

TRIPLE SCIENCE Curriculum Overview

“Nothing in life is to be feared, it is only to be understood. Now is the time to understand more, so that we may fear less.”

Marie Curie

Our science curriculum ensures learners gain the foundations in knowledge and skills that will enable them to understand the scientific aspects of the world around them and make informed decisions about the applications of science. For some, studying the sciences will provide the platform for more advanced studies, establishing the basis for a wide range of careers. For others, it will provide the foundations for understanding the world around us and will enhance their lives in an increasingly technological society, regardless of their career choice.

For this understanding, our young people need learning experiences that are interesting and engaging and seen as relevant to their lives. This is achieved through high quality practical work that will help to develop their curiosity and skills as well as high-quality teaching that will engage students with exciting examples of applications of science in the real world. This also help to develop resilience and independence in learners.

Our curriculum follows the National programmes of study at both KS3 and KS4. As a result, our curriculum intends to:

- develop **scientific knowledge and conceptual understanding** in biology, chemistry and physics
- develop understanding of the **nature, processes and methods of science** through scientific investigation
- equip learners with the **scientific skills** required to understand the **uses and implications** of science, today and for the future.

Our curriculum is structured so that the ‘big ideas in science’ (ASE 2015) run throughout their studies and that knowledge and skills are re-visited and built on through their five years at Bristnall Hall Academy. It is inclusive – it takes account of the starting point of our learners and as students’ progress through science, we understand that some students may require more support and therefore adjust our curriculum accordingly. Students will study the three disciplines of science during each term following a 5-year plan to ensure they get a good depth and breadth of science education each year.

Rationale behind the 5-year plan:

Learners are exposed to the Big ideas of Science in a progressive manner, building up understanding from simple to complex and from concrete to abstract. Key ideas such as particles, cells and forces, which underpin much of the Science curriculum, are covered in Y7 and Y8 to lay out the foundation for what is to come, and then revisited in more detailed in a more abstract manner in later years. Scientific concepts and skills are built upon and referred to throughout the curriculum, highlighting the links both within and between subjects.

Biology:

In Y7, after covering the basics of cells and organisms, students learn about animal (human) and plant reproduction and interactions between organisms (food webs and ecosystems).

In Y8, students then progress to learn about respiration and photosynthesis as well as breathing and digestion, finishing with the basics of variation and evolution.

Y9 students continue building their understanding of cells at a higher, more abstract level (including transport of substances in and out of cells), and are introduced to the idea of inheritance and then learn about health and disease.

In Y10, students learn the bulk of the KS4 Biology curriculum, covering animal systems (including the endocrine and nervous systems), plant systems and bioenergetics at a more abstract level.

By Y11, students finish learning about evolution and ecology.

Chemistry:

In Y7, students learn the fundamentals of matter and particle theory. They are then introduced to elements, compounds and the basics of the periodic table followed by learning about acids and alkalis using concrete examples.

In Y8, students learn about chemical reactions and some of their applications. Afterwards, students learn about the structure of the Earth and the rock cycle. This is covered in the spring term after they've learned about the place of the Earth in the Solar system.

In Y9, they learn about solutions and methods of separation. Afterwards, students learn about atomic structure, the periodic table, structure and bonding. These topics are taught in the second half of the year, after students have extended their knowledge of the particle theory of matter.

In Y10, students learn the bulk of the KS4 Chemistry curriculum, covering chemical changes, energy changes, chemical calculations and organic chemistry, with the more abstract topics covered in the second half of the year.

By Y11, students complete their study of Chemistry by learning about rates of reaction and the Earth's atmosphere and resources.

Physics:

In Y7, students firstly learn the foundations of energy, which is then followed by forces and an introduction to sound and light waves. This introduces students to the concept of waves as oscillations that transfer energy in a more concrete way.

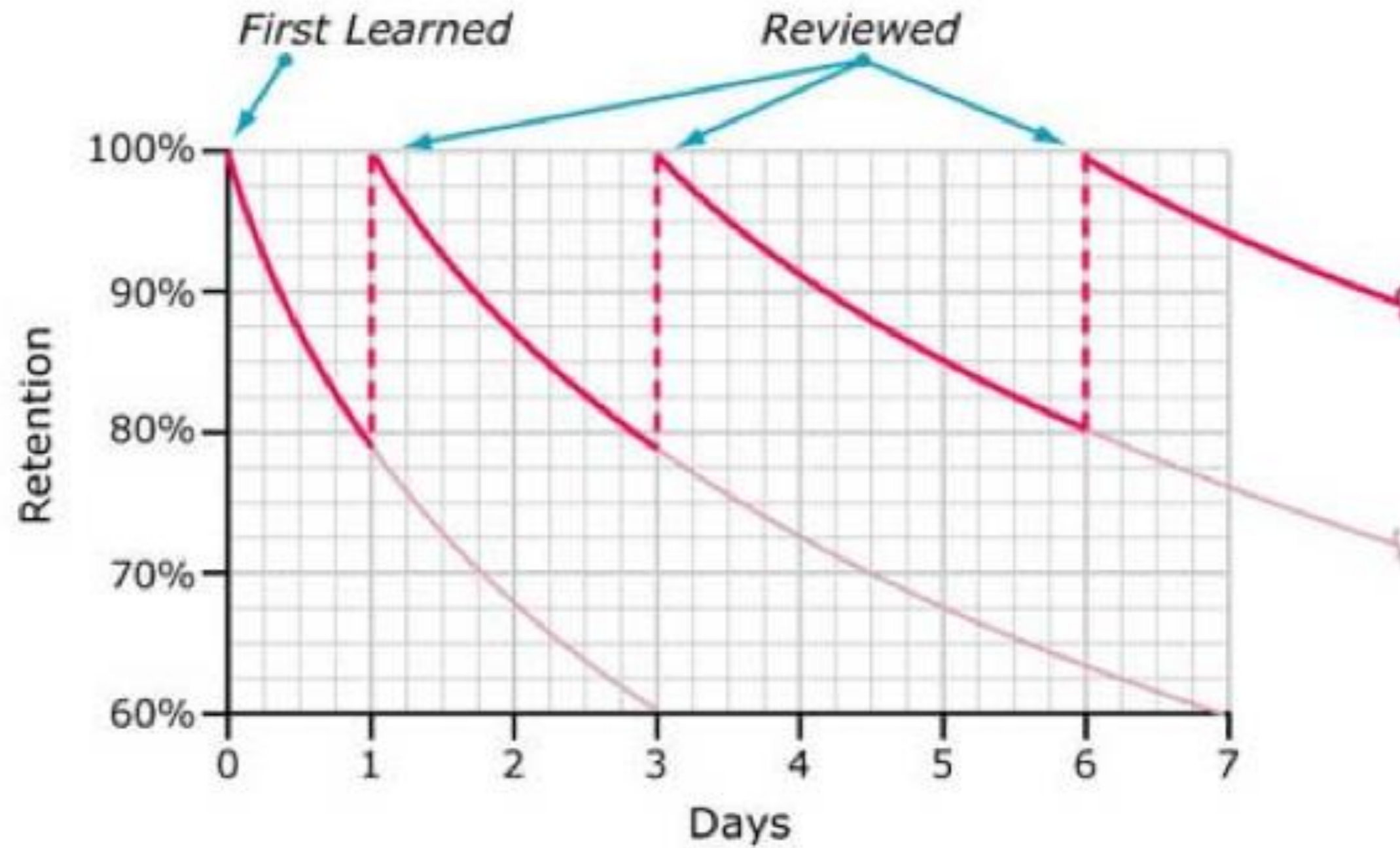
Y8 students learn about electricity and magnetism, followed by space and the solar system. This is covered before they learn the Chemistry topic of Earth and rocks. Afterwards, students learn about moments, work and pressure. These topics are covered using real-life examples and practical approaches.

In Y9, students extend their knowledge on energy and particle theory of matter to a more abstract, mathematical level of understanding. Afterwards, students learn about heat transfer, transitioning from concrete, example-based learning of methods of heat transfer to more abstract and mathematical concepts, such as specific heat capacity, latent heat and internal energy.

In Y10, students learn the bulk of the KS4 Physics curriculum, covering radioactivity, electricity and forces and motion.

By Y11, students finish their study of physics by learning about electromagnetic waves and electromagnetism.

Typical Forgetting Curve for Newly Learned Information



Curriculum plan for Triple Science

Triple only content **bold and underlined**

Year	Topic	
Y7	Term 1	Energy
		Matter and Particle Theory
		Cells and Organism
	Term 2	Atoms, elements and compounds
		Forces and motion
		Reproduction
	Term 3	Acids and alkalis
		Sound and Light waves
		Food chains and Ecosystems.
Predator and prey adaptations. Interdependence.		
Y8	Term 1	Chemical reactions.
		Photosynthesis and Respiration
		Electricity
	Term 2	Magnetism. Electromagnets
		Food, digestion and health
		Space and the Universe
		Earth and Rocks
	Term 3	More on reactions (oxidation, metals and acids).
		Moments, Work and Pressure
		Variation and Evolution (introduction to evolution with links to competition and adaptation (Darwin and Lamarck))
Y9	Separation Techniques	
	Health and disease (communicable and non-communicable diseases) TR: bacterial growth. Plant diseases and responses. Monoclonal antibodies	
	Molecules and Matter (Particle model, Density, Gas pressure TR: gas pressure and volume)	
	Cells and Inheritance inc. KS3 introduction to Inheritance TR: DNA structure, protein synthesis. Mutation	
	Atomic structure	
	The Periodic Table and Structure and bonding. TR: transition metals. Nanoparticles	
	Energy and Energy Resources (Work, Power, Efficiency, Energy resources)	
	Heat transfer and Internal Energy (Specific heat capacity. Latent heat. Internal energy TR: infrared radiation and black body radiation)	

Year	Biol	Chem	Phys
Y10	Animal systems and respiration (Digestive system, enzymes, circulatory system, breathing, anaerobic and aerobic respiration and exercise)	Chemical changes. (Acids and alkalis. Reactions with metals).	Radioactivity, <u>radiation in medicine, nuclear fission, nuclear fusion and nuclear issues</u>
	Plants and photosynthesis (photosynthesis, transport systems, transpiration)	Electrolysis and Energy Changes, <u>chemical cells and batteries, fuel cells</u>	Electricity (in the home and electrical circuits.) <u>electrical charges and fields (static electricity)</u>
	Nervous and endocrine systems, <u>the brain. The Eye (the eye, common problems of the eye) Plant responses and hormones (plant hormones, using plant hormones); Homeostasis (controlling body temperature and the kidneys)</u>	Chemical Calculations, <u>yield, atom economy, titrations, volume of gases.</u> Chemical analysis, <u>tests for ions and instrumental analysis</u>	Forces and Motion. <u>conservation of momentum, impact forces, safety</u>
Reproduction and Inheritance, <u>the best of both worlds (life cycles)</u>	Crude oil and fuels. <u>Organic reactions (alkenes, alcohols, carboxylic acids, esters); Polymers (addition & condensation polymerisation, natural polymers, DNA)</u>	<u>Moments and machines. Pressure (pressure and surfaces, pressure in liquids, atmospheric pressure, upthrust and flotation).</u>	

