Long Term Plan: (Science) 2022-23

Year 7 (Science)	Intent	The Science curriculum has ten key ideas that encompass the National Curriculum for Science: Forces; Electromagnets; Energy; Waves; Matter; Reactions; Earth; Organisms; Ecosystems and Genes. Each big idea contains four related topic; their complexity and the relationships between topics, is reflected in the route through. The foundations of the big ideas are laid early in KS3 and then developed throughout the five-year curriculum; it is our intent that by the end of year 11 each student will be able to relate scientific explanations to phenomena around them and confidently take part in the big conversation. An understanding of the nature, processes and methods of science are developed through the scientific enquiry skill families of analyse, communicate, enquire and solve. Together these skill families capture what it means to work scientifically. They are taught alongside the knowledge and conceptual understanding curriculum and develop an understanding of how scientists work. It is the intention that the curriculum will evolve to address the following aims: • Deepen each student's understanding of 'science' through interleaving topics in different big idea topics and identifying common themes such as the relationship between structure and function / properties. • Enquiry skills integrated into the knowledge and conceptual understanding curriculum so that they are developed purposefully in a range of contexts. This will enable students to relate scientific explanations to phenomena but also understand how scientists work to shape the world around us (e.g. how we should respond to phenomena such as global warming and SARS-COV-2). Through explicitly telling the stories of different scientists and the challenges they have faced, including barriers associated with bias related to gender and ethnicity, we begin to address the barriers presented to different cohorts by Science. • Eliminate misconceptions through explicitly addressing them within lessons and through careful consideration of lesson sequences and how they lead to misconceptions. • Develop written communication skills so that by the end of Year 11 students can communicate their ideas about science clearly and concisely. At the end of year 7 students will have studied core ideas that are the foundation of every other topic. They will also have begun to apply these ideas in different contexts. Students will also have begun to develop an understanding of the importance of the scientific method and the scientific community in ensuring rigorous practice.

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	Assessment strategy	Astrea Assessment Weeks: Summative. Cover all content taught to date. Questions are short answer, multiple choice etc. Mid-Assessment Points: Formative. Misconceptions targeted with granular tasks (Best Evidence). Also, a substantial writing question to enable students to explain their ideas.

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		Half Term 1	Half Term 2	Half Term 3	Half Term 4	Half Term 5	Half Term 6
Year 7 (Science)	Disciplinary knowledge	Variables. Use of simple equations Interpretation of graphs. Using simple models. What does it mean to be scientific (the scientific method)?	Conceptual levels via Johnson' triangle (macroscopic, microscopic, symbolic). Writing an effective method. Models of cells. Representing cells in sketches.	The role of the scientific community (CRISPR). Further use of equations. Representing data in tables and graphs (scales given). Evaluating data.	Further use of equations. Representing data in tables and graphs (scales given). Evaluating data. Calculating (e.g., resultant forces).	Application of a model to an application. Identifying and using a range of techniques. Using scientific ideas to explain phenomena.	Making and testing predictions.
	Substantive knowledge	Speed Particle model	Elements Cells & organisation	Cells & Organisation Energy (1 week)	Energy Forces Variation (1 week)	Variation Separating mixtures Fields (2 weeks)	Fields Interdependence
	Justification	**Speed:** Concrete topic that students have an intuitive grasp of. Reduces cognitive load whilst introducing the scientific method. **Particle model:** Threshold topic for many areas; this is a core topic. Enables structure – property relationships to be explored early. Also, enables a theme of scale to be embedded to reduce associated misconceptions.	**Elements:** Core topic that builds on the particle model. Threshold topic for much of chemistry and physical processes. Continues the theme of scale. Introduces formulae and the macroscopic – microscopic – symbolic dynamic. **Cells & Organisation:** Threshold topic at the roots of biology and so is a core topic. Continues theme of scale including into organs, organ systems and whole organisms and the interaction between these as the basis of life.	**Cells & Organisation:** Threshold topic at the roots of biology and so is a core topic. Continues theme of scale including into organs, organ systems and whole organisms and the interaction between these as the basis of life. **Energy: A**bstract concept that is ubiquitous in science. It is taught at this point because it is a core topic that will be too complex to teach sooner. However, it is a threshold concept for many topics. The model used, which is also used at KS4 and beyond, enables a focus on explaining	**Energy: A**bstract concept that is ubiquitous in science. It is taught at this point because it is a core topic that will be too complex to teach sooner. However, it is a threshold concept for many topics. The model used, which is also used at KS4 and beyond, enables a focus on explaining scientifically and using correct terminology. **Forces:** Core topic that is quite abstract so it is taught after other core topic. Fields are taught later as they are more abstract; this reduces misconceptions and	**Variation:** Threshold topic for inheritance, evolution and interdependence. Revisits cells and the nucleus. Also, quite concrete. **Separating mixtures:** Physical properties are studied in the Particle Model topic (spaced retrieval opportunity). These are a threshold topic for this one as physical properties are used to separate mixtures. **Fields:** Fields are covered in two contexts. This builds on the ideas in the Forces topic and so is a good opportunity for spaced retrieval and	**Fields:** Fields are covered in two contexts. This builds on the ideas in the Forces topic and so is a good opportunity for spaced retrieval and interleaving (contact / non-contact). **Interdependence:** Continues the theme of scale and builds on Cells and Organisation to introduce large scale biology.

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				scientifically and using correct terminology.	cognitive load. It also provides an opportunity for spacing and interleaving with discrimination. **Variation:** Threshold topic for inheritance, evolution and interdependence. Revisits cells and the nucleus. Also, quite concrete.	interleaving (contact / non-contact).	
	Keystone vocabulary	Particle State Diffusion	Formula Molecule Monoatomic Giant structure Cell Tissue Organ Organ system	Cell Tissue Organ Organ system Store Pathway Transfer	Store Pathway Transfer Resultant	Variation Inherited Physical property State Field	Field Consumer Producer Food web Food chain Interdependent
	Links to prior learning	**Speed:** None at KS3. **Particle model:** Year 5 Properties and changes of materials; Speed	**Elements:** Year 5 Properties and changes of materials; Particle model & physical processes **Cells & organisation:** Year 5 Living things and their habitats; Year 6 Animals including humans; Particle model & physical processes; Elements and compounds.	**Cells & organisation:** Year 5 Living things and their habitats; Year 6 Animals including humans; Particle model & physical processes; Elements and compounds. **Energy:** None at KS3	**Energy:** None at KS3 **Forces:** None at KS3; Year 5 Forces **Variation:** Year 5 Living things and their habitats; Year 6 Evolution and inheritance; Cells. Organisation and movement.	**Variation:** Year 5 Living things and their habitats; Year 6 Evolution and inheritance; Cells. Organisation and movement. **Separating mixtures:** Particle model & physical processes **Fields:** Year 5 Earth & space; Forces.	**Fields:** Year 5 Forces; Forces **Interdependence:** Year 5 Living things and their habitats; Year 6 Evolution and inheritance; Variation; Energy transfers.
	Cross-curricular and careers links	All Physics topics involve calculations. The skills associated with applying equations (e.g. conversion of units, simple calculations, graphing skills rearranging equations) are also addressed in Maths. Cell Biology also requires simple calculations (e.g. of magnification). The teaching strategies currently being used (direct instruction, embedding routines from Teach Like a Champion) require concentrated listening (TLAC FOCUS) and Speaking skills that are embedded in the Skills Builder framework. Teachers have high expectations of their students and expect them to aim high (a Skills Builder skill). Through applying their developing knowledge students also develop problem solving skills.					

