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Science

Science Nursery (EYFS)

Topic	**My local area**	**Our Community**	**Family and Community**	**Wider World**	**Wider World**	**Wider World**
Enquiry Question	I wonder who I will become.	I wonder what is important to my community.	I wonder who I will become.	I wonder who shares our home.	I wonder how the world needs me.	I wonder who shares our world.
Big Ideas/ Key concepts	The five senses - sight, taste, touch, hearing and smell – collect information about our environment that are interpreted by the brain. Personal hygiene ensures we keep germs away and prevent illness. Pupils are familiar with their new surroundings.	In Autumn the environment changes because of the weather.	Objects can float or sink because of the material they are made from.	There are a variety of insects that live in different environments and habitats. A chicken comes from an egg and the cycle happens continuously.	All plants need space to grow, the right temperature, light, water, air, nutrients, and time. When left outside, food can decay or animals can eat it.	Ocean animals have special adaptations to live in the water. It is important to look after our environment to look after the animals on our earth.
Key Knowledge and skills	To learn the 5 senses. To explore the provision and school environment. To embed the skill of how to go to the toilet. To understand how to wash their hands.	To notice seasonal autumnal changes. To experience what light and dark is. To understand what makes daytime and night time.	To explore how things work (floating and sinking – Noah's Ark).	To care for the natural environment. To observe seasonal spring changes. To explore habitats of animals. To understand animal lifecycles.	To learn plant lifecycles. To plant seeds and care for growing plants. To observe growth and decay. To make simple predictions.	To explore habitats of ocean animals. To care for the natural environment.
End Point	• Explore the natural world around them, making observations and drawing pictures of animals and plants. • Know some similarities and differences between the natural world around them and contrasting environments, drawing on their experiences and what has been read in class. • Understand some important processes and changes in the natural world around them, including the seasons and changing states of matter.					
Prior Knowledge	To know familiar adult.	To talk about what they see, using a wide vocabulary.	To explore and respond to different natural phenomena in their setting and on trips.	To explore and respond to different natural phenomena in their setting and on trips.	To explore and respond to different natural phenomena in their setting and on trips.	To begin to understand the need to respect and care for the natural environment and all living things.

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Key Misconceptions	The sense for our hands is to hold. The sense for our nose is to breathe.	It is night time because the moon hides away. It is night time all over the world.	An object sinks because it is heavy.	An egg from the supermarket is not an egg from a chicken.	Plants grow very quickly.	Animals in the water have a nose to breathe through.
Core Key Words	• germs • senses • sight • taste • touch • hearing • smell	• autumn • weather • day time • night time	• sink • float • heavy • light • dense	• life cycle • habitat • environment	• decay • predict • temperature • nutrients	• ocean • habitat • adapt

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Science Reception (EYFS)

Topic	My local area	Our Community	Family and Community	Wider World	Wider World	Wider World
Enquiry Question	I wonder who I will become.	I wonder what is important to my community.	I wonder who I will become.	I wonder who shares our home.	I wonder how the world needs me.	I wonder who shares our world.
Big Ideas/ Key concepts	A map helps me to find my way around the school. We go through stages from a baby to an adult.	In Autumn, environmental changes happen due to climate e.g. leaves falling off the tress, leaves turning colour, plants stop making food. When we mix materials, it can be irreversible or reversible.	Electricity is made in power stations that are connected to our homes. Electricity allows us to turn on our lights, TV, games console etc. in our home. Magnets have a north and south pole and they can only attract to materials that are magnetic.	When Autumn changes to Spring, there are environmental changes. Animals have a life cycle that is continuous. Each animal has a life cycle otherwise they would be extinct. We can classify into invertebrates and vertebrates.	Food is grown in a variety of ways. There is a journey from grower to consumer. An investigation will prove what a plant needs to grow. Food grows in a variety of ways.	Some objects float and sink dependent on density. Animals can be classified into mammals, fish, reptiles, amphibians, insects and birds.
Key Knowledge and skills	To explore the school setting and the environment. To understand the human lifecycle. To identify key body parts and bones. To explore what body parts we use for certain activities and why.	To observe and compare on seasonal autumn changes. To observe changes of state: ice and baking.	To observe and comment on the effect of magnets. To understand what electricity is and how it affects our lives. To describe the season and weather associated with it. To observe how animals behave differently in different seasons.	To observe and compare seasonal spring changes. To understand a variety of animal Lifecycles. To understand that different animals have different habitats and why. To identify animals and matching them to their habitat. To classify animals.	To investigate plant lifecycles. To conduct a plant investigation. To compare how food is grown.	To observe and compare objects that float and sink and understand why. To classify animals. To explore adaptation of animals (land and sea).
End Point	• Explore the natural world around them, making observations and drawing pictures of animals and plants. • Know some similarities and differences between the natural world around them and contrasting environments, drawing on their experiences and what has been read in class. • Understand some important processes and changes in the natural world around them, including the seasons and changing states of matter.					

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Prior Knowledge	Make connections between the features of their family and other families. Notice differences between people.	Talk about the differences between materials and changes they notice. To observe and compare the plants and animals that I see in the natural world around me.	To explore and investigate mechanisms. Explore and talk about different forces they can feel.	To observe and compare the plants and animals that I see in the natural world around me.	To observe and compare the plants and animals that I see in the natural world around me. Plant seeds and care for growing plants.	To observe and compare the plants and animals that I see in the natural world around me. Talk about the differences between materials and changes they notice.
Key Misconceptions	A baby and a toddler are the same part in the human lifecycle.	Baking can be reversible. Ice is not frozen water.	Magnets are like glue so they stick together. Electricity is free and it is made at home.	Animals are all the in the same classification group.	Food is made in the supermarket or the shops.	Animals are all the in the same classification group. Objects sink because they are heavy.
Core Key Words	• map • baby • toddler • child • teenager • adult	• reversible • irreversible • autumnal • climate	• electricity • power grid • North Pole • South Pole	• invertebrates • vertebrates • extinct	• factory • fruit • vegetables • grains • protein • dairy	• mammals • fish • reptiles • amphibians • insects • birds • density

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Science KS1 (Cycle A)

Topic	Humans	Seasonal Changes (Autumn/Winter)	Animals	Materials	Living things and their Habitats	Plants
Enquiry Question	Which sense is the most useful?	How might we know what season it is? (Cycle A)	What is most important for animals to survive?	What is the best material to create a floating mode of transport?	Why don't polar bears live in the desert?	Why is it useful to know which plants are in our local area?
Big Ideas/ Key concepts	Genetic information is passed from each generation to the next; this information and the environment affect the features, growth and development of organisms.	Substances can move within and between the atmosphere, hydrosphere, geosphere and biosphere as part of large-scale Earth systems.	All organisms, including humans, depend on, interact with and affect the environments in which they live and other organisms that live there.	Materials are either made of a single chemical substance or a mixture of substances which each have distinctive properties.	All organisms, including humans, depend on, interact with and affect the environments in which they live and other organisms that live there.	All organisms, including humans, depend on, interact with and affect the environments in which they live and other organisms that live there.
Key Knowledge and skills	To identify, name, **draw** and label the basic parts of the human body. To explore the five senses and explain which part of the human body is associated with each sense, **using observational skills to ask and answer questions about these.** To explore the different stages of a human lifecycle, **researching and** explaining the specific changes that occur as humans move through these stages.	To understand that the UK has four seasons and name these. To understand when the UK has autumn and winter, **naming the months associated with these seasons**, and use observational skills to observe autumnal changes. To explore, **research and explain** changes that occur during winter. To consider, **research and explain** how humans and animals adapt to respond to the changes that occur during autumn and winter. To research **and explain** how day length varies as	To understand and explain that animals need water, food and air (oxygen) to survive, **making comparisons to the needs of humans**. To understand and explain the differing needs of some animals **and research how their needs are met within specific habitats.** To identify and sort a variety of animals that are carnivores, herbivores and omnivores.	To identify and name a variety of everyday materials, describing their physical properties, **such as being transparent, rigid, flexible and opaque,** and compare materials based on these. To distinguish between an object and the material from which it is made, **considering which materials are natural and which are man-made**. To identify and compare the suitability of a variety of everyday materials for particular uses, **justifying their choices.**	To identify and name a variety of plants and animals in their habitats, including microhabitats. To develop knowledge of the different habitats which various animals need to survive and ask questions relating to living things and their habitats. To explore **and explain** why different animals suit their habitats, considering prior knowledge of what animals need to survive **and prior knowledge of food chains.** To describe how different habitats provide for the basic	To identify, name and **describe the roles of** different parts of plants, including trees, focusing on the roles of the roots, stem, leaves and petals **and compare the key similarities between trees and small flowering plants**. To name and identify some common wild and garden plants such as daisies, roses, daffodils and sunflowers and identify some of these in the school environment. To identify **and explain** differences between deciduous and evergreen trees and begin to identify examples of these,