Year	Biology	Chemistry	Physics
Y11	Evolution and Genetics, <u>cloning, adult cell cloning, history of genetics, theories of evolution, accepting Darwin's ideas, evolution and speciation.</u>	Rates of reaction	Waves and the EMS (<u>sound waves, ultrasound, seismic waves</u>); <u>Light (reflection, refraction, colour, lenses)</u>
	Ecology, <u>rates of decomposition, trophic levels and biomass biomass transfers, sustainable and efficient food production.</u>	Earth's atmosphere and Resources. <u>Using our Resources (rusting, alloys, glass, ceramics, ammonia and the Haber process, fertilisers)</u>	Electromagnetism (<u>electromagnets in devices, generator effect, AC generator, transformers</u>)
			<u>Space (solar system, stars, planets, satellites, expanding universe, beginning and future of the Universe)</u>

YEAR 7

Autumn term

Biology		Chemistry		Physics	
TOPIC TITLE: Cells and organisms		TOPIC TITLE: Matter and particle theory		TOPIC TITLE: Energy	
Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)
Using Microscopes Plant cells Animal cells Specialist cells Movement of substances Unicellular organisms Levels of organisation The skeleton Movement of joints Movement of muscles	State and explain what each part of a microscope does Explain how to use a microscope and prepare slides State what cells are Describe and label different parts of a plant and animal cell Explain the similarities and differences between plant and animal cells Name some specialist cells and describe how they are adapted for their function Identify substances that move in and out of cells Describe diffusion Describe what a unicellular organism is State the order of hierarchy of organisation in a multi-cellular organism Name (different parts) and state the function of the skeleton Describe different types of joints and where they might be found	The Particle Model States of Matter Melting and Freezing Boiling Changes of State Diffusion	To state that materials are made up of particles, and the arrangement of these particles change when they undergo a change in state. To apply changes of state to everyday scenarios.	Food and fuels Energy in food practical Energy resources Energy adds up Energy dissipation Power	Identify energy value in food Compare the energy of food with the amount different people need Investigate which food has the most energy – evaluation too Describe how energy is generated via renewable and non-renewable means. Describe and explain how energy store transfers occur. Be able to account for energy loss and calculate efficiency Be able to calculate power and cost of electricity.
Prior Domains: Explore and compare the differences between things that are living, dead, and things that have never been alive. Find out and describe how plants need water, light and a suitable temperature to grow and stay healthy. Identify that humans and some other animals have skeletons and muscles for support, protection and movement.		Prior Domains: Explain that there are three states of matter. Describe the properties of the three states of matter, Solids, Liquids and Gases,		Prior Domains: Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object. To identify how sounds are made, associating some of them with something vibrating. Explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes.	

Spring term

Biology		Chemistry		Physics	
TOPIC TITLE: Reproduction		TOPIC TITLE: Atoms, Elements and Compounds		TOPIC TITLE: Forces and Motion	
Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)

Adolescence Reproduction Fertilisation and implantation Development of a fetus The menstrual cycle Flowers and pollination Fertilisation and germination Seed dispersal	Describe the function of the main structures in the male and female reproductive systems. Describe what happens during fertilisation, gestation, birth and the menstrual cycle. Identify the main structures in a flower and link their structure to their function. Describe the process of pollination, fertilisation and germination. Explain why seed dispersal is important and methods they use.	Elements Atoms Compounds The Periodic Table	To state what an element is. To recall the chemical symbol of 16 elements. To state what atoms are. To represent atoms and elements using particle diagrams. To state what the groups and periods of the Periodic Table tell you about the elements.	Introduction to forces Balanced and unbalanced forces Friction and drag Speed Distance-time graphs Squashing and stretching	To describe what forces do and how they are measured. To identify contact and non-contact forces, including friction and gravity. To explain the effect of balanced and unbalanced forces on the motion of an object. To identify and calculate the resultant force. To investigate how different surfaces and /or the angle of a slope affect the force of friction on a block. To investigate how forces deform objects. To plot and interpret bar charts and draw conclusions using their scientific knowledge. To be able to calculate speed. To calculate other aspects of the speed equation through rearranging. Describe the motion of an object using a distance-time graph. Describe how forces deform objects. Investigate the effect of force on the extension of a spring.
Prior Domains: Describe how plants need water, light and a suitable temperature to grow and stay healthy. To identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers. To explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal. Identify stages in the growth and development of humans and about the changes experienced in puberty. Identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers. Explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal (Y3) describe the life process of reproduction in some plants and animals (Y5) Pupils should be introduced to the requirements of plants for germination, growth and survival, as well as to the processes of reproduction and growth in plants.		Prior Domains: Group materials based on states of matter. Group materials based on properties (hardness, solubility, transparency, electrical & thermal conductivity, magnetism)		Prior Domains: 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 Compare how things move on different surfaces Notice that some forces need contact between two objects, but magnetic forces can act at a distance	

Summer term

Biology		Chemistry		Physics	
TOPIC TITLE: Food chains and Ecosystems		TOPIC TITLE: Acids and alkalis		TOPIC TITLE: Sound and Light waves	
Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)
Food chains and webs	State the definition of a food chain and food web.	Chemical reactions Acids and alkalis Indicators and pH	To describe features of chemical reactions and give examples of chemical and physical changes. To compare properties of acids and alkalis.	Introduction to waves	Describe the different types of wave and their features. Compare the properties of waves and their features.

<p>Disruptions to food chains and webs</p> <p>Ecosystems</p> <p>Competition</p> <p>Adapting to Change</p>	<p>State that one population of organisms can affect another.</p> <p>State what is meant by ecosystem, community, habitat, environment and niche.</p> <p>State some resources that plants and animals compete for.</p> <p>Give a possible reason for adaptation or extinction.</p>	<p>Neutralisation</p> <p>Making salts</p>	<p>To identify acids, alkalis and neutral solutions on the pH scale.</p> <p>To investigate how you can make crystals of salts (sodium chloride).</p> <p>To describe what happens when metals react with oxygen and acids.</p> <p>To investigate displacement reactions between metals and nitrate solutions.</p>	<p>Sound waves and the speed of sound</p> <p>Loudness and amplitude</p> <p>Frequency and pitch</p> <p>The ear and hearing</p> <p>Light</p> <p>Reflection</p> <p>Refraction</p> <p>Lenses</p> <p>Colour</p> <p>The eye</p>	<p>Name some sources of sound and some materials that sound can travel through.</p> <p>State that frequency is measured in hertz.</p> <p>Describe the link between loudness and amplitude.</p> <p>Describe some risks of loud music.</p> <p>Describe how the ear works.</p> <p>Use key words and diagrams to describe how light travels.</p> <p>Use ray diagrams to show how light is reflected from a mirror. Describe and explain how images are formed in a mirror.</p> <p>Use diagrams to show how light passes through transparent materials</p> <p>Construct ray diagrams to show refraction.</p> <p>Explain how a prism can be used to split white light. Use the ray model to explain how coloured objects are seen in different coloured light.</p> <p>Name describe and explain how parts of the eye are used to produce images. Draw diagrams to show how lenses can be used to correct vision.</p>
<p>Prior Domains:</p> <p>Find out about and describe the basic needs of animals, including humans, for survival (water, food and air)</p> <p>Identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat</p> <p>Identify that most living things live in habitats to which they are suited and describe how different habitats provide for the basic needs of different kinds of animals and plants, and how they depend on each other.</p> <p>Identify and name a variety of plants and animals in their habitats, including microhabitats.</p> <p>Recognise that environments can change and that this can sometimes pose dangers to living things.</p> <p>Identify and name a variety of common animals that are carnivores, herbivores and omnivores.</p> <p>Describe how animals obtain their food from plants and other animals, using the idea of a simple food chain, and identify and name different sources of food.</p> <p>Construct and interpret a variety of food chains, identifying producers, predators and prey.</p> <p>Know how plants and animals are adapted to their environment.</p> <p>Give a possible reason for adaptation or extinction.</p>		<p>Prior Domains:</p> <p>To know that some changes result in the formation of new materials (e.g. burning and the action of acid on bicarbonate of soda).</p> <p>To explore changes that are difficult to reverse, for example, vinegar reacting with bicarbonate of soda.</p>		<p>Prior Domains:</p> <p>To identify how sounds are made, associating some of them with something vibrating.</p> <p>To recognise that vibrations from sounds travel through a medium to the ear.</p> <p>To find patterns between the pitch of a sound and features of the object that produced it.</p> <p>To find patterns between the volume of a sound and the strength of the vibrations that produced it.</p> <p>To recognise that sounds get fainter as the distance from the sound source increases.</p> <p>Recognise that they need light in order to see things and that dark is the absence of light.</p> <p>Recognise that light appears to travel in straight lines.</p> <p>Use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye.</p> <p>Recognise that shadows are formed when the light from a light source is blocked by an opaque object.</p> <p>Notice that light is reflected from surfaces.</p> <p>Recognise that light from the sun can be dangerous and that there are ways to protect their eyes.</p> <p>Find patterns in the way that the size of shadows change.</p> <p>Explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes.</p>	

Identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.

Use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them.

YEAR 8
Autumn term

Biology		Chemistry		Physics	
TOPIC TITLE: Respiration and Photosynthesis		TOPIC TITLE: Chemical reactions		TOPIC TITLE: Electricity	
Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)
Breathing Gas exchange Aerobic respiration Anaerobic respiration Plants and photosynthesis Leaves	<p>List and describe the different parts of the respiratory system and how breathing takes place.</p> <p>Describe the process of gas exchange</p> <p>State the word equation for aerobic respiration; anaerobic respiration and photosynthesis</p> <p>Plan an investigation to measure the effect of exercise on breathing rates.</p> <p>Describe how to test a leaf for starch.</p> <p>Explain how a leaf is adapted for photosynthesis.</p>	Chemical reactions Chemical formulae Atoms in chemical reactions Combustion Thermal decomposition Conservation of mass Exothermic and endothermic	<p>To describe how chemical reactions involve the chemical transformation from reactants into products.</p> <p>To name compounds using their chemical formula and determine their relative proportions.</p> <p>To describe the model of chemical change and conservation of mass.</p> <p>To write word equations for combustion and thermal decomposition reactions.</p> <p>To investigate thermal decomposition reactions for metal carbonates.</p> <p>To describe exothermic and endothermic changes.</p>	Electrical circuits Current Potential difference Series and parallel circuits Resistance Conductors and insulators Charges and electric fields Charging up	<p>Describe how electrical circuits work.</p> <p>Describe what is meant by an electric current. Describe what happens to current when you change components in a circuit.</p> <p>Use models to explain p.d. Explain how p.d. affects the way components work.</p> <p>Draw and make circuits to measure current and P.d.</p> <p>Make series and parallel circuits to measure the current and p.d.</p> <p>Measure resistance in circuits and use a model to explain how resistance affects the way components work.</p> <p>Investigate what materials are good conductors or insulators.</p> <p>Describe electric fields and how charged objects interact.</p> <p>Draw diagrams to explain how an object becomes charged up.</p>
Prior Domains: <p>Find out about and describe the basic needs of animals, including humans, for survival (water, food and air)</p> <p>Identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat</p> <p>Describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene</p> <p>To understand what plants and animals need to survive.</p> <p>Identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers.</p> <p>Investigate the way in which water is transported within plants.</p>		Prior Domains: <p>Demonstrate that dissolving, mixing and changes of state are reversible changes.</p> <p>To know some changes result in the formation of new materials (e.g. burning and the action of acid on bicarbonate of soda).</p> <p>To explore changes that are difficult to reverse, for example, burning, rusting and other reactions, for example, vinegar with bicarbonate of soda.</p>		Prior Domains: <p>Identify common appliances that run on electricity.</p> <p>Construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers.</p> <p>Identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery.</p> <p>Recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit.</p> <p>Compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches.</p> <p>Use recognised symbols when representing a simple circuit in a diagram.</p>	