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	Links to future study	**Speed**: Particle model & physical processes; Forces; Energy transfers; Sound; KS4 Forces 2; KS4 energy. **Particle model:** Elements and compounds; Separating mixtures; Periodic Table; Metals & non-metals; Sound; Earth structure; Types of reactions; Photosynthesis; Heating & cooling; Current; Climate; Digestion; KS4 Particle model of matter; KS4 Atomic structure; KS4 Chemistry.	**Elements:** Cells, organisation & movement; Metals & non-metals; Periodic Table; Energy transfers; Earth structure; Types of reactions; Respiration; Acids and alkalis; Climate; Chemical energy; Earth resources; KS4 Chemistry. **Cells & Organisation:** Variation; Photosynthesis; Breathing; Digestion; Respiration; Reproduction; Evolution & inheritance; KS4 Biology.	**Cells & Organisation:** Variation; Photosynthesis; Breathing; Digestion; Respiration; Reproduction; Evolution & inheritance; KS4 Biology. **Energy:** Sound; Wave properties and light; Respiration; Interdependence; Voltage, resistance and electromagnets; Types of reactions; Photosynthesis; Heating and cooling; Climate; Energy costs; Work; Chemical energy; KS4 Energy; KS4 Forces; KS4 electricity; KS4 Waves.	**Energy:** Sound; Wave properties and light; Respiration; Interdependence; Voltage, resistance and electromagnets; Types of reactions; Photosynthesis; Heating and cooling; Climate; Energy costs; Work; Chemical energy; KS4 Energy; KS4 Forces; KS4 electricity; KS4 Waves. **Variation:** Interdependence; Inheritance and evolution; Reproduction; KS4 Inheritance, variation and evolution.	**Variation:** Interdependence; Inheritance and evolution; Reproduction; KS4 Inheritance, variation and evolution. **Separating mixtures:** None at KS3; KS4 Organic chemistry; KS4 Chemical changes; KS4 Chemical analysis; KS4 Using resources. **Fields:** Voltage, resistance and electromagnets; Current; Universe; KS4 Forces; KS4 Magnetism and electromagnetism; KS4 Particle model of matter.	**Fields:** Voltage, resistance and electromagnets; Current; Universe; KS4 Forces; KS4 Magnetism and electromagnetism; KS4 Particle model of matter. **Interdependence:** Evolution & inheritance; Photosynthesis; Climate.
	Assessment	KS3 baseline test		KS3 summative assessment			KS3 summative assessment
	Homework	Homework that reinforces recent classwork is set every week. The class teacher has the autonomy to decide which activity/activities to set.					

Long Term Plan: (Science) 2022-23

Year 8 (Science)	Intent	The Science curriculum has ten key ideas that encompass the National Curriculum for Science: Forces; Electromagnets; Energy; Waves; Matter; Reactions; Earth; Organisms; Ecosystems and Genes. Each big idea contains four related topic; their complexity and the relationships between topics, is reflected in the route through. The foundations of the big ideas are laid early in KS3 and then developed throughout the five-year curriculum; it is our intent that by the end of year 11 each student will be able to relate scientific explanations to phenomena around them and confidently take part in the big conversation. An understanding of the nature, processes and methods of science are developed through the scientific enquiry skill families of analyse, communicate, enquire and solve. Together these skill families capture what it means to work scientifically. They are taught alongside the knowledge and conceptual understanding curriculum and develop an understanding of how scientists work. It is the intention that the curriculum will evolve to address the following aims: • Deepen each student's understanding of 'science' through interleaving topics in different big idea topics and identifying common themes such as the relationship between structure and function / properties. • Enquiry skills integrated into the knowledge and conceptual understanding curriculum so that they are developed purposefully in a range of contexts. This will enable students to relate scientific explanations to phenomena but also understand how scientists work to shape the world around us (e.g. how we should respond to phenomena such as global warming and SARS-COV-2). Through explicitly telling the stories of different scientists and the challenges they have faced, including barriers associated with bias related to gender and ethnicity, we begin to address the barriers presented to different cohorts by Science. • Eliminate misconceptions through explicitly addressing them within lessons and through careful consideration of lesson sequences and how they lead to misconceptions. • Develop written communication skills so that by the end of Year 11 students can communicate their ideas about science clearly and concisely. At the end of year 8, students will have developed expertise in recognising the golden threads of science and integrating these ideas in different applications. For example, ideas about particles, cells and energy are integrated when respiration is studied. Students will be able to apply models in different contexts.

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	Assessment strategy	Astrea Assessment Weeks: Summative. Cover all content taught to date. Questions are short answer, multiple choice etc. Mid-Assessment Points: Formative. Misconceptions targeted with granular tasks (Best Evidence). Also, a substantial writing question to enable students to explain their ideas.

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		Half Term 1	Half Term 2	Half Term 3	Half Term 4	Half Term 5	Half Term 6
Year 8 (Science)	Disciplinary knowledge	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Metals and non-metals: Use appropriate techniques and apparatus to observe reactions of metals. Photosynthesis: Ask questions based on observations of the real world related to plants and conditions require for growth.	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Wave properties & Light: Use a model to explain reflection, absorption and transmission of light. Breathing: Evaluate a model for showing the mechanism of breathing.	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Pressure: Use the idea of pressure changing to explain inhalation and exhalation. Digestion: Make deductions from medical symptoms showing problems with the digestive system.	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Respiration: Use word equations to describe aerobic and anaerobic respiration. Acids & alkalis: Use appropriate techniques and apparatus to observe reactions of metals.	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Current: Turn circuit diagrams into real series and parallel circuits, and vice versa. Heating & cooling: Interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions Types of reactions: Use particle diagrams to show what happens in a reaction.	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Earth structure: Explain the properties of rocks using a cooling model. Reproduction: Make and record observations related to flower structure and relate to the mode of pollination.
	Substantive knowledge	Metals & non-metals Photosynthesis	Wave properties & Light Breathing Pressure (1 week)	Pressure Digestion	Respiration Acids & alkalis Current (1 week)	Current Heating & cooling Types of reactions Earth structure (1 week)	Earth structure Reproduction
	Justification	**Metals and non-metals:** Builds on Elements and the Particle Model to introduce specific chemical reactions.	**Wave properties & light:** Year 6 Light; Concept about waves that is more abstract than that seen in the previous Sound topic.	**Pressure:** Complex topic so it is taught later. It also allows for deeper learning of the Breathing topic.	**Respiration:** Integrates ideas from breathing and digestion as well as chemical reactions and energy. This is complex	**Current:** Year 6 Electricity; Threshold concepts include Particle Theory, Fields, Energy. As all threshold topics are	**Earth structure:** Threshold concepts of physical and chemical processes applied on a large scale.

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		Photosynthesis: Integrates ideas from Cells and Organisation, Particle Model, Elements, Energy, Chemical Reactions, Interdependence etc. All of these topics contain threshold concepts.	Good opportunity for spaced retrieval of Sound and related topics and also interleaving as it requires discrimination between similar ideas. **Breathing:** Pressure is taught after Breathing to reduce demands on the working memory (breathing is complex). Only the mechanics of breathing are taught. Threshold topics are Cells and Organisation, Movement, Particle Model (diffusion). Placement here also allows coherent sequencing of Breathing, Pressure, Digestion and Respiration.	Threshold topics include Forces, Particle Model. **Digestion:** Digestion and breathing integrate and feed into Respiration (which follows). Cells and organisation is a threshold topic as area ideas about particles.	and so has been left until year 8. **Acids and alkalis:** Builds on chemical reactions and introduces neutralisation. Interleaving could be used here to push students to discriminate between different types of chemical reaction. **Current:** Year 6 Electricity; Threshold concepts include Particle Theory, Fields, Energy. As all threshold topics are abstract this is not taught in Y7. Potential difference has been separated from Current so working memory is not overloaded; this route allows Current to be chunked when working on Potential Difference. Pd is simply addressed as 'electrical push'.	abstract this is not taught in Y7. Potential difference has been separated from Current so working memory is not overloaded; this route allows Current to be chunked when working on Potential Difference. Pd is simply addressed as 'electrical push'. **Heating & cooling:** Requires discrimination of methods using particles and those using energy waves. Requires knowledge of multiple threshold concepts that are quite abstract (Energy, Particle Theory, Wave Properties etc) so it is taught later. **Types of reactions:** Chemical reactions have been addressed in relatively simple ways throughout the course. More complex reactions are introduced here (combustion, thermal decomposition). Good opportunity for spaced retrieval and interleaving (including discrimination).	**Reproduction:** Year 5Animals including humans; Human and plant reproduction are covered. Cells and Organisation and Variation and threshold topics.
	Keystone vocabulary	Metal Non-metal	Wave Energy transfer	Fluid Flow	Respiration Reactant	Circuit Current	Layer Cell

