger force but at the expense of smaller movement (and vice versa), product of force and displacement unchanged heating and thermal equilibrium: temperature difference between two objects leading to energy transfer from the hotter to the cooler one, through contact (conduction) or radiation; such transfers tending to reduce the temperature difference: use of insulators other processes that involve energy transfer: changing motion, dropping an object, completing an electrical circuit, stretching a spring, metabolism of food, burning fuels. Energy as a quantity that can be quantified and calculated; the total energy has the same value before and after a change comparing the starting with the final conditions of a system and describing increases and decreases in the amounts of energy associated with movements, temperatures, changes in positions in a field, in elastic distortions and in chemical compositions using physical processes and mechanisms, rather than energy, to explain the intermediate steps that bring about such changes.	**Previous Links:** Build on prior learning from KS3 - Identify the parts of a plant and animal cell including their functions. Identify various specialised cells and describe how they are adapted for their function. Apply your knowledge of organs and link this to which organs are required to make various systems function. Builds on knowledge from The Human Body in year 7 and Cells and Control in year 9. **Future Links:** • Homeostasis in year 11.	**Previous Links:** Build on prior learning from KS3 - **Forces -** □ forces as pushes or pulls, arising from the interaction between two objects □ using force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces □ moment as the turning effect of a force □ forces: associated with deforming objects; stretching and squashing – springs; with rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and water □ forces measured in newtons, measurements of stretch or compression as force is changed □ force-extension linear relation; Hooke's Law as a special case □ work done and energy changes on deformation □ non-contact forces: gravity forces acting at a distance on Earth and in space, forces between magnets and forces due to static electricity. Builds on knowledge from KS3. **Future Links:** • Particle Models and Stretching in year 11.

		Builds on knowledge from energy topic in year 8. **Future Links:** • Electricity, circuits, magnets and magnetism in year 11. • Particle model and forces and extension in year 11.		
		<u>Genes</u> Introductory lesson ***Sexual and asexual reproduction*** Meiosis DNA DNA extraction ***Protein synthesis*** ***Mendell*** Alleles Inheritance ***Multiple missing alleles*** Gene mutation Variation Evolution Darwin Classification ***Tissue culture*** Breeds and varieties Genes in agriculture ***and medicine and GM*** ***Fertilisers and biological control***	**<u>Acids and Alkalis</u>** Introductory lesson Acids, alkalis and indicators Looking at acids Bases and salts CORE PRAC copper sulfate Alkalis and balancing equations CORE PRAC neutralisation Alkalis and neutralisation Acids, metals and carbonates Solubility	**<u>Calculations, electrolysis and equilibria</u>** Introductory lesson Masses and empirical formulae Conservation of mass Moles Electrolysis Products of electrolysis Core Prac - electrolysis ***Electroplating*** Reactivity Oxidation and Reduction Ores Oxidation & reduction Life cycle assessment Dynamic equilibrium ***Factors affecting dynamic equilibrium*** ***Fertilisers and the Haber process***