Find out and describe how plants need water, light and a suitable temperature to grow and stay healthy (Y2)		Associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit. Recognise some common conductors and insulators, and associate metals with being good conductors.
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Spring term

Biology		Chemistry		Physics	
TOPIC TITLE: Food, digestion and health		TOPIC TITLE: Earth and rocks		TOPIC TITLE: Magnetism	
Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)
Nutrients Energy in food Unhealthy diet Digestive system Bacteria and enzymes Smoking Drugs Alcohol	Describe different nutrients and explain their effects on the body Investigate energy content of foods Describe unhealthy foods and their effects Describe the structure and function of the main parts of the digestive system. Investigate enzymes and their functions Describe the effects of smoking and alcohol consumption Investigate legal and illegal drugs	Earth Structure The structure of the Earth Sedimentary rocks Igneous and metamorphic rocks The rock cycle	Name the layers of the Earth. State what a mineral is. Describe properties of the different layers of the Earth's structure. Compare the different layers of the Earth in terms of their properties. State a property of sedimentary rocks. Explain in detail each stage in the formation of a sedimentary rock. To investigate how temperature affects crystal size. Explain why igneous and metamorphic rocks have particular properties based on how they were formed. Investigate what happens to wax in a model rock cycle. Explain the process of rock formation	Magnets and magnetic fields Electromagnets Using electromagnets	Describe how magnets interact. Draw field lines round a magnet in detail. Describe the Earth's magnetic field. Explain how a compass works. Describe how to make an electromagnet and change its strength. Describe some uses of electromagnets. Describe how an electric bell, circuit breaker, or loudspeaker works. Investigate the effect of changes to the number of wire coils, the size of electrical current or the use of a core on the strength of an electromagnet.
Prior Domains: Find out about and describe the basic needs of animals, including humans, for survival (water, food and air) Identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat Describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene Describe the simple functions of the basic parts of the digestive system in humans Identify the different types of teeth in humans and their simple functions		Prior Domains: Group different types of rocks based on their appearance. Describe how fossils are formed. Pupils might identify and classify rocks according to whether they have grains or crystals, and whether they have fossils in them. Pupils might research and discuss the different kinds of living things whose fossils are found in sedimentary rock and explore how fossils are formed. Pupils could investigate what happens when rocks are rubbed together or what changes occur when they are in water		Prior Domains: Observe how magnets can act at a distance, attract or repel each other and attract some materials and not others. Identify some magnetic materials Describe magnets and predict whether 2 magnets will attract or repel each other.	

Summer term

Biology	Chemistry	Physics	Physics
TOPIC TITLE: Variation and Evolution	TOPIC TITLE: More on Reactions	TOPIC TITLE: Space	TOPIC TITLE: Moments, work and pressure

Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)
Continuous and discontinuous variation Natural Selection Darwin Extinction Preserving biodiversity	State what is meant by the term variation. Describe how variation in species occurs. State that there are two types of variation. Use knowledge of continuous and discontinuous variation to explain whether characteristics are inherited, environmental, or both. To be able to apply the concept of Natural Selection to a variety of different organisms within their own environment. Understand how Darwin developed the idea of evolution To be able to explain the benefits of preserving biodiversity and describe the methodology of doing so	Reactions of metals and non-metals with oxygen Reactions of metals with acids Reactions of metals with water Metal displacement reactions Extracting metals Ceramics Polymers	Name the substances formed when metals and non-metals react with oxygen and write word equations for these reactions Define oxidation Name the substances formed when metals react with acids and write word equations for these reactions Carry out an experiment between metals and acids Name the substances formed when metals react with water Carry out an investigation into the reactivity of 3 metals with water and acid Define displacement and write word equations representing displacement reactions Use observations from experiment to state if a displacement reaction has occurred. State what minerals and ores are Name two processes used to extract metals and explain why these methods are used State what a ceramic is, describe its properties and explain why it has these properties Use properties to decide if a material is a ceramic Define what a polymer is and explain how polymer properties depend in their molecules	The night sky The Solar System Gravity, mass and weight The Earth The Moon and changing ideas	Name some objects seen in the night sky and Solar System Describe the structure of the Universe in detail, in order of size and of distance away from the Earth. Describe how objects in the Solar System are arranged. Explain why we see objects in the Solar System, and why they appear to move as they do. To describe the difference between mass and weight and calculate weight using mass and gravitational field strength. State what facts the Solar system model can be used to explain. Explain why places on Earth experience different daylight hours and seasons Name some phases of the Moon	Turning forces Work, energy and machines Pressure in gases Pressure in liquids Pressure on solids	To describe what is meant by a moment. To explain how machines work. To describe the motion of particles in a fluid. To explain why fluids, exert a pressure. To describe how liquid pressure changes with depth. To calculate pressure. To apply pressure calculations to different situations.
Prior Domains: Describe how fossils are formed Recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago.		Prior Domains: To describe features of chemical reactions and give examples of chemical and physical changes. To describe what happens when metals react with oxygen and acids. To investigate displacement reactions between metals and nitrate solutions.		Prior Domains: Observe changes across the four seasons. Observe and describe weather associated with the seasons and how day length varies. Describe the movement of the Earth, and other planets, relative to the Sun in the solar system.		Prior Domains: Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.	

		<p>Describe the movement of the Moon relative to the Earth.</p> <p>Describe the Sun, Earth and Moon as approximately spherical bodies.</p> <p>Use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky.</p>	
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YEAR 9

Biology			
TOPIC TITLE: Health and Disease		TOPIC TITLE: Cells and Inheritance	
Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)
Health and disease Pathogens and disease AND preventing infection Growing bacteria in the lab (TRP only) Preventing bacterial growth (TRP only) Diseases caused by viruses, bacteria, fungi and protists Human defence responses Plant diseases (TRP only) Plant defence responses (TRP only) Vaccination Antibiotics and painkillers Discovering drugs Developing drugs Making monoclonal antibodies (TRP only)	<p>Explain how pathogens are passed from one organism to another and use this to suggest ways of preventing the spread.</p> <p>Plan a method and prepare an uncontaminated culture using aseptic techniques. (TRP only)</p> <p>Explain what is meant by exponential growth and analyse a graph showing it. (TRP only)</p> <p>Name some diseases that are caused by viruses, bacteria, fungi and protists.</p> <p>Describe how human body defence mechanisms stop the entry of pathogens.</p> <p>Explain in detail how antibody production fights pathogens.</p> <p>Describe some signs of plant disease and how they can be detected. (TRP only)</p> <p>Classify plant defences as physical, chemical, or mechanical and explain in detail how plant defence responses work. (TRP only)</p> <p>Explain how vaccination works.</p> <p>Describe how antibiotics work.</p> <p>Describe the stages in discovery of penicillin.</p> <p>Explain why each stage of drug testing is carried out.</p> <p>Describe the process used to produce monoclonal antibodies and explain in detail how they can be used in pregnancy tests and to treat cancer. (TRP only)</p> <p>Explain the difference between benign and malignant tumours</p> <p>Describe the effects of the harmful substances found in tobacco and alcohol.</p> <p>Describe causal mechanisms for the link between exercise and health.</p> <p>Explain why a correlation does not prove a causal mechanism.</p>	Microscopes Plant and animal cells Eukaryotic and prokaryotic cells Specialisation of animal cells Inheritance DNA Cell division Growth and division Stem cells Diffusion Osmosis Osmosis required practical Active transport Exchanging materials	<p>Describe how to use a light microscope to observe cells.</p> <p>Carry out magnification calculations using the formula</p> <p>Compare animal and plant cells in terms of their subcellular structures.</p> <p>Compare prokaryotic and eukaryotic cells</p> <p>Demonstrate an understanding of the scale and size of cells and be able to make order of magnitude calculations, including the use of standard form</p> <p>Explain how specialised animal cells are adapted to allow them to carry out their functions</p> <p>Explain the relationship between DNA, genes and chromosomes.</p> <p>Describe the structure of DNA</p> <p>Describe how scientists worked together and discovered the structure of DNA</p> <p>Describe the stages in the cell cycle</p> <p>Compare animal and plant cells in terms of growth and differentiation</p> <p>Evaluate the advantages and disadvantages of using adult and embryonic stem cells for medical purposes</p> <p>Compare diffusion, osmosis and active transport</p> <p>Analyse the results of the osmosis in potato chips experiment</p> <p>Calculate surface area to volume ratio for shapes representing a single celled organism and a multicellular organism</p>

Using monoclonal antibodies (TRP only) Cancer Smoking Alcohol Diet and exercise Data analysis – establishing cause and effect			
Prior Domains: Describe what a unicellular organism is Describe the effects of smoking and alcohol consumption Investigate legal and illegal drugs		Prior Domains: Explain how to use a microscope and prepare slides Describe and label different parts of a plant and animal cell Name some specialist cells and describe how they are adapted for their function. Recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents. Describe diffusion State the order of hierarchy of organisation in a multi-cellular organism.	