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		Physical Reactivity Biodiversity Producer Photosynthesis	Transverse Longitudinal Reflect Refract Inhale Exhale Exchange Fluid Flow	Exchange Digest Enzyme Organ	Product Aerobic Anaerobic Neutralisation Acid Alkali Circuit Current	Transfer Store Pathway Chemical Reaction Layer	Fertilisation Pollination
	Links to prior learning	**Metals & non-metals:** Particle model & physical processes; Elements and compounds. **Photosynthesis:** Energy transfers; Particle model & physical processes; Interdependence; Cells, organisation & movement.	**Wave properties & Light:** Energy transfers; Sound. **Breathing:** Cells, organisation & movement; Particle model & physical processes. **Pressure:** Particle model & physical processes; Forces.	**Pressure:** Particle model & physical processes; Forces. **Digestion:** Cells, organisation & movement; Particle model & physical processes.	**Respiration:** Breathing; Digestion; Elements and compounds; Energy transfers; Cells, organisation & movement. **Acids & alkalis:** Metals and non-metals; Elements and compounds; Digestion. **Current:** Fields; Particle model & physical processes.	**Current:** Fields; Particle model & physical processes. **Heating & cooling:** Wave properties & light; Particle model & physical process; Energy transfers. **Types of reactions:** Year 5 Properties and changes of materials; Elements & compounds; Particle model and physical changes; Energy Transfers. **Earth structure:** Particle model and physical changes; Elements & compounds.	**Earth structure:** Particle model and physical changes; Elements & compounds. **Reproduction:** Cells, organisation and movement; Variation.
	Cross-curricular and careers links	All Physics topics involve calculations. The skills associated with applying equations (e.g. conversion of units, simple calculations, graphing skills rearranging equations) are also addressed in Maths. Cell Biology also requires simple calculations (e.g. of magnification). The teaching strategies currently being used (direct instruction, embedding routines from Teach Like a Champion) require concentrated listening (TLAC FOCUS) and Speaking skills that are embedded in the Skills Builder framework. Teachers have high expectations of their students and expect them to aim high (a Skills Builder skill). Through applying their developing knowledge students also develop problem solving skills.					
	Links to future study	**Metals and non-metals:** Periodic Table; Acids & alkalis; Earth resources.	**Wave properties & light:** Wave effects; Heating & cooling; KS4 Waves. **Breathing:** Respiration.	**Pressure:** None at KS3; KS4 Forces. **Digestion:** Respiration; Acids & alkalis; KS4	**Respiration:** Climate; KS4 Bioenergetics; KS4 Cell Biology; KS4 Organisation.	**Current:** Wave Effects; Voltage, resistance and electromagnets; KS4 Electricity; KS4 Forces 1.	**Earth structure:** None at KS3. **Reproduction:** Evolution & inheritance; KS4

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		Photosynthesis: Respiration; Climate; KS4 Bioenergetics; KS4 Ecology.	**Pressure:** None at KS3; KS4 Forces.	Organisation; KS4 Bioenergetics.	**Acids and alkalis:** None at KS3; KS4 Chemical Changes. **Current:** Wave Effects; Voltage, resistance and electromagnets; KS4 Electricity; KS4 Forces 1.	**Heating and cooling:** Climate; Universe. **Types of reactions:** Chemical energy. **Earth structure:** None at KS3.	Inheritance, variation and response.
	Assessment	KS3 baseline test		KS3 summative assessment			KS3 summative assessment
	Homework	Homework that reinforces recent classwork is set every week. The class teacher has the autonomy to decide which activity/activities to set.					

Long Term Plan: (Science) 2022-23

Year 9 (Science)	Intent	The Science curriculum has ten key ideas that encompass the National Curriculum for Science: Forces; Electromagnets; Energy; Waves; Matter; Reactions; Earth; Organisms; Ecosystems and Genes. Each big idea contains four related topic; their complexity and the relationships between topics, is reflected in the route through. The foundations of the big ideas are laid early in KS3 and then developed throughout the five-year curriculum; it is our intent that by the end of year 11 each student will be able to relate scientific explanations to phenomena around them and confidently take part in the big conversation. An understanding of the nature, processes and methods of science are developed through the scientific enquiry skill families of analyse, communicate, enquire and solve. Together these skill families capture what it means to work scientifically. They are taught alongside the knowledge and conceptual understanding curriculum and develop an understanding of how scientists work. It is the intention that the curriculum will evolve to address the following aims: • Deepen each student's understanding of 'science' through interleaving topics in different big idea topics and identifying common themes such as the relationship between structure and function / properties. • Enquiry skills integrated into the knowledge and conceptual understanding curriculum so that they are developed purposefully in a range of contexts. This will enable students to relate scientific explanations to phenomena but also understand how scientists work to shape the world around us (e.g. how we should respond to phenomena such as global warming and SARS-COV-2). Through explicitly telling the stories of different scientists and the challenges they have faced, including barriers associated with bias related to gender and ethnicity, we begin to address the barriers presented to different cohorts by Science. • Eliminate misconceptions through explicitly addressing them within lessons and through careful consideration of lesson sequences and how they lead to misconceptions. • Develop written communication skills so that by the end of Year 11 students can communicate their ideas about science clearly and concisely. By the end of year 9, students will have developed a good understanding of how the three scientific disciplines interact and can be used to explain a wide range of natural phenomena. They will have a strong understanding of how scientists and the scientific community works in an effort to understand the world around us.

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	Assessment strategy	Astrea Assessment Weeks: Summative. Cover all content taught to date. Questions are short answer, multiple choice etc. Mid-Assessment Points: Formative. Misconceptions targeted with granular tasks (Best Evidence). Also, a substantial writing question to enable students to explain their ideas.

		Half Term 1	Half Term 2	Half Term 3	Half Term 4	Half Term 5	Half Term 6
Year 9 (Science)	Disciplinary knowledge	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Types of reaction: Use particle diagrams to show what happens in a reaction. Heating and cooling: Interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions Work: Use the formula: work done (J) = force (N) x distance moved (m) to compare energy transferred for objects moving horizontally.	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Reproduction: Make and record observations related to flower structure and relate to the mode of pollination. Periodic table: Use data to describe a trend in physical properties. Chemical energy: Use experimental observations to distinguish exothermic and endothermic reactions.	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Wave effects: Use the particle model to explain the transfer of sound. Inheritance & evolution: Find out why scientists Watson, Crick and Franklin were so important.	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Earth resources: Use data to evaluate proposals for recycling materials. Climate: Use a model, the Greenhouse Effect, to explain global warming.	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Universe: Make deductions from observation data of planets, stars and galaxies. KS4 Atomic structure (Chem):	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. KS4 Particle model of matter: Students should be able to recognise/draw simple diagrams to model the difference between solids, liquids and gases. KS4 Cell biology: Students should be able to: • understand how microscopy techniques have developed over time • explain how electron microscopy has increased understanding of sub-cellular structures.
	Substantive knowledge	Types of reaction Heating and cooling Work	Reproduction Periodic table Chemical energy	Wave effects Inheritance & evolution (1 week)	Inheritance & evolution Earth resources Climate	Universe KS4 Atomic structure (Chem)	KS4 Particle model of matter KS4 Cell biology

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						KS4 Particle model of matter (1 week)	
	Justification	**Types of reactions:** Chemical reactions have been addressed in relatively simple ways throughout the course. More complex reactions are introduced here (combustion, thermal decomposition). Good opportunity for spaced retrieval and interleaving (including discrimination). **Heating & cooling:** Requires discrimination of methods using particles and those using energy waves. Requires knowledge of multiple threshold concepts that are quite abstract (Energy, Particle Theory, Wave Properties etc) so it is taught later. **Work:** Threshold concepts are Forces and Energy.	**Reproduction:** Human and plant reproduction are covered. Cells and Organisation and Variation and threshold topics. **Periodic table:** Metals and non-metals are a threshold topic as reactivity was introduced there. Other threshold concepts include Particle Model, Elements and Types of Reactions. **Chemical energy:** Threshold topics are the Particle Model (physical changes), all chemistry topics and Energy. Complex topic that requires a secure grasp of chemistry and what happens during a chemical reaction. Complexity is increased as the Particle Model and Energy are integrated.	**Wave effects:** This topic builds on the other topics related to waves. However, it also requires good knowledge of electricity and pressure. All of these concepts need to be applied to given situations, hence scheduling it later in the route through. **Inheritance & evolution:** Threshold topics: Cells and Organisation and Variation. It also builds on concepts covered in Interdependence. As Evolution is poorly understood by many students it has been left to the end so that students have a chance to develop.	**Inheritance & evolution:** Threshold topics: Cells and Organisation and Variation. It also builds on concepts covered in Interdependence. As Evolution is poorly understood by many students it has been left to the end so that students have a chance to develop. **Earth resources:** This is a complex chemistry topic that draws on a number of other topics. It is therefore left to the end to enable students to master the concepts required if they are to be successful. **Climate:** On a large scale so follows Earth Structure well. Involves cycles and so is related to Interdependence whilst being more abstract (relating microscopic to the highly macroscopic). So has to follow Interdependence. Threshold concepts include Photosynthesis, Respiration, Energy, Elements, Chemical	**Universe:** Fields are a threshold concept. Students often struggle to explain the phases of the moon, lengths of daylight hours changing throughout the year. This is partly due to the massive scale involved but also having to visualise in three dimensions. This topic is taught towards the end of the route through due to these issues. **KS4 Atomic Structure (C):** Atomic structure is a threshold concept for Chemistry. It is taught early because of this and it builds directly onto related KS3 topics. **KS4 Particle model of matter:** Threshold topic that is drawn upon throughout K4.	**KS4 Particle model of matter:** Threshold topic that is drawn upon throughout K4. **Cell Biology:** The first topic in Biology, it sets out the basics of living things that other topics build on. For example, it adds detail to KS3 concepts whilst building on the theme of scale that runs through KS3 and KS4. It is also a threshold concept for Organisation, Ecology etc.