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		seasons change, focusing on autumn and winter. **Year 2 Pupils will make comparisons between day length in different seasons.**			needs of different kinds of animals and plants and **how they depend upon each other.**	linking with knowledge of seasons.
End Point	To name body parts, understanding and explaining what they help us to do. To understand and explain some of the changes which occur as humans pass between stages in the human lifecycle.	To understand and explain the changes which occur in the world around us during autumn and winter and how these changes affect humans, animals and plants.	To understand and explain the basic needs of animals for survival, describing how these needs differ and how they are met.	To understand and explain the properties of different materials, considering which materials are best suited for specific purposes based on these.	To understand and explain the different habitats of various plants and animals and also explain ways in which organisms are adapted to suit their specific habitats.	To understand and explain which plants, including trees, may be found in our local area and how these can be identified. To name and begin to describe the roles of the basic parts of plants.
Prior Knowledge	In Early Years, pupils will have used their senses in a variety of ways to explore the world around them. Pupils will have begun to identify and name key body parts. Pupils will have prior knowledge of the stages in the human lifecycle.	In Early Years, pupils will have explored some seasonal changes throughout the year. Pupils will have prior understanding of what the four seasons are. Year 2 pupils will have an understanding of spring and summer and an awareness of the variation in day length in different seasons.	Pupils will have a basic understanding that animals need food and water to survive. Pupils will be aware of some of the differences in what animals eat. Year 2 pupils will have knowledge of the basic needs of humans.	Pupils will have some knowledge of objects made from everyday materials. Pupils will have explored some simple properties of everyday materials. Year 2 pupils will have begun to consider how properties of materials affect their uses.	In Early Years, pupils will have gained some knowledge of habitats being the place where living things live. Pupils will know the basic needs of animals and understand that these may differ slightly e.g. diet. Year 2 pupils will have prior knowledge of food chains.	In Early Years, pupils will have observed the growth of plants and begun to consider what they need to grow. Pupils have prior knowledge of how some trees lose their leaves in winter, whereas others do not. Pupils will have an awareness of the names of some common plants. Year 2 pupils will have knowledge of what plants need to grow.
Key Misconceptions	Everyone has the same body parts.	If it is sunny, it is warm/summer.	All animals need the same things.	Objects and materials are the same thing.	All animals and plants can survive in all environments.	Trees are not plants. Flowers are not plants.

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	Everyone has all five senses. The five senses do not work together to help us to understand the world around us. Adults were never babies or Pupils.	If it is rainy, it is cold/autumn or winter. It only snows in winter. The change in daylight hours between seasons is not gradual. There are less than 24 hours in a day during winter. All animals hibernate.	Animals do not have wants. Wants and needs are the same. Misconceptions around the definitions of carnivores, herbivores and omnivores e.g. if something eats any meat it is a carnivore.	Some properties mean the same thing e.g. soft/smooth. All heavy things sink. 'Material' refers to fabric.	All animals and plants have the same needs. Large creatures can live in microhabitats.	Plants are not living things. Plants have the same basic needs as animals. The trees that we can see at the moment must be evergreen, because they have leaves.
Core Key Words	• five senses • lifecycle • offspring • stages • baby • toddler • child • teenager • adult • elderly	• seasons • winter • autumn • weather • change • adapt	• carnivore • herbivore • omnivore • need • survive • diet • air • oxygen	• material • properties • float • sink • waterproof • hard / soft	• habitat • microhabitat • organism • adaptation • survive • need	• roots • stem • leaves • petals • deciduous • evergreen

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Science

Science KS1 (Cycle B)

Topic	Humans	Animals	Living Things and their Habitats	Materials	Plants	Seasonal Changes (Spring/Summer)
Enquiry Question	Who's the healthiest person in the world?	Are all animals the same?	What do animals eat?	Can a box be made from any material?	How do plants grow from a seed or bulb?	How might we know what season it is? (Cycle B)
Big Ideas/ Key concepts	Organisms must stay in good health to survive and thrive; the health of an individual results from interactions between its body, behaviour, environment and other organisms.	Organisms can be classified according to their features.	All organisms, including humans, depend on, interact with and affect the environments in which they live and other organisms that live there.	Materials are either made of a single chemical substance or a mixture of substances which each have distinctive properties.	Organisms must stay in good health to survive and thrive; the health of an individual results from interactions between its body, behaviour, environment and other organisms.	Substances can move within and between the atmosphere, hydrosphere, geosphere and biosphere as part of large-scale Earth systems.
Key Knowledge and skills	To understand and explain that humans need water, food and air (oxygen) to survive, **making comparisons to the needs of animals**. To understand and describe the importance of exercise for humans. To observe **and research** the changes in their bodies after **different types of** exercise. To identify and classify different foods and discuss the importance of eating the right amounts of different types of food. To discuss **and explain** the importance of hygiene **and**	To identify and name a variety of common animals including fish, amphibians, reptiles, birds and mammals. To explore **and research** characteristics of different groups of animals and classify animals based on their characteristics. To explore the offspring of different animals, identifying some similarities and differences in lifecycles, **describing how animals change as they grow**.	To describe what different animals eat, **using prior knowledge of basic needs of animals and carnivores, herbivores and omnivores to explain how this varies.** To identify and name different sources of food for various animals. To explore **and explain** the feeding relationships between living things using the idea of a simple food chain, **considering where animals get their food from in different habitats.** To explore, compare **and explain the differences**	To identify and name a variety of everyday materials, describing their physical properties, **such as being transparent, rigid, flexible and opaque,** and compare materials based on these. To distinguish between an object and the material from which it is made, **considering which materials are natural and which are man-made**. To identify and compare the suitability of a variety of everyday materials for particular uses, **justifying their choices**.	To observe the growth of seeds and bulbs into mature plants, describing this process, **using knowledge of parts of plants to describe in detail.** To consider and explore what plants need to grow well and remain healthy. To explore the impact of variables such as water, light and a suitable temperature on the growth of plants. To consider **and begin to research** ways in which different plants require different conditions to grow healthily.	To understand that the UK has four seasons and name these. To understand when the UK has spring and summer, **naming the months associated with these seasons**, and use observational skills to observe signs of spring/summer. To explore, **research and explain** changes that occur during spring and summer. To consider, **research and explain** how humans and animals adapt to respond to the changes that occur during spring and summer.

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	consider what we can do to be hygienic.		between things that are living, dead and have never been alive. .	To explore how some materials can change their shape by being squashed, bent, twisted or stretched **and explain when this may be useful.**		To research **and explain** how day length varies as seasons change, focusing on spring and summer. **Year 2 Pupils will make comparisons between day length in different seasons.**
End Point	To understand and explain the basic needs of humans for survival and what humans can do to keep their bodies healthy.	To understand and explain the different ways in which animals can be classified, based on their characteristics. To understand and explain how different animals change as they grow.	To understand and explain what different animals eat and how living things are linked through feeding relationships. To understand and explain which things are living, which are dead and which were never alive.	To understand and explain the properties of different materials, considering which materials are best suited for specific purposes based on these.	To understand and explain how plants grow from seeds and bulbs into healthy, mature plants.	To understand and explain the changes which occur in the world around us during spring and summer and how these changes affect humans, animals and plants.
Prior Knowledge	Pupils will have knowledge of what humans need to survive. Pupils will have begun to explore how different body parts can be used for different purposes. Year 2 pupils will have knowledge of the basic needs of animals and how these needs are met.	In Early Years, pupils will have begun to explore different animals and how these can be sorted into different groups, including knowledge of vertebrates and invertebrates. Pupils will have knowledge of some animal lifecycles. Year 2 pupils will have knowledge of the human lifecycle.	Pupils will have a basic understanding that animals need food and water to survive. Pupils will know the basic needs of animals and understand that these may differ slightly e.g. diet. Year 2 pupils will have knowledge of carnivores, herbivores and omnivores.	Pupils will have some knowledge of objects made from everyday materials. Pupils will have explored some simple properties of everyday materials. Year 2 pupils will have begun to consider how properties of materials affect their uses.	In Early Years, pupils will have observed the growth of plants and begun to consider what they need to grow. Pupils will have an awareness of the names of some common plants, Year 2 pupils will be able to name these, and the parts of plants.	In Early Years, pupils will have explored some seasonal changes throughout the year. Pupils will have prior understanding of what the four seasons are. Year 2 pupils will have an understanding of autumn and winter and an awareness of the variation in day length in different seasons.
Key Misconceptions	Humans have different basic needs to animals.	Only mammals are animals.	All animals have the same diets.	Objects and materials are the same thing.	Plants are not living things.	If it is sunny, it is warm/summer.