Chemistry					
TOPIC TITLE: Separation techniques		TOPIC TITLE: Atomic Structure and Periodic table		TOPIC TITLE: Periodic Table, Structure and Bonding	
Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)
Solutions Solubility Filtration & crystallisation Distillation Chromatography	Describe how to separate mixtures by filtration, crystallisation, simple distillation and fractional distillation To use evidences from the results of these processes to show how they can be applicable to daily life such as the separation of rock-salt/seawater To describe the difference between pure substance and impure substances Describe the main processes occurring in paper chromatography.	Atoms and elements Compounds Representing chemical reactions Balancing symbol equations History of the atom Structure of the atom Size of atoms Electronic structures Isotopes Development of the periodic table Electronic structures and the periodic table	Define the word element and compound Describe the basic structure of an atom. Explain, including diagrams, the difference between a pure element, a mixture, and a compound. Explain how their properties differ Name and give the chemical symbol of the first 20 elements in the Periodic Table. Describe how the properties of elements and their compounds differ Represent compounds using formula Describe familiar chemical reactions in word equations, balanced symbol equations including state symbols. State and explain why mass is conserved in a chemical reaction Explain why atoms have no overall charge. State the relative sizes of an atom and its nucleus.	Atoms into ions Ionic bonding Structure of ionic compounds Properties of ionic compounds Covalent bonding Structure of simple covalent molecules Properties of simple covalent molecules Giant covalent structures Fullerenes and graphene Metallic bonding Metallic structure and properties	Describe how an atom becomes an ion Describe how ionic bonding occurs by drawing a dot and cross diagram to illustrate electron transfer Describe the structure of ionic compounds and evaluate models used to represent them Explain the properties of giant ionic compounds, relating to their structure Describe how covalent bonding occurs by drawing dot and cross diagrams Describe what polymers are and recognise polymers from diagrams showing their bonding Explain the properties of simple covalent molecules Explain the properties of giant covalent structures, including diamond and graphite Describe uses of structures graphene and fullerenes, relating to their properties Evaluate models used to represent covalent molecules and giant structures Describe the bonding in metals

		<p>Noble gases (Group 0)</p> <p>Group 1 Alkali metals and water</p> <p>Other alkali metal reactions and explaining reactivity</p> <p>Group 7 The halogens reactions and explaining reactivity</p> <p>Group 7 Displacement reactions</p> <p>The transition elements (TRP only)</p>	<p>State that electrons are found in energy levels of an atom and the maximum number of electrons in the first three energy levels</p> <p>Describe the differences between the plum-pudding model and the nuclear model of the atom.</p> <p>Describe atoms using the atomic model.</p> <p>To describe how the elements are arranged in groups and periods in the periodic table.</p> <p>To explain in terms of electronic structure how the elements are arranged in the periodic table.</p> <p>To explain how properties of the elements in Group 0 depend on the outer shell of electrons of the atoms.</p> <p>To write word and balanced symbol equations for Group 1 metals with water.</p> <p>To explain why the elements in Group 1 react similarly and how Group 1 metals form ions.</p> <p>To describe the main properties of halogens.</p> <p>To explain why the elements in Group 7 react similarly and how Group 7 non-metals form ions.</p> <p>To investigate halogen displacement reactions and explain what happens in the reaction.</p> <p>To explain in detail how to compare the reactivity of the Group 1 and Group 7 elements.</p> <p>List the typical properties of transition metals and their compounds and how the properties of Group 1 metals compare with transition metals. (TRP only)</p>	<p>Nanoparticles (TRP only)</p> <p>Applications of nanoparticles (TRP only)</p>	<p>Explain the properties of metals, related to their bonding</p> <p>Classify a particle as coarse, fine, or nanoparticle based on its size. (TRP only)</p> <p>List the advantages and disadvantages of using nanoparticles and evaluate the use of nanoparticles in their applications, including sun cream. (TRP only)</p>
<p>Prior Domains:</p> <p>Link states of matter to the separation techniques needed to separate them.</p> <p>Apply separation techniques to everyday life.</p>		<p>Prior Domains:</p> <p>To state what atoms are.</p> <p>To represent atoms and elements using particle diagrams.</p>		<p>Prior Domains:</p> <p>To state what an element is.</p> <p>To recall the chemical symbol of 16 elements.</p> <p>To state what atoms are.</p> <p>To represent atoms and elements using particle diagrams.</p> <p>To represent atoms, molecules, elements, mixtures and compounds using particle diagrams.</p> <p>To name compounds using their chemical formula and determine their relative proportions.</p>	

		<p>To state what the groups and periods of the Periodic Table tell you about the elements.</p> <p>To state the properties and reactivity of Group 1 elements.</p> <p>To state the properties and reactivity of Group 7 elements.</p> <p>To state the properties and reactivity of the Group 0 elements.</p>
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Physics					
TOPIC TITLE: Molecules and matter		TOPIC TITLE: Energy and Energy Resources		TOPIC TITLE: Heat transfer and internal energy	
Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)
<p>States of matter</p> <p>Changes of state</p> <p>Density</p> <p>Required practical: density</p> <p>Gas pressure and temperature</p> <p>Gas pressure and volume (TRP only)</p>	<p>Use the particle model to explain the differences in the states of matter and differences in density.</p> <p>Measure the melting point of a substance and produce a time-temperature graph.</p> <p>Interpret graphs to identify boiling points and melting points.</p> <p>Explain why objects sink or float using the concept of density.</p> <p>Calculate the density of a regular solid, an irregular solid and a liquid through required practical (investigation).</p> <p>Explain how increasing the temperature of a gas affects the particles motion and pressure.</p> <p>Explain how the demo showing Brownian motion of a smoke cell provides evidence for the particle nature of matter.</p> <p>Describe how changing pressure (when temperature is constant) affects the volume of the gas and vice versa and use the equation: $pV = \text{constant}$. Explain why the temperature of a gas increases when it is compressed quickly enough. (TRP only)</p>	<p>Changes in energy stores</p> <p>Energy and work</p> <p>Gravitational potential energy stores</p> <p>Kinetic energy stores</p> <p>Elastic energy stores</p> <p>Conservation of energy</p> <p>Energy and power</p> <p>Energy and efficiency</p> <p>Energy demands</p> <p>Energy resources</p> <p>Big energy issues</p>	<p>Describe how energy is stored and transferred and what happens to it after it is used.</p> <p>Calculate the energy stored in a moving object or in an object when it is lifted or stretched.</p> <p>To describe what work is and how to calculate work done by a force.</p> <p>Explain how work and energy are related.</p> <p>To be able to use the conservation of energy to describe energy changes in closed systems.</p> <p>Understand the concept of power and how it is calculated.</p> <p>Understand the ideas of useful and wasted energy.</p> <p>How to compare machines and appliances in terms of their efficiency.</p> <p>Identify which fuels are renewable and which are non-renewable and explain why biofuels are considered carbon neutral.</p> <p>Outline the operation of a fossil fuel burning power station, a nuclear power station and a renewable energy source.</p> <p>Use base load and start-up time data to explain why some power stations are in constant operation whereas others may be switched on and off.</p> <p>Suggest the most appropriate energy resource to use in a range of scenarios and compare energy resources in terms of capital and operational costs.</p>	<p>Heat and temperature</p> <p>Heat transfer by conduction, convection and radiation</p> <p>Heating and insulating buildings</p> <p>Specific heat capacity</p> <p>Required practical: Specific heat capacity</p> <p>Specific latent heat</p> <p>Internal energy</p>	<p>Describe the difference between heat and temperature</p> <p>Describe what conduction is.</p> <p>Explain why metals are good conductors of heat.</p> <p>Describe what an insulator is and what makes a good insulator.</p> <p>Investigate the best insulation to use around hot drinks.</p> <p>Compare the thermal conductivities of materials in simple terms and relate the thermal conductivities of a material to familiar contexts.</p> <p>Describe the process of convection and explain how it may occur in real life examples.</p> <p>Describe what radiation is.</p> <p>Investigate the best and worst radiator of heat.</p> <p>Describe some design features used to prevent energy transfer to the surroundings in the home and calculate their payback time.</p> <p>Define specific heat capacity and how to use it to calculate the energy required to change the temperature of an object.</p> <p>Required practical: Measure the specific heat capacity of a material and find a mean value.</p> <p>Define specific latent heat of fusion and vaporisation and recall and use the equations</p> <p>Investigate and calculate the specific latent heat of fusion or vaporisation</p> <p>Define internal energy</p> <p>Explain the effect of heating an object on its internal energy, leading to a rise in temperature or a change in state</p>

<p>Prior Domains:</p> <p>To state that materials are made up of particles, and the arrangement of these particles change when they undergo a change in state.</p> <p>To apply changes of state to everyday scenarios.</p>	<p>Prior Domains:</p> <p>Identify energy value in food and compare the energy of food with the amount different people need.</p> <p>Investigate energy content in food.</p> <p>Describe how energy is generated via renewable and non-renewable means.</p> <p>Describe and explain how energy transfers occur.</p> <p>Calculate efficiency, power and cost of electricity.</p> <p>Describe how energy is generated via renewable and non-renewable means.</p>	<p>Prior Domains:</p> <p>Recognise common conductors and insulators. Association with metals being good conductors</p>
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YEAR 10

Biology							
TOPIC TITLE: Animal systems and respiration		TOPIC TITLE: Plants and photosynthesis		TOPIC TITLE: Nervous and Endocrine Systems		TOPIC TITLE: Reproduction and Inheritance	
Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)
<p>Organisation in animals</p> <p>Digestion</p> <p>Enzymes</p> <p>The lock and key hypothesis</p> <p>Enzyme activity</p> <p>Blood</p> <p>Blood vessels</p> <p>The heart</p> <p>Heart diseases</p> <p>Breathing and gas exchange</p> <p>Aerobic respiration</p> <p>The response to exercise</p> <p>Anaerobic respiration</p>	<p>Define key terms e.g cell, tissue, organs, organ systems and give examples of each.</p> <p>Describe digestion and label and describe the key parts.</p> <p>Explain how the villi are adapted for their function.</p> <p>Describe how to test food for glucose, starch, protein and lipids.</p> <p>State what an enzyme is and describe the function of key enzymes.</p> <p>Explain how enzymes work relating to the lock and key theory.</p> <p>Explain how the activity of enzymes changes due to temperature and pH.</p> <p>Explain the role of bile in digestion.</p> <p>Be able to describe the different components and blood and explain their uses</p>	<p>Photosynthesis</p> <p>The rate of photosynthesis</p> <p>How plants use glucose</p> <p>Making the most of photosynthesis</p> <p>Transport system in plants</p> <p>Transpiration and the factors affecting it</p> <p>Adaptation in the plant</p>	<p>Know why photosynthesis is important and to be able to recall the equation for photosynthesis</p> <p>To know what the limiting factors for photosynthesis are</p> <p>To be able to describe and use the inverse square law [H]</p> <p>To investigate the effect of light intensity on photosynthesis</p> <p>To be able to explain how plants use glucose</p> <p>Investigate whether a leaf has starch in it or not</p> <p>To be able to evaluate different methods of producing high yield crops vs their cost. [HT]</p> <p>Describe how water and mineral enter a plant. Explain how xylem and phloem are adapted to its function</p> <p>Describe how different factors affect the rate of transpiration</p> <p>Describe how plants are adapted to their environment</p>	<p>Principle of homeostasis</p> <p>Structure and function of the nervous systems</p> <p>Reflex actions</p> <p>Required practical: reaction time</p> <p>The brain (TRP only)</p> <p>The eye (TRP only)</p> <p>Common problems with the eye (TRP only)</p> <p>Principle of hormonal control</p> <p>The control of blood glucose levels and diabetes</p>	<p>State what homeostasis is and what needs to be controlled in the human body.</p> <p>Describe pathways for impulses from receptor to effector.</p> <p>Identify the sense organs.</p> <p>Investigate reflex actions.</p> <p>Describe the function of a synapse.</p> <p>Describe the function of brain structures (TRP only)</p> <p>(HT) Describe how regions of the brain have been mapped to particular functions. (TRP only)</p> <p>Describe the functions of the eye structures and how the it focuses light. (TRP only)</p> <p>Explain in detail the changes to the eye in response to changes in light intensity. (TRP only)</p> <p>Draw accurate ray diagrams to explain what happens during accommodation and what causes long and short sightedness. (TRP only)</p>	<p>Asexual and sexual reproduction</p> <p>The best of both worlds (TRP only)</p> <p>DNA structure (TRP only)</p> <p>Protein synthesis, genes expression and mutations (TRP only)</p> <p>DNA and the genome</p> <p>Inheritance in action/sex determination</p> <p>The history of genetics (TRP only)</p> <p>Inherited disorders</p> <p>Screening for genetic disorders</p>	<p>Define and investigate sexual and asexual reproduction.</p> <p>Describe how malarial parasites and fungi reproduce both asexually and sexually. (TRP only)</p> <p>Describe the benefits of studying the human genome.</p> <p>Describe the structure of DNA and how the four bases make up the genetic code. (TRP only)</p> <p>Describe the steps involved in producing a protein inside the cell. (TRP only)</p> <p>Explain how mutations in DNA can affect protein structure. (TRP only)</p> <p>Describe how inheritance occurs using a Punnet's square.</p> <p>Describe developments of genetics including the work of Mendel. (TRP only)</p>