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				Reactions, Heating and Cooling.		
Keystone vocabulary	Transfer Store Pathway Chemical Reaction Transfer	Fertilisation Pollination Element Group Period Property Exothermic Endothermic	Gene Natural selection Variation Evolve	Natural selection Variation Evolve Photosynthesis Respiration Interdependent Cycle	Atom Formula Model Configuration Electron Periodic Group Density Pressure Volume Latent Capacity	Density Pressure Volume Latent Capacity Differentiated Specialist Concentration Solution Osmosis Diffusion Function
Links to prior learning	**Types of reactions:** Year 5 Properties and changes of materials; Elements & compounds; Particle model and physical changes; Energy Transfers. **Heating and cooling:** Wave properties & light; Particle model & physical process; Energy transfers. **Work:** Forces; Energy.	**Reproduction:** Year 5 Animals including humans; Cells, organisation and movement; Variation. **Periodic table:** Particle model & physical processes; Elements and compounds; Metals and non-metals. **Chemical energy:** Elements and compounds; Energy transfers; Types of reaction.	**Wave effects:** Sound; Wave properties & light; Current; Voltage, resistance and electromagnets. **Inheritance & evolution:** Year 6 Evolution and inheritance Cells. Organisation and movement; Variation; Reproduction; Interdependence.	**Inheritance & evolution:** Cells. Organisation and movement; Variation; Reproduction; Interdependence. **Earth resources:** Particle model and physical changes; Elements & compounds. **Climate:** Photosynthesis; Respiration; Elements & compounds; Interdependence; Particle model & physical processes; Energy transfers; Heating & cooling.	**Universe:** Year 5 Earth and space; Year 5 Forces; Forces. **KS4 Atomic structure (Chem):** KS3 Particle model. **KS4 Particle model of matter:** KS3 Fields; KS3 Particle model.	**KS4 Particle model of matter:** KS3 Fields; KS3 Particle model. **KS4 Cell biology:** KS3 Cells and organisation; most of KS3 Biology!
Cross-curricular and careers links	All Physics topics involve calculations. The skills associated with applying equations (e.g. conversion of units, simple calculations, graphing skills rearranging equations) are also addressed in Maths. Cell Biology also requires simple calculations (e.g. of magnification). The teaching strategies currently being used (direct instruction, embedding routines from Teach Like a Champion) require concentrated listening (TLAC FOCUS) and Speaking skills that are embedded in the Skills Builder framework. Teachers have high expectations of their students and expect them to aim high (a Skills Builder skill). Through applying their developing knowledge students also develop problem solving skills.					

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	Links to future study	**Types of reactions:** Chemical energy; KS4 Chemical changes; KS4 Rate and extent of chemical change; KS4 Organic chemistry; KS4 Chemistry of the atmosphere; KS4 Using resources. **Heating and cooling:** Climate; Universe; KS4 Energy. **Work:** None at KS3; KS4 Energy.	**Reproduction:** Evolution & inheritance; KS4 Inheritance, variation and evolution. **Periodic table:** None at KS3; KS4 Chemistry. **Chemical Energy:** None at KS3; KS4 Energy; KS4 The rate and extent of chemical change.	**Wave effects:** None at KS3; KS4 Waves. **Inheritance & evolution:** None at KS3; KS4 Inheritance, variation and evolution.	**Inheritance & evolution:** None at KS3; KS4 Inheritance, variation and evolution. **Earth resources:** None at KS3; KS4 using resources. **Climate:** None at KS3; KS4 Chemistry of the atmosphere.	**Universe:** None at KS3; KS4 Space. **KS4 Atomic structure (Chem):** All of KS4 Chemistry; KS4 Particle Model of Matter **KS4 Particle model of matter:** KS4 Rate and extent of chemical change; KS4 Energy.	**KS4 Particle model of matter:** KS4 Rate and extent of chemical change; KS4 Energy. **KS4 Cell biology:** KS4 Organisation; KS4 Infection & response; KS4 Bioenergetics; KS4 Homeostasis & response.
	Assessment	KS3 baseline test		KS3 summative assessment			KS3 summative assessment
	Homework	Homework that reinforces recent classwork is set every week. The class teacher has the autonomy to decide which activity/activities to set.					

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Year 10 (Science)	Intent	The Science curriculum has ten key ideas that encompass the National Curriculum for Science: Forces; Electromagnets; Energy; Waves; Matter; Reactions; Earth; Organisms; Ecosystems and Genes. Each big idea contains four related topic; their complexity and the relationships between topics, is reflected in the route through. The foundations of the big ideas are laid early in KS3 and then developed throughout the five-year curriculum; it is our intent that by the end of year 11 each student will be able to relate scientific explanations to phenomena around them and confidently take part in the big conversation. An understanding of the nature, processes and methods of science are developed through the scientific enquiry skill families of analyse, communicate, enquire and solve. Together these skill families capture what it means to work scientifically. They are taught alongside the knowledge and conceptual understanding curriculum and develop an understanding of how scientists work. It is the intention that the curriculum will evolve to address the following aims: • Deepen each student's understanding of 'science' through interleaving topics in different big idea topics and identifying common themes such as the relationship between structure and function / properties. • Enquiry skills integrated into the knowledge and conceptual understanding curriculum so that they are developed purposefully in a range of contexts. This will enable students to relate scientific explanations to phenomena but also understand how scientists work to shape the world around us (e.g. how we should respond to phenomena such as global warming and SARS-COV-2). Through explicitly telling the stories of different scientists and the challenges they have faced, including barriers associated with bias related to gender and ethnicity, we begin to address the barriers presented to different cohorts by Science. • Eliminate misconceptions through explicitly addressing them within lessons and through careful consideration of lesson sequences and how they lead to misconceptions. • Develop written communication skills so that by the end of Year 11 students can communicate their ideas about science clearly and concisely. By the end of year 10, students will have a more detailed understanding of the golden threads of science including the models that are used to understand phenomena and make predictions. They will have begun to apply these ideas to explain complex ideas such as factors that affect the rate of reaction. They will be able to describe, represent and interpret data from experiments and investigations.

Long Term Plan: (Science) 2022-23

	Assessment strategy	Mock examinations and assessment weeks are summative and use past papers and past paper questions respectively. MAPs are formative and give the teacher feedback on recent content and associated skills.