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	Humans need more than food, water and air to survive. Eating only fruits and vegetables is healthy. Fats, sugars and oils are bad foods and should not be eaten. Pulse is not linked to heartrate. When exercising, you breathe faster and your heartrate increases because you are tired. Exercise must involve running.	Humans are not animals. All pets are mammals. Whales and dolphins are fish. All animal lifecycles have the same stages.	Animals have the same dietary requirements as humans. Animals do not eat other animals. Things that are dead were never alive. Things that were never alive are dead.	Some properties mean the same thing e.g. soft/smooth. All heavy things sink. 'Material' refers to fabric.	Plants have the same basic needs as humans. Plants do not require specific conditions to be able to grow healthily. Plants grow from bulbs or seeds quickly. Once planted, seeds always grow into healthy, mature plants.	If it is rainy, or cold, it's autumn or winter. It only snows in winter. The change in daylight hours between seasons is not gradual. There are more hours during a day in summer than in winter. Animals only give birth in spring.
Core Key Words	• need • survive • air • oxygen • balanced diet • hygiene • exercise • heartrate	• classify • characteristics • fish • amphibians • reptiles • birds • mammals • offspring • lifecycle	• food • sources • diet • food chain • living • dead • alive	• material • properties • rigid • strong • lightweight • metal • wood • fabric • glass	• seed • bulb • growth • mature • healthy • water • light • temperature	• seasons • spring • summer • weather • change • adapt

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Science LKS2 (Cycle A)

Topic	Animals including Humans (Nutrition and food chains)	Electricity	Plants	Plants	Sound	Living Things
Enquiry Question	What might happen if there were no plants?	If we cannot see electricity, how do we know it is there?	Why are bees important to the survival of other living things?		How do we hear sound?	How can the actions of humans affect living things?
Big Ideas/ Key concepts	Organisms must stay in good health to survive and thrive; the health of an individual results from interactions between its body, behaviour, environment and other organisms.	The everyday world is largely a consequence of electrical charge. Understanding electricity and magnetism helps us develop technology to improve lives.	Genetic information is passed from each generation to the next; this information and the environment affect the features, growth and development of organisms.		Waves radiate information. Understanding waves helps us to communicate.	Organisms can be classified according to their features.
Key Knowledge and skills	To understand that living things need food to grow and be healthy. To identify and describe the functions of the parts of the digestive system including: mouth, tongue, teeth, oesophagus, stomach and small and large intestine. To **research and explain** differences, similarities or changes related to simple scientific ideas and processes such as: animals, including humans, require food, water and air to stay alive. To identify and explain the requirements of a balanced diet for humans.	To identify common appliances that run on electricity, asking relevant questions about how everyday appliances rely on electricity to function **and using different types of scientific enquiries to justify explanations**. To construct a simple series circuit (identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers) exploring the effects of variations in circuits. To **make predictions then** investigate and explain whether a lamp will light in a variety of circuits.	To explore **and explain** the requirements of plants for life and growth (water, light, food and nutrients from the soil, gases from the air and space on the ground) and how these vary from plant to plant. To identify and describe the functions of the parts of a flowering plant including: the flower, stem, leaves and roots. To investigate **and explain** the way in which water is transported within **different** plants. To explore how plants reproduce through the processes of pollination, seed formation and seed dispersal **identifying the parts of the**		To explore **and explain** identify how sounds are created, associating some of them with something vibrating. To find patterns in the sounds that are made by different objects, **investigating how sound travels and how it changes through different materials**. **To work collaboratively to investigate how** the pitch of a sound is impacted by the features of the object that produced it. To find patterns between the volume of a sound, the strength of the vibrations that produced it, and the distance from it.	To explore and use classification keys to help identify, name and sort a variety of living things in the local and wider environment. To gather, record **and present** data to group living things, based on their characteristics. To recognise **different ways in which** environments can change and **explain how** this can sometimes pose dangers to living things, yet sometimes be helpful.

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	To construct **and interpret** a variety of food chains, identifying producers, predators and prey.	To identify the difference between conductors and insulators, **recognising that not all metals are conductors of electricity**. To understand and investigate how electricity can be generated sustainably through different means, such as solar power and wind.	**plant required for these processes.** To recognise and explain the five main stages of a plant lifecycle: germination, growth, pollination, fertilisation and dispersal. **To explore and classify a range of common plants according to certain criteria such as environment, size and climate**.		
End Point	To understand and explain ways in which animals, including humans get the necessary nutrition from what they eat, using knowledge of food chains.	To understand and explain ways in which electricity is used to power everyday appliances and also explain the workings of a simple series electrical circuit.	To understand and explain the requirements of plants for life and growth, including explanations of functions of different parts of plants in the life cycle of plants.	To understand and explain how sound is produced and how the human body is designed to hear sound.	To understand and explain how living things can be grouped based on their characteristics and also to explain the impact of changes in environments on living things.
Prior Knowledge	Pupils will have an understanding of the basic needs of animals and humans (food, water, oxygen). Pupils will have basic knowledge of the importance for humans of exercise, diet and hygiene.	Pupils will build on their knowledge of 'Uses of Everyday Materials' from Key Stage 1, extending their knowledge to understand which materials conduct and insulate electricity.	Pupils will have prior knowledge of the parts of plants. Pupils will understand what plants need to grow healthily and experience of observing a plant grow from a seed.	Pupils will have limited knowledge about the science behind sound. Pupils will have some knowledge of pitch and volume. Pupils will have explored different sounds during their learning about the five senses.	Pupils will have basic understanding of living things and some of the categories that these can be grouped into (fish, mammals, reptiles, amphibians, birds). Pupils will have learned about the basic needs of living things and living things adapt to suit their habitats.

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Key Misconceptions	All animals and humans have the same nutritional needs. Being healthy means to eat healthily. Eating healthily means to only eat fruits and vegetables.	Batteries store electrical energy. Electricity is not present when a circuit is opened. Circuits will always work if there is a power supply attached. If a component, such as a bulb, does not work, then the battery is empty. All metals are conductors and all conductors are metal.	All plants are flowering plants. Trees are not plants. Plants are not living things. Plants grow quickly. All plants thrive in the same environment.	Sound travels straight into a human ear (without vibrations). The human ear is only external. The thickness of a material correlates with its effectiveness in absorbing sound. The quieter a sound appears, the further away you are from the source.	Humans always help living things. Human impact is always harmful to the environment and living things. Living things can only be grouped as 'plants' or 'animals'.
Core Key Words	• nutrition • food chain • carnivore • herbivore • omnivore • producer • predator • prey	• electricity • circuit • components • conductor • insulator	• nutrients • pollination • dispersal • functions • transportation	• vibrations • pitch • volume • amplitude	• classification • characteristics • environment • habitat

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Science LKS2 (Cycle B)

Topic	Rocks	States of Matter	Forces and Magnets	Forces and Magnets	Light	Animals including Humans
Enquiry Question	What can rocks tell us?	How do states of matter matter?	How do magnets work?		How does light affect what we see?	How do our bodies move and function?
Big Ideas/ Key concepts	The Earth's crust is constantly changing as new rocks are formed and older rocks are worn away.	Objects are made of particles with mass. Understanding particles helps us to design our world.	Forces make things change. Understanding forces helps us to predict and control physical changes.		Waves radiate information. Understanding waves helps us to communicate.	Organisms are made of organs and organ systems which work together to supply the energy and molecules needed to carry out life processes.
Key Knowledge and skills	To **identify and understand the difference** between different rocks. To group different kinds of rocks on the basis of their appearance and physical properties, **including using the Mohs Hardness Scale to investigate** minerals and classify different rocks. To use a hand lens or microscope to help identify and classify rocks. To use scientific vocabulary to describe how fossils are formed **and how these formations vary**. **To evaluate and discuss ways to improve scientific experiments and use the evaluations to draw further questions**.	To compare and classify a variety of different materials and group materials together, according to whether they are solids, liquids or gases. To observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C). To identify the part played by evaporation and condensation in the water cycle and **design and complete** an investigation associating the rate of evaporation with temperature.	To observe and compare how things move on different surfaces, investigating the effect of friction. To explore **and explain how** some forces need contact between two objects, but magnetic forces can act at a distance. To **design and** complete an experiment into the impact different materials have on a moving object. To observe **and investigate** how magnets attract or repel each other and attract some materials and not others. To compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, **making predictions and reflecting on the outcomes**.		To recognise the importance of light, understanding that light is needed in order to see things and that dark is the absence of light, **explaining how humans see light**. To understand that light is reflected from surfaces. To discover which surfaces reflect light **and explore the use of mirrors to reflect light**. To understand **and explain** the impact of the light from the sun and explain how to protect their eyes **and skin**. To explore how shadows are created, recognising that shadows are formed when the light from a light source is blocked by an opaque object. To explore and find patterns in the way that the size of shadows change, **explaining how any why this occurs.**	To describe and investigate the digestive system in humans, **explaining how this process works**. To identify the different types of teeth in humans and their simple functions, **comparing these with the teeth of different animals.** To describe and investigate the roles of the skeleton, muscles, tendons and joints and how they support, protect and allow the body to move, **considering and exploring what may happen if humans did not have skeletons**. **To understand the difference between muscular and skeletal and describe how muscular and skeletal systems work together to create movement**.