<p>Metabolism and the liver</p>	<p>Be able to explain how each blood vessel is adapted to its function</p> <p>Be able to identify different parts of the heart</p> <p>Explain how coronary heart disease occurs and evaluate treatments</p> <p>Explain how a heart beats normally and how an irregular heartbeat can be corrected</p> <p>Explain the advantage and disadvantage of an artificial heart</p> <p>Be able to explain how the circulatory system is linked with breathing</p> <p>Be able to explain how the respiratory system is adapted to its function</p> <p>Explain the importance of respiration</p> <p>Describe how the body responds to exercise</p> <p>Explain the differences between aerobic and anaerobic respiration</p> <p>Describe the anaerobic respiration in other organisms</p> <p>Define metabolism</p> <p>Explain how the liver is involved in oxygen debt [HT]</p>			<p>Negative feedback (HT)</p> <p>Human reproduction</p> <p>Hormones involved in the menstrual cycle</p> <p>The artificial control of fertility and infertility treatments (HT)</p> <p>Plant hormones and responses. (TRP only)</p> <p>Using plant hormones. (TRP only)</p>	<p>Describe how lenses and surgery can help with long and short sightedness. (TRP only)</p> <p>State where the main glands are found in the body</p> <p>Describe what hormones are and what they target.</p> <p>Describe how blood glucose is controlled by hormones.</p> <p>Explain and describe the causes of type 1 and type 2 diabetes.</p> <p>Describe the function of adrenaline and thyroxine.</p> <p>Interpret and explain negative feedback loops.</p> <p>Explain and describe the main hormones in reproduction and the menstrual cycle.</p> <p>Explain and describe different methods of contraception (hormonal and non-hormonal).</p> <p>Describe the process of IVF and evaluate IVF treatments.</p> <p>Investigate the effect of light on the growth of newly germinated seedlings. (TRP only)</p> <p>Describe some uses of plant hormones (gibberellins, ethene, and auxins) in agriculture, horticulture, and the food industry. (TRP only)</p> <p>Explain the mechanisms that take place if body temperature is too high or too low. (TRP only)</p> <p>Describe how your body gets rid of waste products. (TRP only)</p> <p>Explain how urea is produced by the body. (TRP only)</p> <p>To outline the main roles of the kidneys and how they filter the blood. (TRP only)</p> <p>To explain the importance of the hormone ADH in water balance. (TRP only)</p> <p>Describe why kidney failure is a threat to life and how kidney dialysis and organ transplants work</p>		<p>Describe what is meant by an inherited disorder and give example e.g. polydactyly and cystic fibrosis.</p> <p>Research genetic screening.</p> <p>Make an informed judgement about embryo screening by evaluating in detail the economic, social, and ethical issues.</p>
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					as a way of treating kidney failure. (TRP only)		
Prior Domains: State the order of hierarchy of organisation in a multi-cellular organism Describe the structure and function of the main parts of the digestive system. Investigate enzymes and their functions List and describe the different parts of the respiratory system Describe the process of gas exchange State the word equation for aerobic respiration; anaerobic respiration and photosynthesis.		Prior Domains: Name some specialist cells and describe how they are adapted for their function Compare diffusion, osmosis and active transport State the word equation for aerobic respiration; anaerobic respiration and photosynthesis Plan an investigation to measure the effect of exercise on breathing rates. Describe how to test a leaf for starch. Explain how a leaf is adapted for photosynthesis. Carry out and record observations for an experiment to prove that oxygen is produced during photosynthesis.		Prior Domains: Name some specialist cells and describe how they are adapted for their function Describe unhealthy foods and their effects		Prior Domains: Describe the function of the main structures in the male and female reproductive systems. Describe what happens during fertilisation, gestation, birth and the menstrual cycle. To be able to explain the relationship between DNA, genes and chromosomes. Describe the structure of DNA Describe how scientists worked together and discovered the structure of DNA	

Chemistry							
TOPIC TITLE: Chemical changes		TOPIC TITLE: Electrolysis and Energy changes		TOPIC TITLE: Chemical calculations. Chemical Analysis and Chromatography		TOPIC TITLE: Crude oil and fuels	
Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)
Reactions of metals with oxygen and water The reactivity series Displacement reactions Loss and gain of electrons (HT) Extracting metals Salts from metals Acids, alkalis and the pH scale Strong and weak acids (HT)	To write word equations for metals reacting with oxygen, water, and acid, and balance given symbol equations. To describe oxidation and reduction in terms of gain or loss of oxygen and electrons. To investigate displacement reaction using different metals and sulfate solutions. To describe how metals can be extracted. Describe different methods of extracting copper from ores To describe how to make a salt by reacting a metal with an acid. To describe how universal indicator can be used to classify a chemical as acidic or alkaline. To explain the difference between concentration and strength in terms of acids and alkalis.	Introduction to electrolysis Electrolysis of molten compounds Electrolysis of aluminium Electrolysis of aqueous solutions Required practical: Electrolysis of aqueous solutions Exothermic and Endothermic reactions Required Practical:	Describe what is involved in electrolysis Describe the movement of ions during in electrolysis of molten compounds Identify the products formed at electrodes during electrolysis of molten compounds Describe the process of extracting aluminium using electrolysis, including the use of cryolite Predict products formed at electrodes during electrolysis of aqueous solutions Write half equations to represent oxidation and reduction at electrodes during electrolysis (H) Investigate electrolysis of aqueous solutions	Counting atoms and balanced equations Conservation of mass Relative atomic mass and formula mass The mole Reacting masses in equations Masses to balanced equations Limiting reactants The yield of a chemical reaction (TRP only) Atom economy (TRP only) Expressing concentrations	Students can count atoms in chemical formula. Students can count atoms in formula with brackets Define the term conservation of mass Students can balance symbol equations Use the periodic table to find the relative atomic mass of all elements. Calculate the relative formula mass for unfamiliar compounds when the formula is given. Calculate the number of moles or mass of a substance from data supplied Calculate the relative formula mass for one substance when the relative	Hydrocarbons Fractional distillation of oil Burning hydrocarbon fuels Cracking hydrocarbons Reactions of the alkenes (TRP only) Structures of alcohols, carboxylic acids and esters (TRP only) Reactions and uses of alcohols (TRP only) Carboxylic acids and esters (TRP only)	To define hydrocarbon and alkane. To name the different fractions from crude oil. To describe how the trend in colour, viscosity, flammability, and boiling point changes as the length of the hydrocarbon chain changes. To explain in detail how fractional distillation is used to separate crude oil into fractions. To explain the differences between complete and incomplete combustion. To describe the process of cracking, including conditions. To explain the similarities and differences between alkanes and alkenes. To use examples to explain the process of cracking and why it is

<p>Neutralisation-salts from alkalis</p> <p>Required practical: Making a salt</p>	<p>To describe a method to prepare a pure, dry sample of a soluble salt from an insoluble substance and a dilute acid (copper sulfate).</p>	<p>Temperature changes</p> <p>Reaction Profiles</p> <p>Bond energies (H)</p>	<p>Define and give examples of exothermic and endothermic reactions.</p> <p>Investigate temperature changes</p> <p>Draw reaction profiles</p> <p>Define activation energy and label it on an energy profile</p> <p>Use bond energy calculations to show if a reaction is endothermic or exothermic</p>	<p>Titration theory (TRP only)</p> <p>Titration required practical (TRP only)</p> <p>Volumes of gases (TRP only)</p> <p>Pure substances, mixtures and formulations</p> <p>Chromatography</p> <p>Testing for gases</p> <p>Required practical: Ion Tests – Flame Tests (TRP only)</p> <p>Required practical: Ion Tests – Cation precipitation reactions (with NaOH) (TRP only)</p> <p>Required practical: Negative Ion Tests (TRP only)</p> <p>Instrumental techniques – Flame emission Spectroscopy (TRP only)</p>	<p>formula masses are given for all the other substances in a balanced symbol equation.</p> <p>Interpret balanced symbol equations in terms of mole ratios.</p> <p>Be able to balance an equation given the masses of reactants and products.</p> <p>Explain the effect of a limiting reactant on the amount of product made.</p> <p>Calculate percentage yield when actual yield and theoretical yield are given and when the actual yield is given and the mass of the limiting reactant is given. (TRP only)</p> <p>Calculate the atom economy for a given chemical reaction. (TRP only)</p> <p>Describe what the concentration of a solution is.</p> <p>Calculate the concentration of a solution in g/dm^3 when given the mass of solute in g and volume of solution in dm^3.</p> <p>Calculate the mass of solute (in g) in a solution when given the concentration in g/dm^3 and volume in dm^3 or cm^3</p> <p>Calculate the amount of acid or alkali needed in a neutralisation reaction by titration. (TRP only)</p> <p>Calculate the volume of a gas at room temperature and pressure from its mass and relative formula mass. (TRP only)</p> <p>Calculate volumes of gaseous reactants and products from a balanced equation and a given volume of a gaseous reactant or</p>	<p>Addition Polymerisation (TRP only)</p> <p>Condensation polymerisation (TRP only)</p> <p>Natural polymers (TRP only)</p> <p>DNA (TRP only)</p>	<p>so important to the petrochemical industry.</p> <p>To draw the displayed structural formulae of the first four alkenes and of the products of the addition reactions between alkenes and hydrogen, water (steam), or a halogen. (TRP only)</p> <p>Name and draw the structural and displayed formulae for the first four primary alcohols, the first four carboxylic acids and for ethyl ethanoate. (TRP only)</p> <p>Describe fermentation to make aqueous solutions of ethanol, including a word equation. And describe the reactions of alcohols. (TRP only)</p> <p>List some chemical properties of carboxylic acids and describe what happens when any of the first four carboxylic acids react with carbonates, dissolve in water and react with alcohols. Describe how to make an ester. (TRP only)</p> <p>Draw an addition polymer structure when the structure of the monomer is given and explain how the repeating unit of a polymer relates to the monomer. State some uses of poly(ethene) and poly(propene). (TRP only)</p> <p>Draw a simplified structure of the monomers for a condensation polymer when the structure of the polymer is given. Draw a simplified structure of a condensation polymer when the structure of the monomers is given. (TRP only)</p> <p>State an example of a natural polymer and identify the monomer from the structural formula of a polymer. Explain in detail the process of condensation polymerisation with natural monomers,</p>
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					<p>product (like reactant masses but with gases). (TRP only)</p> <p>To describe the difference between pure substance and impure substances and formulations.</p> <p>Describe the main processes occurring in paper chromatography.</p> <p>To investigate how paper chromatography separates mixtures.</p> <p>To interpret chromatograms and determine R_f values from chromatograms.</p> <p>To describe the tests for hydrogen gas, oxygen gas, carbon dioxide gas and chlorine gas.</p> <p>Describe how to carry out a flame test and know the colours of common metal ions. (TRP only)</p> <p>Describe how to carry out a precipitation test and know the colours of common metal ion precipitates. (TRP only)</p> <p>Describe how to test and the result for sulfates, carbonates and halides and explain why we have to use certain acid in the chloride and sulfate test. (TRP only)</p> <p>State advantages of instrumental methods compared with the chemical tests and interpret an instrumental result given appropriate data, limited to flame emission spectroscopy.</p>		<p>including using equations. (TRP only)</p> <p>Name the type of monomers used to make DNA and describe its main structure. (TRP only)</p>
<p>Prior Domains:</p> <p>Describe features of chemical reactions and give examples of chemical and physical changes.</p> <p>Compare properties of acids and alkalis.</p>		<p>Prior Domains:</p> <p>Describe how an atom becomes an ion</p> <p>Describe the structure of ionic compounds</p> <p>Describe the basic structure of an atom.</p>		<p>Prior Domains:</p> <p>Describe atoms using the atomic model.</p> <p>Represent compounds using formula</p>		<p>Prior Domains:</p> <p>To write word equations for combustion and thermal decomposition reactions.</p>	