		Half Term 1	Half Term 2	Half Term 3	Half Term 4	Half Term 5	Half Term 6
Year 10 (Science)	Disciplinary knowledge	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Cell biology: Students should be able to: • understand how microscopy techniques have developed over time • explain how electron microscopy has increased understanding of sub-cellular structures. Organisation: Students should be able to use the 'lock and key theory' as a simplified model to explain enzyme action	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Bonding and structure: Students should be able to draw dot and cross diagrams for ionic compounds formed by metals in Groups 1 and 2 with non-metals in Groups 6 and 7. Quantitative chemistry: Students should understand the use of the multipliers in equations in normal script before a formula and in subscript within a formula.	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Infection & response: Students should be able to explain how diseases caused by viruses, bacteria, protists and fungi are spread in animals and plants. Atomic structure (Phy): Students should be able to relate differences between isotopes to differences in conventional representations of their identities, charges and masses.	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Chemical changes: Students should be able to predict the products of the electrolysis of aqueous solutions containing a single ionic compound. Energy: Use calculations to show on a common scale how the overall energy in a system is redistributed when the system is changed.	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Energy: Use calculations to show on a common scale how the overall energy in a system is redistributed when the system is changed. Energy changes: Using accurate observations to determine whether reactions are exothermic or endothermic.	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Electricity: Students should be able to draw and interpret circuit diagrams. Forces 1: Use free body diagrams to describe qualitatively examples where several forces lead to a resultant force on an object, including balanced forces when the resultant force is zero. Rates of reaction: Students should be able to : • predict and explain using collision theory the effects of changing conditions of concentration, pressure and temperature on the rate of a reaction

Long Term Plan: (Science) 2022-23

	Substantive knowledge	Cell biology: Organisation	Organisation (1 week) Bonding and structure Quantitative chemistry (1 week)	Quantitative chemistry Infection & response Atomic structure (Phy) (1 week)	Atomic structure (Phy) Bioenergetics Chemical changes Energy (1 week)	Energy Energy changes	Electricity Forces 1 Rates of reaction
	Justification	**Cell Biology:** The first topic in Biology, it sets out the basics of living things that other topics build on. For example, it adds detail to KS3 concepts whilst building on the theme of scale that runs through KS3 and KS4. It is also a threshold concept for Organisation, Ecology etc. **Organisation:** This topic leads on from the cell biology topic studied in Y9 and develops students understanding of how living things are organised. The theme of scale is revisited.	**Organisation:** This topic leads on from the cell biology topic studied in Y9 and develops students understanding of how living things are organised. The theme of scale is revisited. **Bonding & structure:** This topic leads on from Atomic Structure; it builds on knowledge of atoms to explain how they form compounds. Atomic Structure is a threshold topic for this one. **Quantitative chemistry:** Quantitative chemistry provides students with a deeper understanding of the chemical reaction and the law of conservation of mass whilst also introducing the concept of the mole.	**Quantitative chemistry:** Quantitative chemistry provides students with a deeper understanding of the chemical reaction and the law of conservation of mass whilst also introducing the concept of the mole. **Infection & response:** The topic describes the structure of pathogens and how diseases are transmitted using previous knowledge of cells & organisation. It requires an understanding of specialised cells, the hieerarchy in the body and large-scale impacts (e.g. malaria) and so revisits scale. **Atomic structure (P):** Revisiting atomic structure and its relationship with radioactivity.	**Atomic structure (P):** Revisiting atomic structure and its relationship with radioactivity. **Bioenergetics:** This topic has Cell Biology and the preceding chemistry topics as threshold concepts. This topic integrates Biology and Chemistry topics and so is taught when students are still quite high on the forgetting curve so chunking will be more effective. **Chemical changes:** Follows on from atomic structure, bonding and structure etc.	**Energy:** Abstract topic that is also a core topic. Revisited in various topics. **Energy changes:** Requires knowledge of chemical reactions and energy.	**Electricity:** The KS4 topic builds on the KS3 SoL well. So whilst it is quite complex students can study it early on in KS4. It serves as a threshold topic for Magnetism and so is taught before it. **Forces 1:** Forces links back to the Energy topic and revisits work. **Rates of reaction:** Builds on the understanding of particle behaviour and reactions & applies this to the world around them
	Keystone vocabulary	Differentiated Specialist Concentration Solution Osmosis Diffusion	Carcinogen Exchange Component Artery Causal Diffusion	Conservation Limiting Relative Formula Mass Reactant	Atomic Radioactive Decay Nuclear Contamination Hazard	Potential Elastic Dissipate Efficiency Transfer Capacity	Circuit Component Characteristic Resistance Transmit Current

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		Function Carcinogen Exchange Component Artery Causal Diffusion	Ionic Covalent Metallic Alloy Molecule Polymer Conservation Limiting Relative Formula Mass Reactant	Microorganism Communicable Pathogen Vector Response Infection Resistance Immune Atomic Radioactive Decay Nuclear Contamination Hazard	Photosynthesis Respiration Reactants Aerobic Anaerobic Saturation Response Potential Elastic Dissipate Efficiency Transfer Capacity	Energy Exothermic Endothermic Profile Temperature Activation	Resultant Rate Collision Catalyst Activation Equilibrium Reversible
	Links to prior learning	**Cell biology:** KS3 Cell biology; most of KS3 Biology. **Organisation:** KS3 Cells and organisation.	**Organisation:** KS3 Cells and organisation. **Bonding and structure:** Atomic structure; KS3 Periodic Table. **Quantitative chemistry:** KS3 Elements.	**Quantitative chemistry:** KS3 Elements. **Infection & response:** Cells and organisation. **Atomic structure (Phy):** Atomic structure (chem); KS3 Energy.	**Atomic structure (Phy):** Atomic structure (chem); KS3 Energy. **Bioenergetics:** KS4 Cells and organisation; KS3 Photosynthesis; KS3 Digestion; KS3 Respiration. **Chemical changes:** KS3 Separating mixtures; KS3 Acids and alkalis; KS3 Types of reactions. **Energy;** KS3 Energy.	**Energy:** KS3 Energy; KS3 Speed; KS3 Heating and cooling; KS3 Work. **Energy changes:** KS3 Energy.	**Electricity:** KS3 Current; K3 Potential difference and resistance; KS3 Energy; KS3 Forces. **Forces 1:** KS3 forces; KS3 Fields; KS4 Energy. **Rates of reaction:** KS3 Types of reaction; Bonding and structure; Atomic structure.
	Cross-curricular and careers links	All Physics topics involve calculations. The skills associated with applying equations (e.g. conversion of units and rearranging equations) are also addressed in Maths. Quantitative Chemistry also requires mastery of mathematical skills including ratios. Cell Biology requires conversion of units and basic calculations and so draws on mathematical skills developed in KS3 and KS4 mathematics. The teaching strategies currently being used (direct instruction, embedding routines from Teach Like a Champion) require concentrated listening (TLAC FOCUS) and Speaking skills that are embedded in the Skills Builder framework. Teachers have high expectations of their students and expect them to aim high (a Skills Builder skill). Through applying their developing knowledge students also develop problem solving skills.					

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	Links to future study	**Cell biology:** KS4 Organisation; KS4 Infection & response; KS4 Bioenergetics; KS4 Homeostasis & response. **Organisation**: KS4 Infection & response; KS4 Homeostasis & response.	**Organisation**: KS4 Infection & response; KS4 Homeostasis & response. **Bonding and structure:** All of KS4 Chemsitry. **Quantitative chemistry:** KS4 Rate and extent of chemical change.	**Quantitative chemistry:** KS4 Rate and extent of chemical change. **Infection & response:** KS4 Ecology **Atomic structure (Phy):** KS4 Waves.	**Atomic structure (Phy):** KS4 Waves. **Bioenergetics:** KS4 Ecology. **Chemical changes:** KS4 KS4 Energy changes; KS4 The rate and extent of chemical change; KS4 Organic chemistry; KS4 Chemistry of the atmosphere; KS4 Using resources. **Energy;** KS4 Electricity; KS4 Waves; KS4 Forces.	**Energy;** KS4 Electricity; KS4 Waves; KS4 Forces. **Energy changes:** KS4 the rate and extent of chemical change.	**Electricity:** KS4 Magnetism and electromagnetism. **Forces 1:** KS4 Forces 2; KS4 Magnetism and electromagnetism. **Rates of reaction:** None.
	Assessment		Astrea summative assessment	Astrea summative assessment		Y10 mock exams	
	Homework	Homework that reinforces recent classwork is set every week. The class teacher has the autonomy to decide which activity/activities to set.					