		Substantive Knowledge	Disciplinary Knowledge	Substantive Knowledge	Disciplinary Knowledge	Substantive Knowledge	Disciplinary Knowledge
		• How meiosis produces genetically different haploid cell gametes. • The structure of DNA. • What the 'genome' is and how the Human Genome Project can potentially be used in medicine. • How are characteristics are determined by genetic factors, environmental factors or a combination of both. • *Triple – the stages of protein synthesis.* • *Triple - the role of Gregor Mendel in the discovery of inheritance in characteristics.* • What alleles are, how they are inherited. • The meanings or the terms:	• Calculate the number of chromosomes in a haploid gamete cell from a diploid cell. • Label a DNA diagram and write complimentary base sequences. • Produce genetic diagrams and punnet squares and calculate the percentage chance of characteristics being inherited. • Describe how organisms evolve by the process of natural selection. • Use evidence to support the theory of evolution by natural selection. • Describe how selective breeding and genetic engineering are carried out and give the advantages and disadvantages of each method.	• Hazard symbols associated with different chemicals and what they mean. • Safety precautions when handling chemicals. • How acidic, alkaline and neutral solutions affect different indicators. • How the pH scale is used to determine the nature of different chemicals. • What all acids have in common and what all alkalis have in common. • The difference between strong and week acids. • The difference between a concentrated and dilute acid. • The reactions between acids and metals; acids and alkalis/bases and	• Identify hazard symbols and state their meaning. • Test different chemicals to see their effect on different indicators. • Calculate the change in number of H^+ ions in solution as the pH changes. • Write a method for producing pure, dry samples of salt. • Write a method to investigate neutralisation. • Write word, symbol and balanced symbol equations for chemical reactions.	• How to calculate relative formula mass / relative molecular mass (M_r). • What empirical formula is and how to calculate it. • How to calculate the percentage by mass of elements in a compound. • How to calculate reacting masses. • The law of conservation of mass and how to investigate it. • What a 'mole' is and how to calculate the number of moles of a substance. • How to use Avagadro's Constant / number to calculate the number of atoms/molecules/ions of a substance. • What 'electrolysis' is and how to set up an electrolysis experiment. • What happens in electrolysis, the conditions needed	• How to investigate conservation of mass. • How to investigate the electrolysis of copper sulfate solution using inert electrodes. • Use a reactivity series to predict the products of chemical reactions.

		chromosome, gene, allele, dominant, recessive, homozygous, heterozygous, genotype, phenotype, gamete and zygote. • What genetic diagrams and punnet squares are used to show inheritance of characteristics and determination of sex. • How mutations arise and how they can impact the inheritance of characteristics, leading to variation. • How Darwin's theory of Evolution by Natural Selection can explain the evolution of life on Earth and the evidence that supports this theory. • How genetic analysis allows for		acids and metal carbonates. • The difference between a base and an alkali. • What happens in a neutralisation reaction. • How to produce pure, dry sample of salt. • How to write word, symbol and balanced equations. • The rules of solubility.		and the products that are made at each electrode. • What happens during oxidation and reduction reactions. • *Triple – how objects can be electroplated and how it works.* • How the reactivity series can be used to predict the products of displacement reactions. • How metals are extracted from their ores and why each method is used. • What a 'Life cycle assessment' is and what they are used for. • The importance of recycling materials. • What a dynamic equilibrium is and the factors that affect them. • The conditions used to make ammonia in the Haber process and why these compromise conditions are used.	

		a three-domain classification method rather than the five kingdoms classification method. • How selective breeding and genetic engineering can be used to change the characteristics of a population and the benefits and risks of each method. • *Triple – what aseptic techniques are and how they are applied in tissue culture.* • *Triple – how organisms can be used to control the numbers of other organisms in an ecosystem.*				• The uses of fertilisers and how they are made.	
		Rationale: **Previous Links:** Build on prior learning from KS3 - heredity as the process by which genetic information is transmitted from one generation to the next; a simple model of chromosomes, genes and DNA in		**Rationale:** **Previous Links:** Build on prior learning from KS3 - Understand the key concepts relating to acids and alkalis, the pH scale and indicators. Practical skills- carry out the red cabbage indicator experiment.		**Rationale:** **Previous Links:** Build on prior learning from KS3 - Chemical reactions: chemical reactions as the rearrangement of atoms; representing chemical reactions using formulae and using equations; combustion, thermal	