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	To understand that soils are made from rocks and organic matter.		To describe magnets as having two poles **(polarity)** and predict whether two magnets will attract or repel each other, depending on which poles are facing.		To understand the differences between vertebrates and invertebrates **and describe the different characteristics of both**.
End Point	To understand that rocks come in three main types and investigate how they can be grouped by their properties. To understand how soil is formed and investigate its differing permeability. To understand how fossils are formed and how palaeontologists can use them.	To understand that materials exist in three main states of matter (solid, liquid or gas) and identify that these can be grouped based on their properties. To investigate materials, including water, as they change state and understand how water changes state during the water cycle.	To understand and explain ways in which forces affect the movement of objects on different surfaces. To understand and explain to concept of magnetism and magnets can attract, repel or have no effect on different materials.	To understand and explain how light impacts our ability to see and how humans see light. To understand and explain how different surfaces reflect light and how shadows are formed.	To understand and explain a variety of biological systems in animals, including humans, including digestion, muscular and skeletal systems. To understand and explain the functions of different teeth and consider how these differ in various animals.
Prior Knowledge	Pupils will build upon their prior KS1 learning of 'Everyday Materials', including to identify, name and understand the uses of a variety of everyday materials, including rock. Pupils should be able to build on their prior knowledge of identifying and describing physical properties.	Pupils will build upon their prior KS1 learning of 'Materials' in being able to describe simple physical properties of everyday materials and finding out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching. Pupils should be able to build on their prior knowledge of grouping and classifying different materials based on appearance.	In Early Years, pupils explored magnets and the idea that magnets 'stick together'. In Key Stage 1, pupils gained knowledge of materials and their properties. Pupils will have knowledge of grouping materials based on their properties.	In Early Years, pupils will have explored the concept of light and dark, linking this to observations around day and night. Pupils will have prior knowledge of the properties of materials and will have had discussions to considered whether materials are 'opaque', 'transparent' or 'translucent'.	In Early Years and Key Stage 1, pupils have explored different body parts, and ways in which parts of the human body have specific functions. Pupils will have an understanding of the basic needs of humans. Pupils will understand the difference between carnivores, herbivores and omnivores. Year 4 pupils will have an understanding of the nutritional needs of humans.

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		Pupils will also build on their knowledge from Autumn 1 where they investigated how rocks could be grouped by their properties as well as the differing permeability of different soils.			
Key Misconceptions	All rocks are created naturally. If two rocks have the same property e.g. light coloured that it is the same type of rock. Dense and heavy are the same thing. All rocks are heavy. If some rocks have similar properties that they fall under the same type of rock. Fossils are only of dinosaurs. Fossils can occur through any type of rocks. Some rocks can't be turned into soil because they are too hard.	Sand/salt/sugar is a liquid because it can be poured into a container. Gases aren't in a state of matter because you can't see them. A material is only one state of matter – it can't change state. Carbon dioxide is only used when we breathe it out – it has no other uses/bad for the world. A material is the state it originally was in but just 'melted' or 'frozen'. Wet clothes can't dry/water can't be evaporated in the shade or inside or without the wind.	'Push' and 'pull' are the only forces. You must be able to physically see the force in action for it to exist. All metals are magnetic Magnets must touch a magnetic object to pick it up. All magnets are the same strength. Magnets will always attract each other because they are both magnetic.	Windows are a light source. The moon is a light source. Only shiny materials are reflective. All brightly coloured materials are reflective. Mirrors are the only reflective objects. Shadows can only be created by sunlight. The sun is only dangerous when it feels hot.	The body uses all parts of food. Digestion begins in the stomach. Muscles only exist in clearly visible places e.g. biceps. All living things have bones. All skeletons must be inside the body. All animals have the same teeth as humans. The size of an animal's teeth links directly with the size of the animal.

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Core Key Words	• density • durability • erosion • fossilisation • igneous • lava • magma • metamorphic • permeability • sedimentary	• condensation • evaporation • freeze • mass • material • melt • particles • precipitation • properties • states of matter • water vapour	• force • friction • surface • magnetism • magnetic • attract • repel • poles • polarity	• light • retina • pupil • reflect • shadow • light source • opaque • translucent • transparent	• digestion • nutrients • skeleton • muscle • tendon • joint • invertebrate / vertebrate • incisors • canines • molars

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Science

Science UKS2 (Cycle A)

Topic	Earth and Space	Light	Living things and their Habitats	Animals, including Humans	Forces	Forces
Enquiry Question	Do we need the sun to tell the time?	How does light travel?	How do plants and animals reproduce?	Are humans animals?	How can we make forces work for us?	
Big Ideas/ Key concepts	Understanding the uniqueness of the Earth and the vastness of space gives us perspective and awe.	Waves radiate information. Understanding waves helps us to communicate.	Genetic information is passed from each generation to the next; this information and the environment affect the features, growth and development of organisms.	Genetic information is passed from each generation to the next; this information and the environment affect the features, growth and development of organisms.	Forces make things change. Understanding forces helps us to predict and control physical changes.	
Key Knowledge and skills	To engage with **and question** scientific theories about the Earth and space within our solar system. To formulate questions and **research and explain** the shape, movement and composition of astronomical bodies including the sun, planets and moons. To understand and explain how planetary rotation results in day and night and the apparent movement of the sun across the sky.	To **design**, plan and conduct experiments into the way that light travels in straight lines directly from a light source (or reflected surface) into our eyes. To understand how moving from one medium to another, can cause light waves to refract or bend. To illustrate investigative work **(using detailed, annotated diagrams)** considering how to ensure a fair test **by introducing controls** and evaluating investigations. To **research** and explain the phenomenon of shadows, **observing how**	To describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird, **using evidence to compare and contrast these.** To **formulate** and answer questions about how and why species develop in different ways, **using knowledge of the evolution and consequent classification of species to further develop and justify ideas**. To explain **and analyse** the reproductive process in some plants and animals, **considering differences between these**.	**To engage with current scientific research** to explore the incremental stages that human beings go through - from the moment of fertilisation of the egg **and prenatal development in the womb,** through to old age– including during puberty. To describe, **compare and contrast** adolescence in males and females and **explain** the changes that transform a child boy or girl into an adult man or woman, capable of reproducing themselves.	To **design their own experiments** to investigate the impact of forces including gravity, friction, water resistance and air resistance, taking measurements and collecting data, **which they will display in a manner of their choosing**, to challenge their hypotheses. **To explain the benefits of taking multiple readings** and the importance of working with accuracy and precision to ensure that the results of a test are scientifically viable. To **investigate** and make comparisons between different forces, recognising friction, water resistance and air resistance as stopping forces, compared with gravity, which they should already identify as a pull exerted by the Earth or any object with mass. To **draw together knowledge of forces by explaining** how certain mechanisms, such as levers, pulleys and gears, allow a smaller force to have a greater effect.	

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		these are caused by objects that block the direct path of light. To use scientific vocabulary (transparent, translucent, opaque) in **describing observations** about the quantity of light that is able to pass through an object.	To use scientific vocabulary regarding the sex cells of both plants and animals (pollen, ovule, sperm, egg) **to evidence understanding** of the key stages of reproduction.		**To use scientific vocabulary to explain the impact of these mechanisms in real-world situations involving forces.**
End Point	To understand our heliocentric solar system, and learn about how Earth's rotation causes day and night. Work scientifically to investigate how sundials work, creating one and analysing their results.	To understand that light rays travel in straight lines and enter our eyes to allowing us to see. To investigate how light can be reflected and refracted, and obstructed to form shadows.	To understand the reproductive functions of the parts of a flower, using this to explain pollination and to work scientifically to investigate asexual reproduction in plants. To explain the differences in the life cycles of birds, mammals, amphibians and insects. To understand that conservation as an imperative means of preserving our existing biodiversity.	To understand and describe the changes which occur during a human's lifecycle from birth to death, including changes during puberty and old age. To understand how the gestation period of animals varies significantly.	To understand that forces can act on objects, including gravity, air resistance, water resistance and friction. To investigate and evaluate how we can shape objects, select materials and use leverage to minimise or maximise the impact of these forces, including investigations into friction and water resistance and the creation of a seesaw.
Prior Knowledge	Pupils will use and apply some of their existing knowledge from prior learning on Forces: • Explain that unsupported objects fall towards the Earth because of the force of gravity acting between	Pupils will use and apply their existing knowledge from prior learning on Light in Year 3: • Notice that light is reflected from surfaces.	Pupils will use and apply their existing knowledge from prior learning in KS1 in both: Plants; • Learning the basic structure and common varieties	Pupils will use and apply their existing knowledge from their previous Animals, including humans units; • In KS1, that animals have offspring	Pupils will use and apply their existing knowledge from their previous Forces and magnets learning in LKS2: • compare how things move on different surfaces. • notice that some forces need contact between 2 objects, but magnetic forces can act at a distance to attract or repel each