Long Term Plan: (Science) 2022-23

Year 10 (Separate Sciences)	Intent	The Science curriculum has ten key ideas that encompass the National Curriculum for Science: Forces; Electromagnets; Energy; Waves; Matter; Reactions; Earth; Organisms; Ecosystems and Genes. Each big idea contains four related topic; their complexity and the relationships between topics, is reflected in the route through. The foundations of the big ideas are laid early in KS3 and then developed throughout the five-year curriculum; it is our intent that by the end of year 11 each student will be able to relate scientific explanations to phenomena around them and confidently take part in the big conversation. An understanding of the nature, processes and methods of science are developed through the scientific enquiry skill families of analyse, communicate, enquire and solve. Together these skill families capture what it means to work scientifically. They are taught alongside the knowledge and conceptual understanding curriculum and develop an understanding of how scientists work. It is the intention that the curriculum will evolve to address the following aims: • Deepen each student's understanding of 'science' through interleaving topics in different big idea topics and identifying common themes such as the relationship between structure and function / properties. • Enquiry skills integrated into the knowledge and conceptual understanding curriculum so that they are developed purposefully in a range of contexts. This will enable students to relate scientific explanations to phenomena but also understand how scientists work to shape the world around us (e.g. how we should respond to phenomena such as global warming and SARS-COV-2). Through explicitly telling the stories of different scientists and the challenges they have faced, including barriers associated with bias related to gender and ethnicity, we begin to address the barriers presented to different cohorts by Science. • Eliminate misconceptions through explicitly addressing them within lessons and through careful consideration of lesson sequences and how they lead to misconceptions. • Develop written communication skills so that by the end of Year 11 students can communicate their ideas about science clearly and concisely. By the end of year 10, students will have a more detailed understanding of the golden threads of science including the models that are used to understand phenomena and make predictions. They will have begun to apply these ideas to explain complex ideas such as factors that affect the rate of reaction. They will be able to describe, represent and interpret data from experiments and investigations.

Long Term Plan: (Science) 2022-23

	Assessment strategy	Mock examinations and assessment weeks are summative and use past papers and past paper questions respectively. MAPs are formative and give the teacher feedback on recent content and associated skills.

Long Term Plan: (Science) 2022-23

		Half Term 1	Half Term 2	Half Term 3	Half Term 4	Half Term 5	Half Term 6
Year 10 (Separate Science)	Disciplinary knowledge	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Cell biology: Students should be able to: • understand how microscopy techniques have developed over time • explain how electron microscopy has increased understanding of sub-cellular structures. Organisation: Students should be able to use the 'lock and key theory' as a simplified model to explain enzyme action	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Bonding and structure: Students should be able to draw dot and cross diagrams for ionic compounds formed by metals in Groups 1 and 2 with non-metals in Groups 6 and 7. Quantitative chemistry: Students should understand the use of the multipliers in equations in normal script before a formula and in subscript within a formula.	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Infection & response: Students should be able to explain how diseases caused by viruses, bacteria, protists and fungi are spread in animals and plants. Atomic structure (Phy): Students should be able to relate differences between isotopes to differences in conventional representations of their identities, charges and masses.	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Chemical changes: Students should be able to predict the products of the electrolysis of aqueous solutions containing a single ionic compound.	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Energy: Use calculations to show on a common scale how the overall energy in a system is redistributed when the system is changed. Energy changes: Using accurate observations to determine whether reactions are exothermic or endothermic.	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Electricity: Students should be able to draw and interpret circuit diagrams. Forces 1: Use free body diagrams to describe qualitatively examples where several forces lead to a resultant force on an object, including balanced forces when the resultant force is zero. Rates of reaction: Students should be able to : • predict and explain using collision theory the effects of changing conditions of concentration, pressure and temperature on the rate of a reaction

Long Term Plan: (Science) 2022-23

	Substantive knowledge	Cell Biology Organsiation	Bonding & structure Quantitative chemistry Bioenergetics (1 week)	Bioenergetics Infection and response Atomic structure (Phy) (1 week)	Atomic structure Chemical changes Energy	Energy changes Electricity (2 weeks)	Electricity Forces 1 Rates of reaction Forces 2
	Justification	**Cell Biology:** The first topic in Biology, it sets out the basics of living things that other topics build on. For example, it adds detail to KS3 concepts whilst building on the theme of scale that runs through KS3 and KS4. It is also a threshold concept for Organisation, Ecology etc. **Organisation:** This topic leads on from the cell biology topic studied in Y9 and develops students understanding of how living things are organised. The theme of scale is revisited.	**Bonding & structure:** This topic leads on from Atomic Structure; it builds on knowledge of atoms to explain how they form compounds. Atomic Structure is a threshold topic for this one. **Quantitative chemistry:** Quantitative chemistry provides students with a deeper understanding of the chemical reaction and the law of conservation of mass whilst also introducing the concept of the mole. **Bioenergetics:** This topic has Cell Biology and the preceding chemistry topics as threshold concepts. This topic integrates Biology and Chemistry topics and so is taught when students are still quite high on the forgetting curve so chunking will be more effective.	**Bioenergetics:** This topic has Cell Biology and the preceding chemistry topics as threshold concepts. This topic integrates Biology and Chemistry topics and so is taught when students are still quite high on the forgetting curve so chunking will be more effective. **Infection & response:** The topic describes the structure of pathogens and how diseases are transmitted using previous knowledge of cells & organisation. It requires an understanding of specialised cells, the hieerarchy in the body and large-scale impacts (e.g. malaria) and so revisits scale. **Atomic structure (P):** Revisiting atomic structure and its relationship with radioactivity.	**Atomic structure (P):** Revisiting atomic structure and its relationship with radioactivity. **Chemical changes:** Follows on from atomic structure, bonding and structure etc.	**Energy:** Abstract topic that is also a core topic. Revisited in various topics. **Energy changes:** Requires knowledge of chemical reactions and energy.	**Electricity:** The KS4 topic builds on the KS3 SoL well. So whilst it is quite complex students can study it early on in KS4. It serves as a threshold topic for Magnetism and so is taught before it. **Forces 1:** Forces links back to the Energy topic and revisits work. **Rates of reaction:** Builds on the understanding of particle behaviour and reactions & applies this to the world around them **Forces 2:** Forces related to motion. Requires a thorough understanding of Forces and their effects. Builds on some ideas in Forces 1.

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	Keystone vocabulary	Differentiated Specialist Concentration Solution Osmosis Diffusion Function Carcinogen Exchange Component Artery Causal Diffusion	Ionic Covalent Metallic Alloy Molecule Polymer Conservation Limiting Relative Formula Mass Reactant Photosynthesis Respiration Reactants Aerobic Anaerobic	Photosynthesis Respiration Reactants Aerobic Anaerobic Microorganism Communicable Pathogen Vector Response Infection Resistance Immune Atomic Radioactive Decay Nuclear Contamination Hazard	Atomic Radioactive Decay Nuclear Contamination Hazard	Energy Exothermic Endothermic Profile Temperature Activation Potential Elastic Dissipate Efficiency Transfer Capacity	Circuit Component Characteristic Resistance Transmit Current Velocity Displacement Massive Resultant Momentum Extension Rate Collision Catalyst Activation Equilibrium Reversible	
	Links to prior learning	**Cell biology:** KS3 Cell biology; most of KS3 Biology. **Organisation:** KS3 Cells and organisation.	**Bonding and structure:** Atomic structure; KS3 Periodic Table. **Quantitative chemistry:** KS3 Elements. **Bioenergetics:** KS4 Cells and organisation; KS3 Photosynthesis; KS3 Digestion; KS3 Respiration.	**Bioenergetics:** KS4 Cells and organisation; KS3 Photosynthesis; KS3 Digestion; KS3 Respiration. **Infection & response:** Cells and organisation. **Atomic structure (Phy):** Atomic structure (chem); KS3 Energy.	**Atomic structure (Phy):** Atomic structure (chem); KS3 Energy. **Chemical changes:** KS3 Separating mixtures; KS3 Acids and alkalis; KS3 Types of reactions.	**Energy;** KS3 Energy. **Energy changes:** KS3 Energy.	**Electricity:** KS3 Current; K3 Potential difference and resistance; KS3 Energy; KS3 Forces. **Forces 1:** KS3 forces; KS3 Fields; KS4 Energy. **Rates of reaction:** KS3 Types of reaction; Bonding and structure; Atomic structure.	
	Cross-curricular and careers links	All Physics topics involve calculations. The skills associated with applying equations (e.g. conversion of units and rearranging equations) are also addressed in Maths. Quantitative Chemistry also requires mastery of mathematical skills including ratios. Cell Biology requires conversion of units and basic calculations and so draws on mathematical skills developed in KS3 and KS4 mathematics.						All Physics topics involve calculations. The skills