		heredity, including the part played by Watson, Crick, Wilkins and Franklin in the development of the DNA model; differences between species; the variation between individuals within a species being continuous or discontinuous, to include measurement and graphical representation of variation; the variation between species and between individuals of the same species means some organisms compete more successfully, which can drive natural selection; changes in the environment may leave individuals within a species, and some entire species, less well adapted to compete successfully and reproduce, which in turn may lead to extinction; the importance of maintaining biodiversity and the use of gene banks to preserve hereditary material. Builds on knowledge from the Human Body in year 7; Genetics and Health, Disease and Development of New Medicine in year 9. **Future Links:** • Revision for GCSE examinations.	Describe the reactions of acids and metals, what are the products. Observe the reactions of acids and metals. Link to gas tests. Describe the reactions of acids and metal carbonates, what are the products. Observe reactions between metal carbonates and acids. Link to gas tests. Describe the reaction between an acid and an alkali, what is neutralisation? What are the products of a neutralisation? How can we be sure neutralisation has occurred? Builds on knowledge from Acids and Alkalis in year 7 and Groups in the Periodic Table and Energy Changes in year 10. **Future Links:** • Calculations, Electrolysis and Equilibria in year 10. • Organic Chemistry and the Earth's Atmosphere in year 11.	decomposition, oxidation and displacement reactions. Builds on knowledge from KS3, Atomic Structure in year 9; Bonding and the Periodic Table and Energy Changes in year 10. **Future Links:** • Revision for mocks and GCSEs
		<u>Bonding</u> Introductory lesson Ionic bonds Ionic lattices	***<u>Triple Only - Astronomy</u>*** ***Introductory lesson*** ***Our solar system*** ***Red shift***	***<u>Triple Only - Separate chemistry 1</u>*** ***Introductory lesson*** ***Yields*** ***Concentration and titration calculations***

		Properties of ionic compounds Covalent bonds Molecular compounds Allotropes of carbon Properties of metals Bonding models		***Origins of the universe*** ***Stars***		***Acid-alkali titration*** ***Molar volume of gases*** ***Transition metals and uses*** ***Corrosion and rust prevention*** ***Alloys and uses*** ***Fuel cells***	
		Substantive Knowledge • How ionic bonds form between metal and non-metal atoms and the properties of ionic substances. • How ions are arranged in a lattice structure. • How ionic charges determine the chemical formulae of ionic compounds. • How covalent bonds form between non-metal atoms and the properties of covalent substances. • The different allotropes of carbon and how their structures are linked to their uses.	**Disciplinary Knowledge** • Use the periodic table to identify atoms as metals or non-metals and use this to identify the type of bonding in a molecule. • Draw diagrams showing the formation of ionic bonds and explaining the properties of ionic substances. • Recognise the 3D structure of an ionic lattice. • Use ionic charges to deduce the chemical formulae of ionic compounds. • Recognise the different allotropes of carbon and explain	**Substantive Knowledge**	**Disciplinary Knowledge**	**Substantive Knowledge**	**Disciplinary Knowledge**

		• The properties of metals and how these are linked to their uses. • The different bonding models and their advantages and disadvantages.	their properties and uses. • Recognise different bonding models and be able to state advantages and disadvantages of each model.				
		Rationale: **Previous Links:** Build on prior learning from KS3 - Identify different chemical properties, the differences between a physical and chemical change. Complete word equations for a range of chemical reactions. Extend this by writing symbol equations and balance them. Understand how atoms are rearranged during chemical reactions, but that mass is conserved, as no atoms are lost or gained. Identify the order of the reactivity series, how the series is organised and used. Describe the reactivity of different groups in the periodic table, such as the alkali metals, halogens, noble gases. Predict the likelihood of a reaction occurring based on displacement, and how a more reactive substance will replace a less reactive substance in a compound. Explain how the reactivity series can be		**Rationale:** **Previous Links:** **Future Links:**		**Rationale:** **Previous Links:** **Future Links:**	

		used to decide on the method of extraction of metals and how it is important to recycle materials. Distinguish between an object and the material from which it is made. Identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock. Describe the simple physical properties of a variety of everyday materials. Compare and group together a variety of everyday materials on the basis of their simple physical properties. Builds on learning from the periodic table in year 8 and atomic structure in year 9. **Future Links:** • Calculations, equilibria and electrolysis in year 10. • Electricity, circuits, magnets and magnetism in year 11.		