<p>Identify acids, alkalis and neutral solutions on the pH scale.</p> <p>Investigate how you can make crystals of salts (sodium chloride).</p> <p>Describe what happens when metals react with oxygen and acids.</p> <p>Investigate displacement reactions between metals and nitrate solutions.</p>	<p>Describe familiar chemical reactions in word equations, balanced symbol equations including state symbols.</p> <p>State and explain why mass is conserved in a chemical reaction</p> <p>To name compounds using their chemical formula and determine their relative proportions.</p> <p>To describe the model of chemical change and conservation of mass.</p> <p>Link states of matter to the separation techniques needed to separate them.</p> <p>Apply separation techniques to everyday life.</p>
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Physics

TOPIC TITLE: Radioactivity		TOPIC TITLE: Electricity in the home and electrical circuits		TOPIC TITLE: Forces and Motion.	
Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)
<p>Atoms and radiation</p> <p>Changes in the nucleus</p> <p>More about alpha beta and gamma radiation</p> <p>Activity and half-life; half-life calculations</p> <p>Uses and dangers of radiation</p> <p>Nuclear radiation in medicine (TRP only)</p> <p>The discovery of the nucleus</p> <p>Nuclear fission (TRP only)</p> <p>Nuclear fusion (TRP only)</p> <p>Nuclear issues (TRP only)</p>	<p>Understand how an unstable nucleus changes when it becomes stable and why the radiation it gives out is harmful.</p> <p>Describe what a radioactive substance is and the types of radiation given out by different radioactive sources.</p> <p>Explain what an isotope is and the changes that take place during nuclear decay. Use symbol equations to represent alpha and beta emissions.</p> <p>Understand and use experimental data to describe absorption range and ionising properties of the three types of radiation.</p> <p>Use data to determine half-life and to calculate count rates of radioactive isotopes.</p> <p>Explain what contamination and irradiation are and how to handle radioactive sources safely</p> <p>Describe the various uses of radioactive materials.</p> <p>Explain why alpha, beta or gamma radiation is chosen for a particular medical application.</p> <p>Describe the use of radioactive implants and how medical tracers are used. (TRP only)</p> <p>How experimental evidence was used to reject the plumb pudding model in favour of the nuclear model. Describe and explain how the nuclear model of the atom was established.</p>	<p>Introduction to electrical circuits. Symbols. Series and parallel circuits.</p> <p>Practical: Building circuits.</p> <p>Current and charge</p> <p>Potential difference</p> <p>Practical: Measuring current and potential difference in series and parallel circuits.</p> <p>Resistance</p> <p>Required practical: Resistance and length of wire</p> <p>Required practical: Component characteristics</p> <p>Required practical:</p>	<p>Identify circuit components from their symbols and use them to draw and interpret simple circuit diagrams.</p> <p>Construct an electrical circuit and accurately measure the current.</p> <p>Describe current, potential difference and resistance and be able to calculate them using the appropriate equations.</p> <p>Investigate the effect of changing the length of a wire on the resistance.</p> <p>State Ohm's law and describe its conditions.</p> <p>Investigate the resistance of a resistor, a filament lamp and a diode by measuring current and p.d and plotting I-V graphs.</p> <p>Describe and explain the I-V graphs of a fixed resistor, filament lamp and diode.</p> <p>Describe the characteristics of a light-emitting diode, thermistor and LDR.</p> <p>Investigate the effect of adding resistors in series and parallel on the size of the current in a circuit and the total resistance.</p> <p>To explain the difference between direct and alternating potential difference.</p> <p>Describe the characteristics of the UK mains supply.</p> <p>Identify the key components of a typical three-pin plug and socket.</p> <p>Calculate the power of electrical devices.</p> <p>Select an appropriate fuse for a device.</p>	<p>Vectors and scalars</p> <p>Forces between objects. Resultant forces</p> <p>Forces and elasticity</p> <p>Required practical: Force and extension</p> <p>Centre of mass</p> <p>The parallelogram of forces (HT)</p> <p>Resolution of forces (HT)</p> <p>Speed and distance-time graphs</p> <p>Velocity and acceleration</p> <p>More about velocity-time graphs</p> <p>Analysing motion graphs</p> <p>Force and acceleration</p>	<p>Compare a scalar and a similar vector and explain how these quantities are different.</p> <p>Give examples of contact and non-contact forces.</p> <p>Use scale diagrams to represent the sizes of forces acting on an object.</p> <p>Describe the action of pairs of forces in a limited range of scenarios.</p> <p>Calculate resultant force produced by several forces acting on an object in coplanar directions.</p> <p>Describe the effect of zero and non-zero resultant forces on the motion of moving and stationary objects.</p> <p>Investigate Hooke's law and calculate the force required to cause a given extension in a spring using the spring constant (Required practical).</p> <p>Compare materials in terms of elastic and non-elastic behaviour.</p> <p>Explain the limitations of Hooke's law including the limit of proportionality.</p> <p>Compare the behaviour of different materials under loads in terms of proportional and non-proportional behaviour.</p> <p>Identify the approximate centre of mass of a range of simple shapes.</p> <p>Describe an experimental technique to determine the centre of mass of an object.</p> <p>Compare the stability of objects to the position of their centre of mass.</p> <p>Find the resultant of two forces at an angle (non-parallel) by drawing a scale diagram and using a parallelogram technique.</p>

	<p>Describe how nuclear fission works and complete a nuclear equation showing nuclear fission. Explain how an escalating induced fission reaction (chain reaction) occurs. Explain the operation of a nuclear fission reactor, including the choices of appropriate materials. (TRP only)</p> <p>Outline the process of nuclear fusion and complete a nuclear equation showing simple fusion processes. Describe the key design features of a nuclear fusion reactor and compare it to the operation of a nuclear fission reactor. (TRP only)</p> <p>Discuss the risks and benefits of nuclear power compared to other methods of electricity generation. Describe the type of damage caused by large-scale nuclear accidents and how nuclear waste is very dangerous and must be stored safely for very long periods of time. (TRP only)</p>	<p>Resistors in series and parallel</p> <p>Resistance in series and parallel</p> <p>Alternating current and direct current. National Grid.</p> <p>Cables and plugs</p> <p>Electrical power and potential difference.</p> <p>Electrical currents and energy transfer</p> <p>Appliances and efficiency</p> <p>Static charge (TRP only)</p> <p>Electric fields (TRP only)</p>	<p>Calculate energy transfer in kilowatt-hours and convert between efficiencies stated in percentages and those stated in decimal forms.</p> <p>Describe how objects become charged in terms of electron transfer and explain why sparks can be produced by charged materials in terms of charge build-up. (TRP only)</p> <p>Describe the shape of the field and lines of force around a point charge or charged sphere. Use the concept of electric fields to explain why charged objects interact and why the force between charged objects decreases with increasing distance. (TRP only)</p>	<p>Required practical: Force and acceleration</p> <p>Weight and terminal velocity</p> <p>Forces and braking</p> <p>Momentum (HT)</p> <p>Using conservation of momentum (HT) (TRP only)</p> <p>Impact forces (HT) (TRP only)</p> <p>Safety first (HT) (TRP only)</p>	<p>Resolve a single force into two perpendicular components.</p> <p>Determine if an object is in equilibrium by considering the horizontal and vertical forces.</p> <p>Describe the motion of an object by interpreting distance–time graphs.</p> <p>Calculate the speed of an object and the time taken to travel a given distance.</p> <p>Describe the difference between speed and velocity using an appropriate example.</p> <p>Calculate the acceleration of an object using the change in velocity and time.</p> <p>Calculate the change in velocity for an object under constant acceleration for a given period of time.</p> <p>Identify the features of a velocity–time graph: the acceleration [the gradient] and the distance travelled [the area beneath the line].</p> <p>Use a tangent to determine the speed of an object from a distance–time graph.</p> <p>Use the equation $v^2 - u^2 = 2as$ in calculations where the initial or final velocity is zero.</p> <p>Investigate the factors that will affect the acceleration of an object acted on by a resultant force (Required practical).</p> <p>Perform calculations involving the rearrangement of the $F = ma$ equation.</p> <p>Calculate the weight of objects using their mass and the gravitational field strength.</p> <p>Apply the concept of balanced forces to explain why an object falling through a fluid will reach a terminal velocity.</p> <p>Investigate the relationship between the mass of an object and the terminal velocity.</p> <p>List the factors which affect the stopping distance of a car.</p> <p>Calculate the thinking distance for a car from the initial speed and reaction time.</p> <p>Apply the equation $p = mv$ to find the momentum, velocity or mass of an object (HT).</p> <p>Apply the law of conservation of momentum to find the momentum before and after collisions. Calculate the velocity of objects before or after impacts (HT). (TRP only)</p> <p>Calculate the force involved in an impact from the change in momentum and time. Calculate changes in velocity and momentum during impacts using the force involved and the impact time. (TRP only)</p> <p>Explain how safety features such as air bags, seat belts cycle helmets and gym crash mats work with reference to the rate of change of momentum. Evaluate a range of safety features based on costs and effectiveness. (TRP only)</p>
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<p>Prior Domains:</p> <p>Describe atoms using the atomic model.</p> <p>Describe the differences between the plum-pudding model and the nuclear model of the atom.</p> <p>Describe how an atom becomes an ion</p> <p>Explain why atoms have no overall charge.</p> <p>State the relative sizes of an atom and its nucleus.</p> <p>State that electrons are found in energy levels of an atom</p>	<p>Prior Domains:</p> <p>Draw diagrams to explain how an object becomes charged up.</p> <p>Describe electric fields and how charged object interact.</p> <p>Describe what is meant by an electric current. Describe what happens to current when you change components in a circuit.</p> <p>Use models to explain p.d.</p> <p>Draw and make circuits to measure current and p.d.</p> <p>Explain how p.d. affects the way components work.</p> <p>Make series and parallel circuits to measure the current and p.d.</p> <p>Measure resistance in circuits and use a model to explain how resistance affect the way components work.</p>	<p>Prior Domains:</p> <p>To describe what forces do and how they are measured.</p> <p>To identify contact and non-contact forces, including friction and gravity.</p> <p>To explain the effect of balanced and unbalanced forces on the motion of an object. To identify and calculate the resultant force.</p> <p>To describe the difference between mass and weight and calculate weight using mass and gravitational field strength.</p> <p>To identify and calculate the resultant force.</p> <p>To investigate how different surfaces and /or the angle of a slope affect the force of friction on a block.</p> <p>To investigate how forces deform objects.</p> <p>To plot and interpret bar charts and draw conclusions using their scientific knowledge.</p> <p>To calculate speed. To be able to rearrange the speed equation.</p> <p>To describe and interpret distance–time graphs.</p>
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TOPIC TITLE: Moments and Pressure (TRP only)	
Topics	Domains (Core knowledge and skills)
<p>Moments and turning effects</p> <p>Equilibrium and the principle of moments</p> <p>Levers and gears</p> <p>Pressure and surfaces</p> <p>Pressure in liquids -HT</p> <p>Atmospheric pressure</p> <p>Upthrust and flotation -HT</p>	<p>Give the factors that affect the size of a moment and learn the equation for moment. Perform calculations involving moments, including rearrangement of the equation.</p> <p>Define the principle of moments and apply it to determine if an object is in equilibrium. Find the weight of an object using a balanced beam and use calculations to determine if an object with three or more moments is in equilibrium.</p> <p>Identify levers being used as force multipliers and calculate the forces produced by force multipliers. Describe the action of a pair of gears in terms of increasing or decreasing the size of forces.</p> <p>Describe the effect on the pressure of changing the area of contact or weight acting on a surface. Calculate the pressure caused by an object resting on a surface, given the force and area of contact.</p> <p>Use the concept of force, mass, and volume to explain why the pressure increases with depth in a liquid. Calculate the pressure at a point in a liquid using $p = h \rho g$ and rearrange the equation $p = h \rho g$ to solve a range of questions involving the pressure in a liquid. (HT)</p> <p>Calculate the forces produced by pressure differences. Describe the change in pressure at different heights. Use the equation $p = h\rho g$ to determine pressure in a fluid.</p> <p>Describe the relationship between upthrust and weight for floating and submerged objects. Compare the density of an object with the density of a liquid to determine whether or not the object will float. Calculate the upthrust acting on a submerged object by using the pressure difference on the top and bottom surfaces. (HT)</p>
<p>Prior Domains:</p> <p>Y8: To describe what is meant by a moment.</p> <p>Y8: To explain how machines work.</p> <p>Y8: To calculate pressure.</p> <p>Y8: To apply pressure calculations to different situations.</p> <p>Y9: To describe the motion of particles in a fluid.</p> <p>Y9: To describe the difference between mass and weight and calculate weight using mass and gravitational field strength.</p>	