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		The teaching strategies currently being used (direct instruction, embedding routines from Teach Like a Champion) require concentrated listening (TLAC FOCUS) and Speaking skills that are embedded in the Skills Builder framework. Teachers have high expectations of their students and expect them to aim high (a Skills Builder skill). Through applying their developing knowledge students also develop problem solving skills.					associated with applying equations (e.g. conversion of units and rearranging equations) are also addressed in Maths.
	Links to future study	**KS4 Cell biology:** KS4 Organisation; KS4 Infection & response; KS4 Bioenergetics; KS4 Homeostasis & response. **KS4 Organisation**: KS4 Infection & response; KS4 Homeostasis & response.	**Bonding and structure:** All of KS4 Chemsitry. **Quantitative chemistry:** KS4 Rate and extent of chemical change. **Bioenergetics:** KS4 Ecology.	**Bioenergetics:** KS4 Ecology. **Infection & response:** KS4 Ecology **Atomic structure (Phy):** KS4 Waves.	**Atomic structure (Phy):** KS4 Waves. **Chemical changes:** KS4 KS4 Energy changes; KS4 The rate and extent of chemical change; KS4 Organic chemistry; KS4 Chemistry of the atmosphere; KS4 Using resources.	**Energy;** KS4 Electricity; KS4 Waves; KS4 Forces. **Energy changes:** KS4 the rate and extent of chemical change.	**Electricity:** KS4 Magnetism and electromagnetism. **Forces 1:** KS4 Forces 2; KS4 Magnetism and electromagnetism. **Rates of reaction:** None. **Forces 2:** None.	
	Assessment		Astrea summative assessment	Astrea summative assessment		Y10 mock exams	
	Homework	Homework that reinforces recent classwork is set every week. The class teacher has the autonomy to decide which activity/activities to set.					

Long Term Plan: (Science) 2022-23

Year 11 (Science)	Intent	The Science curriculum has ten key ideas that encompass the National Curriculum for Science: Forces; Electromagnets; Energy; Waves; Matter; Reactions; Earth; Organisms; Ecosystems and Genes. Each big idea contains four related topic; their complexity and the relationships between topics, is reflected in the route through. The foundations of the big ideas are laid early in KS3 and then developed throughout the five-year curriculum; it is our intent that by the end of year 11 each student will be able to relate scientific explanations to phenomena around them and confidently take part in the big conversation. An understanding of the nature, processes and methods of science are developed through the scientific enquiry skill families of analyse, communicate, enquire and solve. Together these skill families capture what it means to work scientifically. They are taught alongside the knowledge and conceptual understanding curriculum and develop an understanding of how scientists work. It is the intention that the curriculum will evolve to address the following aims: • Deepen each student's understanding of 'science' through interleaving topics in different big idea topics and identifying common themes such as the relationship between structure and function / properties. • Enquiry skills integrated into the knowledge and conceptual understanding curriculum so that they are developed purposefully in a range of contexts. This will enable students to relate scientific explanations to phenomena but also understand how scientists work to shape the world around us (e.g. how we should respond to phenomena such as global warming and SARS-COV-2). Through explicitly telling the stories of different scientists and the challenges they have faced, including barriers associated with bias related to gender and ethnicity, we begin to address the barriers presented to different cohorts by Science. • Eliminate misconceptions through explicitly addressing them within lessons and through careful consideration of lesson sequences and how they lead to misconceptions. • Develop written communication skills so that by the end of Year 11 students can communicate their ideas about science clearly and concisely. By the end of year 11, students will have developed a robust understanding of the three disciplines of science and how they interact. This understanding will have prepared them well for further study as well as to understand naturally occurring phenomena.

Long Term Plan: (Science) 2022-23

	Assessment strategy	Mock examinations and assessment weeks are summative and use past papers and past paper questions respectively. MAPs are formative and give the teacher feedback on recent content and associated skills.

		Half Term 1	Half Term 2	Half Term 3	Half Term 4	Half Term 5	Half Term 6
Year 11 (Science)	Disciplinary knowledge	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Homeostasis & response: Evaluate information around the relationship between obesity and diabetes, and make recommendations taking into account social and ethical issues. Waves: Students should be able to describe evidence that, for both ripples on a water surface and sound waves in air, it is the wave and not the water or air itself that travels.	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Inheritance: Students should be able to use other models to explain enzyme action. Organic chemistry: Make models of alkane molecules using the molecular modelling kits.	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Chemistry of the atmosphere: Students should be able to: • describe the main changes in the atmosphere over time and some of the likely causes of these changes • describe and explain the formation of deposits of limestone, coal, crude oil and natural gas. Magnetism & electromagnetism: Explain how a solenoid arrangement can increase the magnetic effect of the current. Ecology: Students should be able to explain how a change in a biotic factor might affect a given community given appropriate data or context.	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Chemical analysis: Students should be able to: • explain how paper chromatography separates mixtures • suggest how chromatographic methods can be used for distinguishing pure substances from impure substances • interpret chromatograms and determine Rf values from chromatograms	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum.	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum.

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	Substantive knowledge	Forces 2 recap Homeostasis & response Waves	Inheritance Organic chemistry	Chemistry of the atmosphere Magnetism & electromagnetism Ecology	Chemical analysis Structured revision (2 weeks)	Structured revision	Structured revision
	Justification	**Forces 2:** Forces related to motion. Requires a thorough understanding of Forces and their effects. Builds on some ideas in Forces 1. **Homeostasis & response**: There has to be an understanding of how an orgnaism works from a cellular level upwards. Threshold concepts are Cell Biology, Organisation. Quite complex as students need to understand equilibrium and feedback mechanisms which are dynamic. **Waves:** Waves is a challenging concept for students to understand without understanding other scientific concepts (Energy & Atomic structure)	**Inheritance:** Inheritance links directly to cell structure as students need to understand the function of the nucleus and what it contains. From this students are introduced to Genetics. **Organic chemistry:** Organic chemistry requires understanding of the previous topics.	**Chemistry of the atmosphere:** draws on a wide variety of threshold topics so is introduced later in KS4. **Magnetism & electromagnetism:** Magnetism links to Energy, Forces, Waves and Electricity. An understanding of these topics is needed to access to entirety of magnetism unit. **Ecology:** Complex topic.	**Chemical analysis:** An understanding of how chemicals combine and what products are formed allows students to identify the need for analysis of chemicals reactions.		
	Keystone vocabulary	Homeostasis Effector Stimulus Response Gland Nervous Threshold	Selective Inherited Clone Variation Evolution Genetic Organic	Proportion Atmosphere Composition Anaerobic Absorb Correlation Attract	Pure Formula Chromatography Instrumental Hazard Analysis		

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		Feedback Transverse Longitudinal Frequency Spectrum Reflection Perpendicular	Hydrocarbon Distillation Cracking Condensation Polymer	Repel Generator Transformer Permanent Induced Community Adaptation Cycling Decomposition Decay Environment Diversity Sustainable			
	Links to prior learning	**Forces 2:** KS3 Speed; KS4 Forces 1 **Homeostasis & response:** KS4 Cell biology; KS4 Organsiation. **Waves**: KS3 & KS4 Enegry; KS3 Wave properties light; KS3 Wave effects; KS4 Atomic structure (Phy); KS4 Magnetism & electromagnetism.	**Inheritance:** KS3 Variation; KS4 Cells biology; KS3 Inheritance & evolution. **Organic chemistry:** KS4 Chemical changes; KS4 Structures and bonding.	**Chemistry of the atmosphere:** KS4 Types of reactions; KS4 Earth resources; KS4 Chemical changes. **Magnetism & electromagnetism:** KS4 Electricity; KS4 Forces. **Ecology:** KS4 Inheritance, variation and evolution; KS4 Bioenergetics.	**Chemical analysis:** KS4 Particle model of matter; KS4 Atomic structure & Periodic Table.		
	Cross-curricular and careers links	Chemistry of the Atmosphere (climate change) is addressed in GCSE Geography. Ecology is also addressed in GCSE Geography. Homeostasis and Response has common content with GCSE Psychology. All Physics topics involve calculations. The skills associated with applying equations (e.g. conversion of units and rearranging equations) are also addressed in Maths. The teaching strategies currently being used (direct instruction, embedding routines from Teach Like a Champion) require concentrated listening (TLAC FOCUS) and Speaking skills that are embedded in the Skills Builder framework. Teachers have high expectations of their students and expect them to aim high (a Skills Builder skill). Through applying their developing knowledge students also develop problem solving skills.					
	Links to future study	**Forces 2:** None **Homeostasis & response:** None. **Waves**: None.	**Inheritance: N**one **Organic chemistry:** None	**Chemistry of the atmosphere:** None **Magnetism & electromagnetism:** None	**Chemical analysis:** None		

Long Term Plan: (Science) 2022-23

				Ecology: None			
	Assessment	Astrea summative assessment	Mock exam 1		Mock exam 2		
	Homework	Homework that reinforces recent classwork is set every week. The class teacher has the autonomy to decide which activity/activities to set.					