				<u>Ecosystems and material cycles</u> Introductory lesson ***Ecosystems and energy transfer*** Abiotic factors & communities CORE PRAC quadrats Biotic factors & communities Biodiversity ***eutrophication and humans*** Preserving biodiversity ***parasitism and mutualism***

						Food security The water cycle The carbon cycle The nitrogen cycle ***Assessing pollution*** ***Decay***	
		Substantive Knowledge	**Disciplinary Knowledge**	**Substantive Knowledge**	**Disciplinary Knowledge**	**Substantive Knowledge** • The different levels of organisation from individual organisms, populations, communities, to the whole ecosystem • The difference between biotic and abiotic factors and how they can affect communities. • The importance of interdependence in a community. • How to investigate the relationship between organisms and their environment using field-work techniques, including quadrats and belt transects. • How to determine the number of	**Disciplinary Knowledge** • How to use random sampling to estimate population size. • How to use a belt transect to investigate the effect of abiotic factors on the distribution of a species.

						organisms, in a given area, using raw data from field-work techniques, including quadrats and belt transects. • The meaning of the term 'biodiversity' and why it is so important. • How human activities can have positive and negative impacts on ecosystems and biodiversity. • The difference between parasitic and mutualistic relationships between organisms. • The stages of the water, carbon and nitrogen cycles and their importance. • How human activity is affecting the carbon cycle and the effect it is having on climate change. • How pollution levels in an ecosystem can be	

						assessed using indicator species. • The biological factors that can affect levels of food security.	
		Rationale: **Previous Links:** **Future Links:**		**Rationale:** **Previous Links:** **Future Links:**		**Rationale:** **Previous Links:** Build on prior learning from KS3 – **Material cycles and energy -** **Photosynthesis -** the reactants in, and products of, photosynthesis, and a word summary for photosynthesis the dependence of almost all life on Earth on the ability of photosynthetic organisms, such as plants and algae, to use sunlight in photosynthesis to build organic molecules that are an essential energy store and to maintain levels of oxygen and carbon dioxide in the atmosphere the adaptations of leaves for photosynthesis. **Interactions and interdependencies** **Relationships in an ecosystem -** the interdependence of organisms in an ecosystem, including food webs and insect pollinated crops the importance of plant reproduction through insect pollination in human food security how organisms affect, and are affected by, their environment, including the accumulation of toxic materials.	

				Builds on knowledge from KS3. **Future Links:** Organic chemistry and Earth's atmosphere in year 11.

<table>
<tr><th colspan="2">YEAR 11</th><th colspan="2">AUTUMN</th><th colspan="2">SPRING</th><th>SUMMER</th></tr>
<tr><td rowspan="3">Year 11</td><td>Theme</td><td colspan="2">Exchange and Transport in Animals, Organic Chemistry and Earth's Atmosphere, Electricity and Circuits, Magnets and Electromagnetic Induction</td><td colspan="2">Homeostasis, Particle Model – Stretching and Squashing, Separate Chemistry</td><td>Revision Exams</td></tr>
<tr><td>Knowledge</td><td colspan="2"><u>Exchange and transport in animals</u>
Introductory lesson
Efficient transport
DIFFUSION AND FICKS LAW
Circulatory system
The heart
Cellular respiration
CORE PRAC respiration</td><td colspan="2"><u>Homeostasis</u>
Introductory lesson
Hormones
Hormones and metabolic rate
The menstrual cycle
Hormones and the menstrual cycle
Blood Glucose
Type 2 diabetes
Thermoregulation
Osmoregulation/the kidney</td><td rowspan="2"></td></tr>
<tr><td></td><td>Substantive Knowledge
• The key features and structure of the circulatory system, including the composition of the blood.
• The structure of the heart and how it is related to its role,</td><td>Disciplinary Knowledge
• Label diagrams of the heart highlighting the four chambers, valves and major blood vessels.
• Calculate cardiac output.
• Measure the impact of</td><td>Substantive Knowledge
• What hormones are and how they are transported around the body.
• The names of hormones, where they are produced in the body and their target organs in the body.
• The role of</td><td>Disciplinary Knowledge
• How to interpret graphs showing hormone levels and the thickness of the uterus lining and link them to the stages of the menstrual cycle.
• The method for carrying out IVF and ART.</td></tr>
</table>