Year 11

Biology			
TOPIC TITLE: Evolution and Genetics		TOPIC TITLE: Ecology	
Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)
Variation Selective breeding Evolution by natural selection Speciation and evolution (TRP only) Evidence for evolution Theories of evolution (TRP only) Antibiotic resistant bacteria Fossils, extinction and more about extinction Genetic engineering and ethics of genetic technologies Cloning (TRP only) Adult cell cloning (TRP only) Classification New systems of classification	<p>Categorise some human traits as being due to genetic causes, environmental causes, or both.</p> <p>Explain the process of selective breeding.</p> <p>Describe the steps that take place during evolution by natural selection.</p> <p>Describe the steps involved in the process of speciation. (TRP only)</p> <p>Describe how fossils are evidence for evolution by natural selection.</p> <p>Compare and contrast Darwin and Lamarck's theories of evolution. (TRP only)</p> <p>Describe what is meant by extinction.</p> <p>Describe how antibiotic resistant bacteria evolve.</p> <p>Describe the steps used in genetic engineering to produce GM organisms.</p> <p>Evaluate the potential benefits and risks of genetic engineering.</p> <p>Describe how to take stem and leaf cuttings of plants. (TRP only)</p> <p>Describe the steps of animal cloning using embryos. (TRP only)</p> <p>Describe adult cell cloning as producing a complete clone of an adult animal. (TRP only)</p> <p>List some benefits and drawbacks of adult cell cloning. (TRP only)</p> <p>Classify animals into groups based on their shared characteristics.</p> <p>Identify genus and species from a scientific name.</p> <p>Describe how organisms are divided in the three-domain system.</p>	The importance of communities and organisms in their environment Distribution and abundance Competition in plants and animals Adaptation in animals and extremophiles Adaptation in plants Feeding relationships Material recycling Carbon cycle Decomposition (TRP only) The human population explosion Land and water pollution Air pollution Deforestation and peat destruction The impact of change (TRP only) Global warming Maintaining biodiversity Trophic levels and biomass (TRP only) Making food production efficient and sustainable (TRP only)	<p>Describe key terms associated with ecosystems</p> <p>Explain the importance of a stable community</p> <p>Required practical: measuring the abundance of a species using a quadrat (systematic and random)</p> <p>Describe what plants and animals compete for</p> <p>Describe how plants and animals are adapted to their environments.</p> <p>State and explore what extremophiles are.</p> <p>Explore feeding relationships using key terms like predator, producer etc.</p> <p>Construct and evaluate food chain and food webs.</p> <p>Describe how materials are recycled in the environment e.g. dead organisms, carbon and water.</p> <p>Identify factors that speed up or slow down decay. (TRP only)</p> <p>Describe what biodiversity mean and the importance of maintaining it.</p> <p>Describe global warming and how human activity is contributing to it.</p> <p>Explain the importance of peat bogs and how their destruction has an environmental effect on the planet.</p> <p>Evaluate the effect of environmental changes on the distribution of organisms.</p> <p>Describe deforestation.</p> <p>Describe some ways that air, water and land are polluted.</p> <p>Construct accurate pyramids of biomass from appropriate data. (TRP only)</p> <p>Describe factors that can affect food security. (TRP only)</p> <p>Describe how sustainable food production could help increase food security. (TRP only)</p> <p>List the advantages and disadvantages of free-range and factory farming of chickens. (TRP only)</p> <p>Explain why eating less meat would result in more food for everyone. (TRP only)</p> <p>Describe the techniques used to conserve fish stocks. (TRP only)</p> <p>Describe how mycoprotein is produced. (TRP only)</p> <p>Compare and contrast the production of mycoprotein and intensive farming. (TRP only)</p>

<p>Prior Domains: State some resources that plants and animals compete for. Give a possible reason for adaptation or extinction. State what is meant by the term variation. Describe how variation in species occurs. State that there are two types of variation. Use knowledge of continuous and discontinuous variation to explain whether characteristics are inherited, environmental, or both. Understand how Darwin developed the idea of evolution To be able to apply the concept of Natural Selection to a variety of different organisms within their own environment Compare prokaryotic and eukaryotic cells</p>		<p>Prior Domains: State some resources that plants and animals compete for. To be able to explain the benefits of preserving biodiversity and describe the methodology of doing so Describe and explain what is meant by global warming. Use the carbon cycle to show how carbon is recycled Describe how human activities affect the carbon cycle. Describe how global warming can impact on climate and local weather patterns.</p>	

Chemistry			
TOPIC TITLE: Rates of reaction		TOPIC TITLE: Earth's atmosphere and resources	
Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)
<p>Introduction to rates of reaction Surface area Temperature Required practical: concentration Catalysts Reversible reactions and equilibrium Effects on the position of equilibrium (H)</p>	<p>Recall a definition for rate of reaction. Calculate the mean rate of reaction. Calculate the rate of reaction at a specific time. Calculate the gradient of a tangent to the curve on these graphs as a measure of rate of reaction at a specific time (HT). List the factors that can affect the rate of a chemical reaction. Describe how changing the surface area changes the rate of reaction. Describe what the activation energy of a reaction is. Calculate the surface area to volume ratio. Use collision theory to explain how changing temperature; concentration or pressure or adding a catalyst alters the rate of reaction. Explain how to change gas pressure. Explain, with an example, the industrial use of a catalyst. Explain, using a familiar example, how a reaction can be reversible. Explain why the energy change in a reversible reaction is exothermic in one direction and endothermic in the reverse direction. Describe a familiar reversible reaction using a balanced symbol equation.</p>	<p>History of Earth's atmosphere Our evolving atmosphere Greenhouse gases Global Climate Change Atmospheric pollutants Finite and renewable resources Water safe to drink Treating wastewater Life cycle assessment Reduce, reuse and recycle Useful alloys (TRP only) Rusting (TRP only) The properties of polymers (TRP only) Glass, ceramics and composites (TRP only) Making ammonia- the Haber Process (TRP only) The economics of the Haber process (TRP only) Making fertilisers in the lab and industry (TRP only)</p>	<p>Be able to describe the earth's early atmosphere and explain how it changed over time Be able to explain how humans are affecting the current atmosphere and climate Be able to explain how pollutants are made and explain their effects on the earth and the environment Distinguish between finite and renewable resources Extract and interpret information about resources from graphs, charts and tables Making potable water from rivers, lakes and sea Explaining the process of desalination Be able to carry out the process of desalination and identifying pure and impure water. Be able to evaluate the life cycle of different products Explain how using less, reusing and recycling of materials decreases their environmental impact How to evaluate ways of reducing the use of limited supplies of metal ores, given information. Define an alloy and list some common examples of alloys and their uses. Evaluate an alloy in terms of its properties and uses. (TRP only) Define the term corrosion and describe an experiment to investigate the conditions required for rusting to occur. Explain how different corrosion prevention techniques work. (TRP only)</p>