	the Earth and the falling object • Identify the effects of air resistance, water resistance and friction, that act between moving surfaces. Pupils will also build upon their prior learning throughout KS2, on Rocks, which will help with examining the properties of each planet in our solar system and Moon. • Compare and group together different kinds of rocks on the basis of their appearance and simple physical properties. • Describe in simple terms how fossils are formed when things that have lived are trapped within rock. • Recognise that soils are made from rocks and organic matter. Pupils will also use and apply their existing knowledge of Light, for example: • Notice that light is reflected from surfaces. • Recognise that light from the sun can be dangerous and that there are ways to protect their eyes.	• Recognise that light from the sun can be dangerous and that there are ways to protect their eyes. • Recognise that shadows are formed when the light from a light source is blocked by an opaque object. • Find patterns in the way that the size of shadows changes. Pupils will also use and apply their learning from their Autumn 1 unit 'Earth and Space', i.e. their knowledge of Solar and Lunar Eclipses; how night and day is formed; sundials, and how these were used to tell the time; what a Solstice is; and how light travels through space.	of flowering plants, including trees and Living things and their habitats; • Identifying and naming a variety of plants and animals in their habitats, including microhabitats, • Describing 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. As well as in Animals including humans, in that they have offspring which grow into adults. Pupils will also apply their knowledge from Plants in Year 3: • Exploring the parts of a flower; Understanding their role in the life-cycle of a flowering plant - including pollination, seed formation and seed dispersal.	which grow into adults. And in LKS2 identify that, • Animals, including humans, need the right types and amount of nutrition. • They cannot make their own food, instead getting nutrition from what they eat. • Humans and some other animals have skeletons and muscles for support, protection and movement. Pupils will also apply their knowledge from Living things and their habitats in that; • Different animals reproduce in different ways, both sexually and asexually. Life cycles happen for all animals	other and attract some materials and not others. • compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials. Pupils will also have a prior knowledge of Materials [use of everyday] (KS1) and their properties (LKS2) which they can apply to resistance.

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	• Recognise that shadows are formed when the light from a light source is blocked by an opaque object. • Find patterns in the way that the size of shadows changes.				
Key Misconceptions	The sun moves/revolves around Earth which is at the centre of our solar system. There is only one solar system; ours. All planets are made of the same substance i.e. rock. Pluto is a planet. Earth is the only planet to have a moon or Earth's Moon is also the moon to other planets in our solar system. We see both sides of the Moon from Earth. Sundials are self-setting and will automatically tell the time. Night-time is caused because the Sun goes to the back of Earth. The amount of daylight we have always stays the same or is the same for all countries on Earth.	That light comes out of our eyes (possibly a diagrammatic error). Light travels in a range of different directions or patterns. Light changes direction itself and has nothing to do with reflection or refraction. That light travels at the same speed through all mediums. The sun moves across the sky and that is how shadows are formed. The sun is our only light source. Light is made up of a single colour and cannot be split up into different colours.	All insects go through metamorphosis. All plants have flowers. All plants start out as seeds. Animals which lay eggs are reproducing asexually. Only birds lay eggs. Only humans reproduce sexually. Only insects can pollinate plants. Plants that grow from bulbs do not have seeds.	All living things have the same life cycle. Each baby develops at the same rate. The taller the baby, the older the baby is. On average, boys start puberty before girls. Something is wrong if puberty starts later than others. All old people are forgetful and senile. Old people are more likely to get ill than younger adults. All animals are pregnant for the same length of time. *That this unit is the *same as* the last unit.	Gravity only exists on Earth. Weight and mass are the same thing. The moon has no gravity. Heavier objects fall more quickly than lighter ones. The bigger the surface area, the quicker it travels through water. Objects have to be in contact to exert a force on each other. Anything that is moving has an unbalanced force acting on it. If anything is stationary, it has no forces acting on it. The best place to put the fulcrum is in the centre of the lever. A greater force on a mechanism always has a greater effect on the object.

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Science

	That there is no link between the Earth's rotation and time zones. The sun travels across the sky.	Reflection and refraction are interchangeable.			
Core Key Words	• axis • equinox • geocentric • gravitational pull • heliocentric • lines of latitude • lines of longitude • Northern Hemisphere • orbit • solar system • solstice • Southern Hemisphere • sundial • time zones	• angle of incidence • angle of reflection • light rays / ray of light • light source • light spectrum • opaque • prism • reflection • refraction • translucent • transparent	• asexual / sexual reproduction • biodiversity • cell • clone • conservation • embryo • egg • extinct • fertilisation • larvae • metamorphosis • nymph • pupa • reproduction	• asexual / sexual reproduction • egg • embryo • fertilisation • foetus • gestation period • hypothalamus gland • mass • pituitary gland • puberty	• air resistance • balancing force • friction • fulcrum • gears • gravity • levers • load • mechanism • molecules • Newtons • pivot • pulleys • streamlined • surface area • upthrust • variables • water resistance

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Science

Science UKS2 (Cycle B)

Topic	**Properties of Materials**	**Properties of Materials**	**Living things and their Habitats**	**Electricity**	**Evolution and Inheritance**	**Animals including Humans (Circulatory system)**
Enquiry Question	What makes a change irreversible?		How small can an animal be?	How can you make bulbs brighter?	Will humans ever stop evolving?	Why does our heart rate increase when we exercise?
Big Ideas/ Key concepts	Objects are made of particles with mass. Understanding particles helps us to design our world. During chemical reactions, atoms are rearranged and new substances are formed.		Organisms can be classified according to their features.	The everyday world is largely a consequence of electrical charge. Understanding electricity and magnetism helps us develop technology to improve lives.	Differences between organisms cause species to evolve by natural selection of better adapted individuals. The great diversity of organisms is the result of evolution.	Organisms are made of organs and organ systems which work together to supply the energy and molecules needed to carry out life processes.
Key Knowledge and skills	To compare and group together everyday materials on the basis of their properties, including hardness (as informed by the Mohs Hardness Scale), solubility, transparency, conductivity and response to magnets. To investigate solution formation and apply knowledge of solids, liquids and gases to **design a means to** investigate how mixtures might be separated, through filtering, sieving and evaporating. To justify reasons, based on evidence **from comparative and fair tests**, for the particular uses of everyday materials. To explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible.		To describe how living things are classified into broad groups according to common observable characteristics **and based on similarities and differences, including microorganisms, plants and animals and know micro-organisms, plants and animals can be subdivided into smaller categories.** To give justified reasons for classifying plants and animals based on specific characteristics.	To design experiments to **test predictions which** associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit. To 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. To create and representing a simple circuit in a diagram, using recognised symbols.	To learn that living things have changed over time and that fossils provide information about living things that inhabited Earth millions of years ago. To recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents. To identify how animals and plants are adapted to suit their environment in different ways **and that adaptation may lead to evolution**.	To identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood. To recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function, **relating their knowledge from PSHE about how some drugs are used safely**. To describe the ways in which nutrients and water are transported within animals, including humans.