		including the major vessels. • What cellular respiration is and compare the process of anaerobic and aerobic respiration. • How substances are transported around the body and how adaptations improve the efficiency of these processes. • *Triple – The factors that affect the rate of diffusion and how to calculate the rate of diffusion using Fick's Law.*	exercise on heart rate and breathing rate and explain the results. • *Triple – How to calculate the rate of diffusion using Fick's Law.*	hormones in homeostasis. • The role of hormones in controlling metabolism. • The role of hormones in the menstrual cycle. • The different types of contraception, how they work and their advantages and disadvantages. • How IVF and ART are carried out. • The roles of insulin and glucagon in controlling blood glucose levels. • The causes of type I and type II diabetes and how they are controlled.	• The method for controlling blood glucose levels in type I and type II diabetes.	
		Rationale: **Previous Links:** Build on prior learning from KS3 - the consequences of imbalances in the diet, including obesity, starvation and deficiency diseases; the structure and functions of the gas exchange system in		**Rationale:** **Previous Links:** Build on prior learning from KS3 - Understand the key principals of puberty, and changes that happen to the body and why. Explain the process of reproduction, and identify the key organs and cells		

		humans, including adaptations to function; the mechanism of breathing to move air in and out of the lungs, using a pressure model to explain the movement of gases, including simple measurements of lung volume; the effects of recreational drugs (including substance misuse) on behaviour, health and life processes; the impact of exercise, asthma and smoking on the human gas exchange system; aerobic and anaerobic respiration in living organisms, including the breakdown of organic molecules to enable all the other chemical processes necessary for life; a word summary for aerobic respiration; the process of anaerobic respiration in humans and micro-organisms, including fermentation, and a word summary for anaerobic respiration; the differences between aerobic and anaerobic respiration in terms of the reactants, the products formed and the implications for the organism. Builds on knowledge from the Human Body; Genetics and Health, Disease and Development of New Medicine in year 9. **Future Links:** • Revision for GCSE examinations.	involved. Describe the different stages of pregnancy and the process of giving birth. Identify key concepts relating to personal hygiene and why it is important. Understand the processes within the menstrual cycle, what happens, what hormones are involved and where these hormones are produced. Identify the key concepts of a healthy diet and explain the importance of exercise to maintain a healthy body. Identify different types of drug and learn how they affect the body, learn the impact of drugs and short/long term effects they can have on the body. Understand what diseases can be caused by, and that some diseases are communicable and some are non - communicable. Describe the process and effects of vaccination. Name and describe the functions of the main parts of the digestive, musculoskeletal and circulatory systems; and describe and compare different reproductive processes and life cycles in animals Builds on knowledge from Cell division and the nervous system in year 10. **Future Links:** • Revision for GCSE examinations.	
		<u>Organic chemistry and Earth's Atmosphere</u> Introductory lesson	**<u>Particle Model/stretching</u>** Introductory lesson Particles and density	

<table>
<tr><td></td><td></td><td colspan="2">Hydrocarbons
Fractional distillation
The alkane/alkene homologous series
Complete/incomplete combustion
oxidation of hydrocarbons
Combustible fuels and pollution
Breaking down hydrocarbons
Testing with bromine water
The early atmosphere
The changing atmosphere
The atmosphere today</td><td colspan="2">CORE PRAC densities
Energy and changes of state
Energy calculations
CORE PRAC - investigating water
Gas temperature and pressure
Gas pressure and volume
Pressure in fluids
Pressure and up thrust
Bending and stretching
CORE PRAC - springs
Extension and energy transfers</td><td></td></tr>
<tr><td></td><td></td><td>Substantive Knowledge
What hydrocarbons are and the difference in structure between alkanes and alkenes in the homologous series.
How fractional distillation is used to separate hydrocarbon fractions in crude oil and the uses of the fractions.
The changes in properties of the fractions and you go up / down the fractionating column.</td><td>Disciplinary Knowledge
Draw alkanes and alkenes.
Determine the chemical formula of hydrocarbons when using the general formula for alkanes and alkenes.
How to test for the products of combustion.
How to complete tables / graphs / pie charts showing the composition of Earth's atmosphere.
How to interpret graphs showing global</td><td>Substantive Knowledge
The arrangement and movement of particles in each state of matter and what happens during changes of state.
How to calculate density of regular and irregular objects.
The meaning of the terms 'specific heat capacity' and 'specific latent heat' and how to calculate them.
How to investigate specific heat capacity and</td><td>Disciplinary Knowledge
How to find the density of regular and irregular shaped objects.
How to investigate and calculate specific heat capacity and specific latent heat.
How to convert temperatures between Kelvin and Celsius scales.
How to investigate Hooke's Law and find the spring constant.</td><td></td></tr>
</table>