	<p>Predict the observations of a familiar reversible reaction when the conditions are changed.</p> <p>Describe how to achieve dynamic equilibrium.</p> <p>Describe how rate of the forward reaction compares to rate of the backward reaction in a dynamic equilibrium.</p> <p>Describe Le Chatelier's Principle.</p> <p>Explain how changing conditions for a system at dynamic equilibrium affects the rate of the forward and reverse reactions.</p> <p>Predict the effect on yield of changing temperature, concentration, or pressure in a given equilibrium system.</p>		<p>Explain the difference between thermosoftening and thermosetting polymers in terms of their structures. (TRP only)</p> <p>Describe how to make soda-lime glass and borosilicate glass as well as clay ceramics. Describe what a composite is and state examples. Compare quantitatively the physical properties of glass and clay ceramics, polymers, composites, and metals and evaluate materials in terms of their properties and uses. (TRP only)</p> <p>Write a word and balanced symbol equation to describe the Haber process. State the sources for the nitrogen and hydrogen used in the Haber process and describe the process for the manufacture of ammonia. (TRP only)</p> <p>Explain the effect of changing pressure on the yield of the Haber process and why the conditions used in the Haber process are a compromise. (TRP only)</p> <p>Write word equations for the formation of the chemicals in NPK fertilisers and describe in detail how fertilisers are produced. (TRP only)</p>
<p>Prior Domains:</p> <p>Describe familiar chemical reactions in word equations, balanced symbol equations including state symbols.</p>		<p>Prior Domains:</p> <p>State how an increase in greenhouse gases has increased the temperature on Earth</p> <p>Name two greenhouse gases</p> <p>Describe and explain what is meant by global warming.</p> <p>Describe how global warming can impact on climate and local weather patterns.</p>	
Physics			
TOPIC TITLE: Waves and the EMS		TOPIC TITLE: Electromagnetism	
Topics	Domains (Core knowledge and skills)	Topics	Domains (Core knowledge and skills)
<p>The nature of waves</p> <p>Properties of waves</p> <p>Required practical: Investigating waves: Ripple tank and Standing waves</p> <p>Speed of sound</p> <p>Using sound waves and ultrasound (HT) (TRP only)</p> <p>Seismic waves (HT) (TRP only)</p> <p>EMS trends</p> <p>EMS uses and dangers</p> <p>Required practical: absorption and emission</p> <p>Black body radiation (TRP only) -Thermal equilibrium (HT)</p> <p>Reflection and Refraction. Required practical (TRP only)</p> <p>Understanding refraction (HT)</p> <p>Lenses (TRP only)</p> <p>Using lenses (TRP only)</p> <p>Light and colour (TRP only)</p>	<p>Describe differences between transverse and longitudinal waves.</p> <p>Use the wave equation.</p> <p>Investigate waves using the ripple tank and a string to measure wave speed.</p> <p>The link between period and frequency.</p> <p>Describe how sound waves travel more quickly in solids than they do in liquids and gases and how to measure the speed of sound.</p> <p>Compare ultrasound and audible sound waves in terms of frequency and outline some uses of ultrasound in distance measurement. Describe the operation of an ultrasound transducer in terms of partial reflection (TRP only).</p> <p>Describe the internal structure of the Earth and compare the three types of seismic waves (P and S) in terms of the speed they travel and whether they are transverse or longitudinal. Describe the operation of a seismometer (TRP only).</p> <p>Describe the EMS as well as the uses and properties of EM waves.</p>	<p>Magnetic fields</p> <p>Magnetic fields of electric current</p> <p>Electromagnets</p> <p>Electromagnets in devices (TRP only)</p> <p>Investigating electromagnets</p> <p>The motor effect (HT)</p> <p>The electrical motor (HT)</p> <p>The generator effect (TRP only) (HT)</p> <p>The alternating-current generator (TRP only) (HT)</p> <p>Transformers (TRP only) (HT)</p> <p>Transformers in action (TRP only) (HT)</p>	<p>Sketch the shape of a magnetic field around a bar magnet.</p> <p>Describe the attraction and repulsion between poles of permanent magnets.</p> <p>Explain the difference between permanent and induced magnets.</p> <p>Compare the earth's magnetic field to that of a bar magnet.</p> <p>Use the corkscrew rule to determine the direction of the field around a current carrying wire.</p> <p>Describe the difference between a solenoid and an electromagnet.</p> <p>Investigate the factors which affect the strength of an electromagnet.</p> <p>Explain the effect of an iron core on the strength of an electromagnet in terms of the magnetic field.</p> <p>Describe the operation of simple devices that use electromagnets. Describe in detail the operation of an electric bell (TRP only).</p> <p>Describe what the motor effect is and how to use Fleming's left-hand rule.</p> <p>Explain how the force on a conductor in a magnetic field causes the rotation of the coil in an electric motor.</p>

	<p>Use the wave equation to calculate frequency or wavelength of EM waves.</p> <p>Describe the use of EM waves in communications and medicine.</p> <p>How electromagnetic waves carry information and how they are used to form images.</p> <p>Plan and carry out an investigation into the rate of cooling of infrared radiation.</p> <p>Describe the cooling of objects in terms of the rate of emission of radiation and how the rate of emission of radiation is related to the temperature of a body. Describe the visible changes in an object's emitted radiation as its temperature is increased (TRP only).</p> <p>State the law of reflection and construct accurate ray diagrams showing the reflection of light rays. Describe how the path of a ray of light will change at a boundary between two transparent materials.</p> <p>Investigate the refraction of light through a glass or Perspex block and construct ray diagrams to illustrate the refraction of a wave at the boundary between two different media (TRP only).</p> <p>Draw diagrams to show reflection and refraction using wavefronts and explain refraction in terms of changes in the speed of waves when they move between one medium and another.</p> <p>Describe the difference between absorption, transmission, reflection and refraction.</p> <p>Identify converging or diverging based on a simple ray diagram and their shapes and form images by using a range of lenses. Identify real and virtual images by using ray diagrams (TRP only).</p> <p>Calculate the magnification of a lens based on object and image size (TRP only).</p> <p>Investigate the image-forming properties of a converging lens. Construct complete ray diagrams showing image formation by a convex lens with a variety of object positions. Fully describe the properties of an image (real, virtual, magnified, diminished, upright, and inverted) based on a ray diagram. (TRP only).</p> <p>Describe the image formed by a magnifying glass and by a camera lens. From first principles, construct ray diagrams showing the formation of images by a convex lens and a concave lens. Use scale diagrams to determine the size of an image produced by a lens (TRP only).</p>		<p>Describe electromagnetic induction in a wire. Explain why relative movement of a wire through a magnetic field is required to cause induction (TRP only).</p> <p>Identify the factors that affect the size of an induced current in a wire and the direction of current induced in a solenoid (TRP only).</p> <p>Describe how a changing current in one coil can be used to induce a current in another (TRP only).</p> <p>Describe and explain the operation of an alternator, moving-coil microphone and loudspeaker and identify the period and peak output voltage for generators from an oscilloscope trace (TRP only).</p> <p>Describe and explain the operation of a d.c. generator and its output and explain why the peak voltage of an a.c. generator is produced when the plane of the coil is parallel to the magnetic field lines (TRP only).</p> <p>Describe the structure of a transformer. Describe and explain the operation of a transformer in terms of induction and changes in magnetic fields (TRP only).</p> <p>Use the equation potential difference across primary coil \times current in primary coil = potential difference across secondary coil \times current in secondary coil (TRP only).</p> <p>Use the equation potential difference across primary coil \times current in primary coil = potential difference across secondary coil \times current in secondary coil to calculate input or output voltages for a transformer (TRP only).</p> <p>Calculate the secondary current in a transformer. Measure the efficiency of a transformer and explain why this may not be 100% (TRP only).</p>
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	<p>Describe the visible spectrum as a continuous series of colours or wavelengths and explain the colour of objects in white light in terms of reflection of parts of the spectrum (TRP only).</p> <p>Describe the colours of objects in different colours of light and determine the appearance of a white object when illuminated by combinations of primary coloured light (TRP only).</p> <p>Describe the effects of combinations of coloured light and filters on the appearance of a variety of coloured objects (TRP only).</p>		
<p>Prior Domains:</p> <p>Describe what happens to light when it meets a different medium. Use key words and diagrams to describe how light travels.</p> <p>Use ray diagrams to show how light is reflected from a mirror. Describe and explain how images are formed in a mirror.</p> <p>Use diagrams to show how light passes through transparent materials</p> <p>Construct ray diagrams to show refraction.</p>		<p>Prior Domains:</p> <p>Describe how magnets interact.</p> <p>Draw field lines round a magnet in detail.</p> <p>Describe the Earth's magnetic field.</p> <p>Explain how a compass works.</p> <p>Describe how to make an electromagnet and change its strength.</p> <p>Describe some uses of electromagnets.</p> <p>Describe how an electric bell, circuit breaker, or loudspeaker works.</p> <p>Investigate the effect of changes to the number of wire coils, the size of electrical current or the use of a core on the strength of an electromagnet.</p>	

TOPIC TITLE: Space (TRP only)	
Topics	Domains (Core knowledge and skills)
<p>Formation of the Solar System</p> <p>The life history of a star</p> <p>The expanding universe</p> <p>The beginning and the future of the universe</p> <p>Planets, orbits, and satellites</p>	<p>Describe a variety of objects within the Solar System and use simple data to compare objects in the Solar System.</p> <p>Describe the formation of a protostar and planets.</p> <p>Explain why a star radiates light in terms of nuclear fusion.</p> <p>Analyse data about the planets to compare them in terms of composition.</p> <p>Compare the life cycle of small and large stars, identifying the names of the stages.</p> <p>Describe the forces that are acting when a star is in its main sequence and explain why a star in its main sequence maintains a constant radius.</p> <p>Describe the formation of 'light' elements by stars in their main sequence.</p> <p>Describe changes in the wavelength (colour) and quantity (brightness) of light emitted by stars during various stages of their life cycle.</p> <p>Explain, in terms of energy requirements, why elements heavier than iron are produced only in supernovae.</p> <p>Describe the features of neutron stars and black holes.</p> <p>Describe how the frequency or wavelength of a wave can be altered by the movement of the source through the Doppler effect.</p> <p>Identify red-shift or blue-shift by comparing emission spectra of objects with those of a non-moving source.</p> <p>Compare galaxies in terms of their red-shift and distance from us.</p> <p>Identify the relationship between the red-shift of a galaxy and its speed of recession from a data set or graph.</p> <p>Explain how red-shift data is used to show that the universe is expanding.</p> <p>Describe how red-shift provides evidence for expansion of the universe and the Big Bang model.</p> <p>Describe the cosmic microwave background radiation (CMBR) Explain in detail how the CMBR supports the Big Bang</p> <p>Describe changes in the universe from the time of the Big Bang to the present day.</p>

	<p>Discuss how scientists using new evidence have changed their theories about how the universe has evolved over time and how it will change in the future.</p> <p>Compare the orbits of planets, moons, and artificial satellites.</p> <p>Describe how, for an object to be moving in an orbit, there must be a gravitational force acting directed at the centre of the orbit.</p> <p>List some uses of artificial satellites and describe their different orbits.</p> <p>Explain why a geostationary satellite must be a specific distance from the centre of the Earth.</p> <p>State that, for a greater radius of orbit, the object must travel at a slower speed and orbit in a longer period (HT).</p> <p>Describe the forces acting on an object that cause it to travel in a circular path (HT).</p> <p>Explain why a centripetal force can change the velocity of an object without changing its speed (HT).</p> <p>Explain why the force acting on an object travelling in a circle must be at right angles to the direction of motion and directed towards the centre of the circle (HT).</p>
<p>Prior Domains:</p> <p>Y10: Forces and their interactions. Newton's laws of motion. Speed, velocity, acceleration and momentum.</p> <p>Y10: moments and turning effects.</p> <p>Y7: basics on Space. The night sky, the moon, the solar system.</p>	