Long Term Plan: (Science) 2022-23

Year 11 (Separate Science)	Intent	The Science curriculum has ten key ideas that encompass the National Curriculum for Science: Forces; Electromagnets; Energy; Waves; Matter; Reactions; Earth; Organisms; Ecosystems and Genes. Each big idea contains four related topic; their complexity and the relationships between topics, is reflected in the route through. The foundations of the big ideas are laid early in KS3 and then developed throughout the five-year curriculum; it is our intent that by the end of year 11 each student will be able to relate scientific explanations to phenomena around them and confidently take part in the big conversation. An understanding of the nature, processes and methods of science are developed through the scientific enquiry skill families of analyse, communicate, enquire and solve. Together these skill families capture what it means to work scientifically. They are taught alongside the knowledge and conceptual understanding curriculum and develop an understanding of how scientists work. It is the intention that the curriculum will evolve to address the following aims: • Deepen each student's understanding of 'science' through interleaving topics in different big idea topics and identifying common themes such as the relationship between structure and function / properties. • Enquiry skills integrated into the knowledge and conceptual understanding curriculum so that they are developed purposefully in a range of contexts. This will enable students to relate scientific explanations to phenomena but also understand how scientists work to shape the world around us (e.g. how we should respond to phenomena such as global warming and SARS-COV-2). Through explicitly telling the stories of different scientists and the challenges they have faced, including barriers associated with bias related to gender and ethnicity, we begin to address the barriers presented to different cohorts by Science. • Eliminate misconceptions through explicitly addressing them within lessons and through careful consideration of lesson sequences and how they lead to misconceptions. • Develop written communication skills so that by the end of Year 11 students can communicate their ideas about science clearly and concisely. By the end of year 11, students will have developed a robust understanding of the three disciplines of science and how they interact. This understanding will have prepared them well for further study as well as to understand naturally occurring phenomena.

Long Term Plan: (Science) 2022-23

	Assessment strategy	Mock examinations and assessment weeks are summative and use past papers and past paper questions respectively. MAPs are formative and give the teacher feedback on recent content and associated skills.

Long Term Plan: (Science) 2022-23

		Half Term 1	Half Term 2	Half Term 3	Half Term 4	Half Term 5	Half Term 6
Year 11 (Separate Science)	Disciplinary knowledge	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Homeostasis & response: Evaluate information around the relationship between obesity and diabetes, and make recommendations taking into account social and ethical issues. Waves: Students should be able to describe evidence that, for both ripples on a water surface and sound waves in air, it is the wave and not the water or air itself that travels.	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Inheritance: Students should be able to use other models to explain enzyme action. Organic chemistry: Make models of alkane molecules using the molecular modelling kits.	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Chemistry of the atmosphere: Students should be able to: • describe the main changes in the atmosphere over time and some of the likely causes of these changes • describe and explain the formation of deposits of limestone, coal, crude oil and natural gas. Magnetism & electromagnetism: Explain how a solenoid arrangement can increase the magnetic effect of the current. Ecology: Students should be able to explain how a change in a biotic factor might affect a given community given appropriate data or context.	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum. Chemical analysis: Students should be able to: • explain how paper chromatography separates mixtures • suggest how chromatographic methods can be used for distinguishing pure substances from impure substances • interpret chromatograms and determine Rf values from chromatograms	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum.	Disciplinary knowledge in science is cumulative. Knowledge is revisited and refined throughout the curriculum.

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	Substantive knowledge	Forces 2 recap Waves Homeostasis and response	Inheritance Organic chemistry	Space Chemistry of the atmosphere Magnetism and electromagnetism Ecology	Chemical analysis Structured revision (2 weeks)	Structured revision	Structured revision
	Justification	**Forces 2:** Forces related to motion. Requires a thorough understanding of Forces and their effects. Builds on some ideas in Forces 1. **Homeostasis & response**: There has to be an understanding of how an orgnaism works from a cellular level upwards. Threshold concepts are Cell Biology, Organisation. Quite complex as students need to understand equilibrium and feedback mechanisms which are dynamic. **Waves:** Waves is a challenging concept for students to understand without understanding other scientific concepts (Energy & Atomic structure)	**Inheritance:** Inheritance links directly to cell structure as students need to understand the function of the nucleus and what it contains. From this students are introduced to Genetics. **Organic chemistry:** Organic chemistry requires understanding of the previous topics.	**Space:** Emotive topic that requires understanding of forces, energy etc. **Chemistry of the atmosphere:** draws on a wide variety of threshold topics so is introduced later in KS4. **Magnetism & electromagnetism:** Magnetism links to Energy, Forces, Waves and Electricity. An understanding of these topics is needed to access to entirety of magnetism unit. **Ecology:** Complex topic.	**Chemical analysis:** An understanding of how chemicals combine and what products are formed allows students to identify the need for analysis of chemicals reactions.		
	Keystone vocabulary	Homeostasis Effector Stimulus Response Gland Nervous	Selective Inherited Clone Variation Evolution Genetic	Force Gravity Proportion Atmosphere Composition Anaerobic	Pure Formula Chromatography Instrumental Hazard Analysis		

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		Threshold Feedback Transverse Longitudinal Frequency Spectrum Reflection Perpendicular	Organic Hydrocarbon Distillation Cracking Condensation Polymer	Absorb Correlation Attract Repel Generator Transformer Permanent Induced Community Adaptation Cycling Decomposition Decay Environment Diversity Sustainable			
	Links to prior learning	**Forces 2:** KS3 Speed; KS4 Forces 1 **Homeostasis & response:** KS4 Cell biology; KS4 Organsiation. **Waves**: KS3 & KS4 Enegry; KS3 Wave properties light; KS3 Wave effects; KS4 Atomic structure (Phy); KS4 Magnetism & electromagnetism.	**Inheritance:** KS3 Variation; KS4 Cells biology; KS3 Inheritance & evolution. **Organic chemistry:** KS4 Chemical changes; KS4 Structures and bonding.	**Space:** KS4 Forces; KS3 Universe. **Chemistry of the atmosphere:** KS4 Types of reactions; KS4 Earth resources; KS4 Chemical changes. **Magnetism & electromagnetism:** KS4 Electricity; KS4 Forces. **Ecology:** KS4 Inheritance, variation and evolution; KS4 Bioenergetics.	**Chemical analysis:** KS4 Particle model of matter; KS4 Atomic structure & Periodic Table.		
	Cross-curricular and careers links	Chemistry of the Atmosphere (climate change) is addressed in GCSE Geography. Ecology is also addressed in GCSE Geography. Homeostasis and Response has common content with GCSE Psychology. All Physics topics involve calculations. The skills associated with applying equations (e.g. conversion of units and rearranging equations) are also addressed in Maths. The teaching strategies currently being used (direct instruction, embedding routines from Teach Like a Champion) require concentrated listening (TLAC FOCUS) and Speaking skills that are embedded in the Skills Builder framework. Teachers have high expectations of their students and expect them to aim high (a Skills Builder skill). Through applying their developing knowledge students also develop problem solving skills.					

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	Links to future study	**Forces 2:** None **Homeostasis & response:** None. **Waves**: None.	**Inheritance: N**one **Organic chemistry:** None	**Space:** none. **Chemistry of the atmosphere:** None **Magnetism & electromagnetism:** None **Ecology:** None.	**Chemical analysis:** None		
	Assessment	Astrea summative assessment	Mock exam 1		Mock exam 2		
	Homework	Homework that reinforces recent classwork is set every week. The class teacher has the autonomy to decide which activity/activities to set.					