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End Point	To understand all materials exist in one of three different 'States of Matter'- solid, liquid and gas. To investigate whether different materials conduct or insulate electricity or heat (thermal) and describe their properties through their; transparency, hardness, flexibility and magnetism. To understand and explain whether different changes are reversible.	To understand that all living things classified into different groups based on their similarities and differences. To investigate the growth of microorganisms.	To understand and use recognised symbols when representing a circuit in a diagram. To investigate the correlation between voltage and the output of components in a series circuit.	To research and understand the core principles of Charles Darwin's Theory of Evolution. To explain how animals and plants are adapted to suit their environment in different ways and understand that adaptation may lead to evolution. To understand and explain how fossils provide information about living things that inhabited Earth millions of years ago.	To understand the purpose of, and name, the circulatory system, and its component parts. To investigate the effect exercising has on demand for oxygen and heart rate. To understand that drugs, which can be both legal and illegal, have diverse effects on the body.
Prior Knowledge	Pupils will build upon their prior learning throughout KS1 and LKS2 on; • Materials and their properties, including magnetism and magnetic materials. • Rocks, grouping and classifying different kinds of rocks on the basis of their appearance and physical properties. • Electricity, exploring conductors and insulators. Pupils will also use and apply their existing knowledge of States of Matter; • Compare and group materials into solids, liquids or gases and how particles behave within these states of matter. • Observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C). • Identify the part played by evaporation and condensation in the water cycle and	Pupils will have learnt aspects of Living things throughout their prior Science curriculum. Pupils will be able to use and apply their prior learning from KS1: • Identify and name a variety of common animals including fish, amphibians, reptiles, birds and mammals. • Identify and name a variety of common animals that are carnivores, herbivores and omnivores. • Describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals including pets).	Pupils will be able to revisit units taught during the Autumn term about the properties of materials, including electrical conductors and insulators. During the Electricity unit, Pupils will use and apply their prior knowledge from LKS2: • Identify common appliances than run on electricity. • Construct a simple series electrical circuit, identifying and naming its	During this unit of learning, pupils will use and apply their existing knowledge from prior learning in LKS2: • Compare and group together different kinds of rocks on the basis of their appearance and simple physical properties. • Describe in simple terms how fossils are formed when things that have lived are trapped within rock. Pupils will also build upon their prior knowledge of Living Things and their Habitats, during both KS1 and LKS2, focusing on how living things pass on	Pupils will build upon their prior KS1 learning of healthy eating and the human body. Pupils will use and apply their prior knowledge from Animals including humans in LKS2: • identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food. • identify that humans and some other animals have skeletons and muscles for support, protection and movement.

	associate the rate of evaporation with temperature.	• Identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense. Pupils will also be able to use and apply their prior learning and understanding from LSK2: • 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. • Identify that humans and some other animals have skeletons and muscles for support, protection and movement.	basic parts, including cells, wires, bulbs, switches and buzzers • 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. • Recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit. • Recognise some common conductors and insulators, and associate metals with being good conductors.	characteristics to their offspring as well as ways in which they can become adapted to their habitats. Pupils will also apply their learning from earlier in the year in understanding that all living things classified into different groups based on their similarities and differences.	• 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. • construct and interpret a variety of food chains, identifying producers, predators and prey.
Key Misconceptions	'Material' just means 'fabric'. Tough and hard are synonymous – (diamond is hard but brittle). Tough and strong are synonymous (polythene doesn't break when dropped, but easy to tear apart).	There are only two groups of Living Things – animals and plants. Plants are green and 'traditionally plant-like.'	Positive and negative ends to a battery (cell) are irrelevant. 'Material' means fabric.	Animals and living things choose to adapt to an environment, i.e. by growing a longer nose. Adaptations cannot happen through chance / genetic mutation.	The lungs are part of the circulatory system. Blood is coloured blue as on diagrams. All drugs are bad.

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	Only the part of a material that is in contact with a heat source will get hot. Dissolved substances have disappeared / and do not contribute to the mass of the solution. All liquids contain water. All changes are reversible. Liquids that evaporate/boil disappear forever. Steam and condensation are the same. Evaporation only occurs when water is boiling. A cold can or class container becomes wet on the outside because liquid from the outside seeps through. Substances like sugar 'melt' in water.	All animals move and have legs. Micro-organisms are only small creatures or that they are all harmful. Fungi aren't alive or are plants.	The bigger the battery, the more electricity is contained in it. Turning on more bulbs doesn't impact brightness, like at home. On a circuit, the first bulb is the brightest or the first buzzer is the loudest as electricity comes out of the battery. Different coloured wires have different properties.	All living things have adapted and evolved to the same extent or adaptations never change once an animal is adapted to its environment. Animals and plants only become extinct because they have all been killed. Evolution can only happen over millions of years. Evolution doesn't exist or has no impact on how humans have adapted (may be religious grounds). The theory of evolution is simply an idea without proof / 'theoretical'. Humans have no impact on evolution. Inheritance is what is passed on to you when a relative dies. Personality traits are strictly inherited, such as 'being bad at Maths'.	
Core Key Words	• condensing • conduct • dissolve • evaporating • filtering	• Class • classification • Domain • eukaryotic • Family	• amps • battery • bulb • buzzer • cell	• adaptation • Charles Darwin • cloning • cross breeding • DNA	• alveoli • aorta • artery • atrium • blood vessels

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	• freezing • insulator • irreversible / reversible • electrical conductor • magnetism • conductivity • solubility • solution • states of matter • thermal conductors	• Genus • Kingdom • microorganism • Order • Phylum • prokaryotic • Species	• circuit diagram • component • conductivity • electrons • insulator • output • resistance • series • voltage	• environmental factors • evolution • fossilisation • genetic modifications • inheritance • natural selection • variation	• bronchiole • bronchus • capillary • circulatory • diaphragm • intercostal muscles • prescription • pulmonary • superior vena cava • trachea • ventricle

Science Year 7

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Science

Topic	Properties, bonding, and matter	Chemical methods	Atoms and Elements	Reactions and Energy	Systems 1	Cells
Enquiry Question	Are the properties of solids, liquids and gases always the same?	How do scientists look at substances to examine purity and the presence of other substances?	Are all atoms the same?	How can vinegar be useful if you've been stung by a wasp?	Is Vaping safer than smoking cigarettes?	What's different about plant and animals?
Big Ideas/ Key concepts	Objects are made of particles with mass. Understanding particles helps us to design our world.	Materials are either made of a single chemical substance or a mixture of substances which each have distinctive properties.	All matter is made up of atoms. The behaviour and structural arrangement of atoms explains the properties of different materials.	During chemical reactions, atoms are rearranged and new substances are formed.	Organisms must stay in good health to survive and thrive; the health of an individual results from interactions between its body, behaviour, environment and other organisms.	Organisms are made of one or more cells, which need a supply of energy and molecules to carry out life processes.
Key Knowledge and skills	• To identify and explain the properties of solids, liquids, and gases in terms of the arrangement of particles. • Plan a valid practical to investigate how volume of water. affects how long it takes to boil. • To use scientific diagrams to represent experimental set up. • To use a Bunsen burner safely. • To explain what happens to a substance when it changes state.	• To identify substances as pure or impure. • To name separation techniques, including filtration, evaporation, distillation and chromatography. • To explain how to separate a solid from a liquid. • To explain how to separate a soluble solid and a liquid. • To explain how to collect a liquid when separating it from a mixture. • To explain how to separate a mixture of ink and dyes with different solubilities. • To explain why different separation	• To identify the subatomic particles in an atom. • To identify the charges on the subatomic particles. • To identify where the subatomic particles are found in the atom. • Define the terms element, compound, mixture, molecule.	• To use hazard symbols to work safely. • To identify if something is a physical or chemical change based on strong observational skills. • To use temperature change to determine if a reaction is endothermic or exothermic. • To state the pH values of acids and alkalis. • To use describe what happens in a neutralisation reaction.	• To describe respiration as a chemical reaction that happens in the body. • To describe how oxygen moves through the gas exchange system. • To describe how smoking, exercise and asthma affect the gas exchange system and breathing. • To describe the contents of a healthy diet and explain the use of each nutrient. • To describe the effect of imbalances in the diet, including obesity, starvation and deficiency diseases. • To describe the importance of bacteria	• To describe how organisms are structured. • To name and describe the function of sub-cellular structures in an animal cell. • To name and describe the function of sub-cellular structures in a plant cell. • To describe how body cells get the reactants they need for respiration. • To name and describe the function of sub-cellular structures in a plant cell. • To describe the role of diffusion in the movement of materials in and between cells.

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	• To explain why some objects float and some sink. • To use observational skills to identify if a substance is soluble or insoluble.	techniques have been chosen for a particular method.			in the human digestive system. • To describe the effects of alcohol on the body. • To identify legal and illegal drugs and describe the impact of these on the body.	
End Point	To understand and explain how the structure of solids, liquids and gases affect their properties.	To write a method showing understanding of different types of separation techniques and when to use them.	To be able to classify substances as elements, mixtures, compounds and/or molecules and explain why. To be able to describe the structure of an atom.	To use observational skills to determine if a change is physical or chemical and if an exothermic or endothermic reaction has taken place. To explain how neutralisation reactions can be used.	To be able to describe how we get the oxygen we need for respiration from the gas exchange system. To be able to describe the impact of lifestyle factors that affect our health.	To be able to describe the organisation of animals in terms of organ systems, organs, tissues, and cells. To be able to describe structure and function of sub-cellular structures.
Prior Knowledge	At KS2 students group materials together as solids, liquids, and gases. They will look at how their particles behave within these states and how the particles within these states have different amounts of energy. Students will observe that some materials change state when they are heated or cooled	Students will understand soluble and insoluble; and will have been introduced to several pieces of scientific equipment including how to use a Bunsen burner and how to draw scientific diagrams.	Students will have previously studied particle models, how particles are arranged in a solid liquid and gas, this now looks at what these particles are. Mixtures links back to the work they have covered in separating mixtures.	Students will have previously studied that changes can be reversible (e.g., dissolving a soluble substance) or irreversible (chemical reactions e.g., burning. They will have looked at how some changes result in the formation of new materials and that this kind of change is not usually reversible.	Students will have looked at chemical reactions and will apply this to a chemical reaction that occurs in the body. They will have studied the circulatory system and how this delivers oxygen to all cells in the body. They will have studied the simple functions of the basic parts of the digestive system in humans.	Students will know from KS2 that the body is made up of cells and that the circulatory system delivers oxygen to all cells in the body.
Key Misconceptions	Properties and the arrangement of particles are the same thing.	Evaporation and boiling point are the same thing. Substances only freeze below 0^{o}C.	Neutrons are negative. Electrons are positive. Cells are larger than atoms and so the nucleus	Boiling and melting are chemical changes.	Respiration happens only in the lungs. We breathe in oxygen.	Cell walls are for protection. Animal cells have cell walls.