		• How cracking of long chain hydrocarbons is carried and why. • The differences between complete and incomplete combustion and the dangers of the carbon monoxide produced in incomplete combustion. • How the composition of Earth's atmosphere has changed over time and the processes involved.	temperatures and carbon dioxide levels in the atmosphere.	specific latent heat. • How the movement of particles in gases exert pressure on a container. • How to convert temperatures between Kelvin and Celsius scales. • The difference between elastic and inelastic materials. • Hooke's Law - how to investigate the link between spring extension and work done when applying force. • How to calculate spring constant using the equation: Force exerted = spring constant x extension • The energy transfers when a force is applied to a spring and when the force is removed.		
		Rationale: **Previous Links:**		**Rationale:** **Previous Links:** Build on prior learning from KS3 –		

		Build on prior learning from KS3 - the properties of the different states of matter (solid, liquid and gas) in terms of the particle model, including gas pressure; changes of state in terms of the particle model; chemical reactions as the rearrangement of atoms; representing chemical reactions using formulae and using equations; combustion, thermal decomposition, oxidation and displacement reactions; Earth as a source of limited resources and the efficacy of recycling the carbon cycle; the composition of the atmosphere; the production of carbon dioxide by human activity and the impact on climate; fuels and energy resources; the reactants in, and products of, photosynthesis, and a word summary for photosynthesis; the dependence of almost all life on Earth on the ability of photosynthetic organisms, such as plants and algae, to use sunlight in photosynthesis to build organic molecules that are an essential energy store and to maintain levels of oxygen and carbon dioxide in the atmosphere; aerobic and anaerobic respiration in living organisms, including the breakdown of organic molecules to enable all the other chemical processes necessary for life.	**Particle model** the differences in arrangements, in motion and in closeness of particles explaining changes of state, shape and density, the anomaly of ice-water transition atoms and molecules as particles. **Energy in matter** changes with temperature in motion and spacing of particles internal energy stored in materials. Builds on knowledge from States of Matter and Separating Techniques in year 9 and Conservation of Energy in year 10. **Future Links:** • Revision for GCSE examinations.	

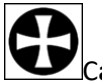
		Builds on knowledge from states of matter and separating substances and plant structures and functions in year 9 and ecosystems and material cycles in year 10. **Future Links:** • Revision for GCSE examinations.		
		<u>Electricity and Circuits</u> Introductory lesson Electrical circuits Current and potential difference Current, charge and energy Resistance More about resistance CORE PRAC resistance Transferring energy Power Transferring energy by electricity ***Charges and static electricity*** ***Dangers and uses of static electricity*** ***Electric fields*** Magnets and magnetic fields Electromagnetism Magnetic forces ***Motor effect*** ***Electromagnetic induction*** Transformers Transformers and energy/***turns ratio equation*** ***Power transmission in high powered voltage cables***	***<u>Triple Only - Separate chemistry 2</u>*** ***Introductory lesson*** ***Homologous series*** ***Polymers and addition polymerisation*** ***Polymer properties/uses and problems*** ***Alcohols and ethanol production*** ***Combustion of alcohols core PRAC*** ***Carboxylic acids*** ***Esters and condensation/polymerisation*** ***Flame tests/photometry and positive ion test*** ***Tests for negative ions*** ***Ion tests core PRAC*** ***Choosing materials*** ***Nanoparticles***	