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	Particles in a liquid are far apart and move freely. Weight and mass are the same thing. Students are used to the term units in maths this can lead to confusion with what a unit is in science.		of a cell is made up of many atoms and their nuclei. Definition of a compound often misses the key point that it is made of different TYPES of elements		We breathe out carbon dioxide.	The nucleus of a cell contains protons and neutrons. A cell is not made of atoms.
Core Key Words	• Property • particle • independent variable • dependent variable • control variable • state change • density • mass • volume • solubility	• evaporation • filtration • distillation • chromatography • soluble • insoluble	• atoms • elements • compounds • mixtures • molecules	• exothermic • endothermic • physical • chemical • acid • alkali • neutralisation	• respiration • small intestine • alveoli • absorption • asthma • obesity • starvation • deficiency diseases • bacteria • enzyme • drug • depressant • addiction	• cell • tissue • organ • organ system • organism • nucleus • cytoplasm • cell membrane • ribosome • mitochondria • chloroplast • vacuole • cell wall • diffusion

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Science

Science Year 7

Topic	Systems 2	Natural World	Energy	Electricity	Forces	Earth and Space
Enquiry Question	Why are bees so important for human food production?	Do other species get their reactants for respiration in the same way as us?	If energy cannot be created or destroyed, why do we have an energy crisis?	Why does your house have lots of light switches?	Why do boats float?	Are we the centre of the Universe?
Big Ideas/ Key concepts	Genetic information is passed from each generation to the next; this information and the environment affect the features, growth and development of organisms.	All organisms, including humans, depend on, interact with and affect the environments in which they live and other organisms that live there.	Forces make things change. Understanding forces helps us to predict and control physical changes.	The everyday world is largely a consequence of electrical charge. Understanding electricity and magnetism helps us develop technology to improve lives.	Forces make things change. Understanding forces helps us to predict and control physical changes.	Understanding the uniqueness of the Earth and the vastness of space gives us perspective and awe.
Key Knowledge and skills	• To identify the parts of the male reproductive system and describe the changes during puberty. • To identify the parts of the female reproductive system and describe the changes during puberty. • To identify the hormones involved in puberty. • To describe what happens in the menstrual cycle. • To describe the reproductive system in plants. • To investigate seed dispersal methods.	• To describe the process of photosynthesis. • To describe what would be found in an ecosystem. • To describe the difference between a population and a community. • To describe how energy is transferred in an ecosystem. • To describe the impact of a new predator on the other organisms in a food web. • To describe predator prey relationships.	• To compare the energy stored in different food groups. • To identify different stores of energy. • To describe energy transfers in everyday objects. • To describe the law of conservation of energy. • To identify energy transfers as useful or wasted. • To compare the advantages and disadvantages of renewable and non-renewable energy resources.	• To describe how energy can be transferred by electrical work done. • To identify electrical components from their symbols. • To draw circuits using circuit symbols. • To describe the features of series and parallel circuits. • To define the terms voltage and current and describe how to measure these quantities. • To describe what happens to current in series and parallel circuits.	• To describe what a force is and give examples. • To suggest how forces affect objects. • To draw free body diagrams. • To identify forces as contact or non-contact forces. • To define resultant force and describe the effect of a resultant force on the motion of an object. • To compare the size of friction on different materials.	• To understand the difference between mass and weight. • To define the term gravity. • To predict the weight of an object on Earth given its mass. • To describe the features of the Universe. • To describe how gravity changes on different planets and the effect of different gravitational field strengths on weight • To explain why we have different seasons. • To explain why day length is different at different times of the

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	• To explain the importance of plant reproduction through insect pollination in human food security.					year and in different hemispheres. • To describe the light year as a unit of astronomical distance. • To describe the rock cycle and the formation of rocks. • To describe how fossil fuels are formed. • To describe how carbon is cycled in the environment. • To describe and explain the impact of burning fossil fuels. • To explain the importance of recycling. • To describe the composition of the Earth's atmosphere.
End Point	To be able to describe the changes in the male and female reproductive systems caused by puberty. To be able to explain how plant reproduction through insect pollination is important for human food security.	To be able to describe how plants gain the reactants they need for respiration. To describe how plants are essential to all life on earth and the impact of one organism on another in an ecosystem.	To be able to identify how energy is stored and how energy can be transferred to the surroundings. To be able to describe the differences between renewable and non-renewable energy resources and how they are used in the home.	To be able to apply the rules for series and parallel circuits relating to current.	To be able to describe how resultant forces affect the motion of an object.	To be able to describe the features of the universe and our place in it. To be able to explain differences in season and day length on our planet. To be able to describe each stage in the rock cycle and carbon cycle.
Prior Knowledge	At KS1 students will have looked at the different stages' humans go through	At KS2 students have classified living things into different groups based on their	Students will have studied respiration as the method for transferring energy from the chemical	At KS2 students draw series circuits using circuit symbols. They will have looked at the	At LKS2 students look at forces as pushes and pulls which can change the motion of an object	At KS2 students have studied that the Earth's rotation causes day and night, as well as the

	from baby to elderly adult. They will have looked at how the body changes as they move through these stages, including puberty and into old age. At KS2 students will look at how plants are able to sexually reproduce through pollination, in which different parts of the flower have different reproductive functions, and asexually. This includes pollination, fertilisation, and germination	similarities and differences from the widest category of kingdom to the most specific, species. Students will have studied food chains and understand the differences between carnivores, herbivores, and omnivores.	energy store in food to the body.	relationship between voltage and the output of components in a series circuit. Students will have looked at complete and incomplete circuits, switches as well as conductors and insulators.	by making it move, speed up, slow down, change direction or stop. Students will have studied gravity as a force to explain that unsupported objects fall towards the Earth because of this force; how a magnet produces a magnetic force to pull certain objects towards it; and will be able to identify air resistance, water resistance and friction as acting between moving surfaces. Students will have studied levers, gears, and pulleys as mechanisms to allow a smaller force to have a greater effect.	apparent movement of the sun across the sky. Students will have studies gravity at KS2 and in the Year 7 forces topic. At KS2 students have compared and grouped together different kinds of rocks based on their appearance and simple physical properties. They have looked at how fossils are formed and that soils are made from rocks and organic matter.
Key Misconceptions	Puberty happens to everyone at the same time. Plants are not living things. Plants do not reproduce.	Respiration only happens in animals. A cell wall protects the cell.	Energy is a substance. Energy can be created or destroyed. Only living things have energy. High energy objects always move faster. Energy is only associated with physical movement.	Electricity is a form of energy. Electricity flows round the circuit. Electrons are consumed in electrical circuits. Electrical current only flows in one direction. Conductors are always better than insulators.	A moving object must have a resultant force acting on it. A stationary object has no forces acting on it. Forces always cause motion.	Mass and weight are the same. The sun in on fire Mercury is the hottest planet as it is the closest. Black holes are vacuums. A light year is a measure of time.