		Substantive Knowledge	Disciplinary Knowledge	Substantive Knowledge	Disciplinary Knowledge	
		• The components used to make electrical circuits, the symbols for each component and the function of each component. • What current is and how it changes in series and parallel circuits. • What potential difference is and how it changes in series and parallel circuits. • What resistance is, how to calculate it and how resistance of a circuit changes when resistors are placed in series and parallel. • How energy is transferred in circuits and how to calculate it. • What power is and how to calculate it. • The parts of the National Grid and how it transfers energy around the	• Complete circuits diagrams using the correct circuit symbols. • Complete calculations to calculate current, potential difference and resistance. • Calculate energy transferred and power. • Label the parts of a plug. • Draw the shape and direction of a magnetic field around a bar magnet.	•	•	

		current. • Why electricity is transferred by the National Grid at high voltages and the role of transformers in the National Grid. • The parts of a power station and how they produce electricity. • The parts of a plug, the role of each wire and how the Earth wire and fuse act as safety devices. • The shape and direction of a magnetic field and how to find them. • How magnetic fields interact in attraction and repulsion. • How electromagnets are made and how to change the strength of an electromagnet. • *Triple - How magnetic fields interact to produce*				

		the motor effect. • *Triple - How Fleming's left-hand rule is used to show the direction of the force applied in the motor effect and how to calculate it.* • *Triple – How electromagnetic inductions works.*				
		Rationale: **Previous Links:** Build on prior learning from KS3 - electric current, measured in amperes, in circuits, series and parallel circuits, currents add where branches meet and current as flow of charge; potential difference, measured in volts, battery and bulb ratings; resistance, measured in ohms, as the ratio of potential difference (p.d.) to current; differences in resistance between conducting and insulating components; separation of positive or negative charges when objects are rubbed together: transfer of electrons, forces between charged objects; the idea of electric field, forces acting across the space between objects not in contact; magnetic poles, attraction and repulsion; magnetic fields by plotting with compass, representation by field lines; Earth's magnetism, compass		**Rationale:** **Previous Links:** **Future Links:** •		

		and navigation; the magnetic effect of a current, electromagnets, D.C. motors **Future Links:** • Revision for GCSE examinations.		

 **Catholic Social Teaching** Discussions will be had during topics which cover the natural World, space and the impact of humans on the planet on the importance of preserving life which has been created by God and preventing harm God's creation. Specific reference to the Catholic Church's teachings when studying evolution and sex, reproduction and contraception and ART.	 **Preparing for Life in Modern Britain** Individual liberty of own views, tolerance and mutual respect of others views is taught through the topics where different views / ethics are involved. These principals underpin the teaching and conduct of all staff and students within the Science team and curriculum. Rule of law relates to: students following laboratory rules for the safety of all. Understanding of the need to have speed limits (speed, force, change of momentum). Alcohol, tobacco and illegal drugs. Practical activities in science require students to engage in team work and show mutual respect for each other. Democracy is taught through student debates. Resilience and self-esteem are developed through students building independent learning skills, getting answers wrong, learning how to formulate the correct response and responding to target questions.
 **Careers** All topics are introduced with key concepts and prior links to learning, then cross-linked with job roles that match the topic delivered.	 **Skills for Life** To safely and effectively, plan and carry out a practical, write up and interpret data. Focus on how, what and why things happen during experiments. This is the start of their Science journey so we want to have fun. Introduce the roles of health and safety officer, literacy champion and all pupils to achieve

	their Bunsen Burner licence. The spiral curriculum and time committed to teaching these topics have allowed sufficient time for pause, reflect and review.

Cultural Capital and Enrichment Opportunities

Introductory lesson for every topic identifies – key words, literature linked to the topic which is available in the Science library.
Job roles- any job roles specific to the topic will be linked and identified.
Learning journey – you learnt this then, you will learn this now, this will come up again in year ….

Trip opportunities in year 7 - Magna – Water Rocket Challenge Workshop, ZooLab, Chester/Blackpool Zoo visit. Science club. Science library access.
Trip opportunities in year 8 – MOSI workshops throughout the year. Science club. Science library access.
Trip opportunities in year 9 – Salters Chemistry Festival/National Coal Mining Museum/Natural Science and History Museum London.
Trip opportunities in year 10 – University visits/workshops linked to careers in Science.