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			Light energy is a store of energy.			Astronauts experience zero gravity. Carbon is transferred into the atmosphere rather than carbon dioxide. Carbon dioxide is passed on from plant to animal.
Core Key Words	• testes • penis • urethra • sperm duct • ovaries • fallopian tubes • uterus • cervix • vagina • hormone • menstrual cycle • gamete • ovulation	• chloroplast • photosynthesis • ecosystem • habitat • environment • population • community • consumer • producer • food web • predator • prey	• gravitational potential • kinetic • chemical potential • elastic potential • thermal • system • Joule • light • sound • heat • renewable • non-renewable • replenished	• Current • voltage • ammeter • voltmeter • amps • volts • series • parallel • circuit	• thrust • friction • air/water resistance • upthrust • weight • reaction • contact • resultant • stationary • Newton • balanced • accelerate	• mass • weight • gravity • gravitational field strength • star • Solar system • Galaxy • Universe • seasons • light year • sedimentary • igneous • metamorphic • erosion • weathering • fossil fuel • respiration • photosynthesis • combustion • renewable • non-renewable

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Science Year 8

Topic	Atoms and Elements	Properties and Bonding	Reactions and Energy	Natural World	Cells	Systems 1
Enquiry Question	Do gases have mass?	Why is magnesium a metal but carbon is a non-metal?	How does thermal decomposition help us to bake muffins?	How do cacti survive in the desert? How do polar bears survive in the arctic?	How do we know what cells are made of?	Why should pregnant women not drink alcohol or smoke during pregnancy?
Big Ideas/ Key concepts	All matter is made up of atoms. The behaviour and structural arrangement of atoms explains the properties of different materials.	Materials are either made of a single chemical substance or a mixture of substances which each have distinctive properties.	During chemical reactions, atoms are rearranged and new substances are formed.	All organisms, including humans, depend on, interact with and affect the environments in which they live and other organisms that live there.	Organisms are made of one or more cells, which need a supply of energy and molecules to carry out life processes.	Organisms must stay in good health to survive and thrive; the health of an individual results from interactions between its body, behaviour, environment and other organisms.
Key Knowledge and skills	• To state the charge and mass of the three subatomic particles. • To use the Periodic Table to describe the structure of different atoms. • To explain why an atom is neutral overall. • To determine the electronic structure of different atoms. • To describe what the atomic number of an element tells us. • To describe what the mass number of an element tells us. • To calculate the relative formula mass of simple molecules.	• To identify the properties of metals and non-metals. • To identify the bonding and elements in a compound • To describe the properties of metal and non-metal oxides with respect to acidity. • To name compounds based on their chemical formula.	• To describe the law of conservation of mass. • To explain why mass appears to increase or decrease in some reactions. • To describe what happens when a metal reacts with oxygen. • To identify the products in a combustion reaction and a thermal decomposition and to identify these as a exothermic or endo thermic reactions. • To be able to explain why the mass of the system appears to increase or decrease	• To describe the features of the leaf for photosynthesis. • To describe the role of the stomata in photosynthesis. • To describe how carbon dioxide enters the leaf through the process of diffusion. • To describe how the levels of oxygen and carbon dioxide in the atmosphere are maintained by photosynthesis. • To describe how some organisms are better adapted to allow them to compete more successfully.	• To describe the structure and function of specialised animal cells. • To describe the structure of the nucleus. • To describe the structure of a bacterial cell. • To compare a bacterial cell and an animal/plant cell. • To describe how a range of cells are specialised for their function. • To describe how to use a microscope to view plant cells. • To calculate the total magnification of a microscope.	• To describe what fertilisation is and where it occurs. • To compare methods of contraception. • To describe what happens during pregnancy and birth. To describe the impact of lifestyle factors, including smoking, diet, alcohol and drug use, on the developing fetus.

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			when a gas is a reactant or product. • To explain the role of a catalyst in a reaction. • To identify other factors that affect the rate of reaction.	• To use a quadrat to estimate the number of daisies on a field.	To interpret and record cell structure using a light microscope.	
End Point	To be able to fully describe the structure of an atom including the number of each subatomic particle and their relative charges and masses.	To be able to compare the properties of metals and non-metals and identify an unknown substance as a metal or a non-metal based on its properties.	To be able to explain why the law of conservation of mass is correct when some reactions appear to lose or gain mass. To be able to identify how different factors affect rate of reaction.	To be able to describe the features of a plant that allow it to obtain the reactants needed for photosynthesis.	To be able to describe how microscopes can be used to see what cells are made of.	To be able to describe what happens during pregnancy and birth and how lifestyle factors can affect this.
Prior Knowledge	In year 7 students have studied the differences between elements, compounds, and mixtures. They understand that all substances are made of atoms and that atoms are made of protons, electrons and neutrons.	In year 7 students have studied the properties of solids, liquids, and gases.	In year 7 students have learnt about the difference between a chemical reaction and a physical change. They have looked at exothermic and endothermic reactions and neutralisation reactions.	In year 7 students have studied the process of photosynthesis and interdependence.	In year 7 students have covered the subcellular structures and their functions of animal cells (in cells) and plant cells (in natural world). They have come across some specialised cells.	In Year 7 students study puberty, the menstrual cycle and fertilisation.
Key Misconceptions	The nucleus of an atom is found in a cell. The nucleus of an atom contains DNA.	Metallic and covalent bonding is a type of property.	Endothermic reactions take in energy and so the temperature increases. Exothermic reactions give out energy and so the temperature decreases. That energy is a product of combustion.	Light energy is a reactant for photosynthesis. Water enters a plant through the leaves. Plants do not respire.	Cell wall is found in an animal cell. The cell wall protects the cell.	A fetus grows in the stomach. The fetus breathes.

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			Mass is not always conserved. Gases have no mass.			
Core Key Words	• Proton • electron • neutron • nucleus • electron shell • positive • negative • neutral • group	• malleable • thermal conductor • electrical conductor • melting/boiling point • metallic • covalent • ionic	• metal oxide • oxidation • combustion • thermal decomposition • exothermic • endothermic • rate • catalyst • conservation	• stomata • diffusion • palisade • mineral • competition • adaptation • structural • behavioural • functional	• eukaryotic • nucleus • microscope • stage • objective lens • coarse focus • fine focus • eyepiece	• zygote • embryo • fetus • fertilisation • oviduct • contraception • placenta • labour • dilate • contraction

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Science Year 8

Topic	Systems 2	Energy	Electricity	Magnetism	Forces	Waves – Sound
Enquiry Question	How do we get the energy we need to live?	Why does tea get cold and why do ice creams melt?	How do we get electric shocks?	How has our understanding of electricity and magnets been used to produce the fastest train ever?	How can we find out how fast a rocket travels and how much energy it transfers?	How do we hear an echo?
Big Ideas/ Key concepts	Organisms are made of one or more cells, which need a supply of energy and molecules to carry out life processes.	Objects are made of particles with mass. Understanding particles helps us to design our world.	The everyday world is largely a consequence of electrical charge. Understanding electricity and magnetism helps us develop technology to improve lives.	The everyday world is largely a consequence of electrical charge. Understanding electricity and magnetism helps us develop technology to improve lives.	Forces make things change. Understanding forces helps us to predict and control physical changes.	Waves radiate information. Understanding waves helps us to communicate.
Key Knowledge and skills	• To describe the process of gas exchange in the alveoli. • To explain how large insoluble food molecules are broken down into small soluble ones. • To describe what enzymes do and the factors that affect enzyme activity.	• To describe what internal energy is and how it changes as a substance heats up or cools down. • To explain what happens to the internal energy when a substance changes state. • To describe how a temperature difference between two objects leads to an energy transfer. • To name methods of energy transfer through heating and radiation. • To describe how this energy is transferred	• To draw series and parallel circuits using circuit symbols. • To describe what happens to potential difference (voltage) in series and parallel circuits. • To state and apply the rules for series and parallel circuits relating to current, and potential difference. • To describe what charge is and how it can be calculated. • To describe how an object gains a static charge. • To state what an electrostatic force is.	• To state which materials are magnetic. • To describe how magnets can attract and repel each other. • To describe how to plot a magnetic field around a bar magnet. • To compare permanent and induced magnets. • To describe the Earth's magnetic field. • To describe how a current through a wire creates a magnetic field around the wire. • To describe the factors which influence the strength of electromagnets.	• To define the term speed. • To calculate speed when given a value for distance and time. • To describe what is meant by the term 'relative motion.' • To plot distance-time graphs and describe the journey. • To calculate speed from distance time graphs. • To explain why some objects are more streamlined than others. • To describe and explain Newton's first law.	• To describe how sound travels. • To explain how an echo is made. • To compare light and sound waves. • To describe how we hear sound. • To define amplitude, frequency, and wavelength. • To explain how a microphone works. • To investigate the range of frequencies that can be heard. • To describe what ultrasound is and what it is used for.

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		through solids in the process of conduction. • To describe how this energy is transferred through fluids in the process of convection. • To describe how this energy is transferred in the process of radiation. • To investigate how the colour of a can affects the rate at which cooling occurs. • To investigate which materials are the best insulators of heat.	• To explain what would happen to positive or negative charges in an electric field.	• To explain how an electric motor works.	• To describe how an object can be made to accelerate or decelerate. • To describe the difference between speed and velocity. • To describe the relationship between force and extension on an elastic object. • To investigate Hooke's law. • To describe how energy can be transferred by a force. • To describe how simple machines can be used to reduce the force needed. • To describe the turning effect of a force as a moment. • To calculate moments. • To calculate pressure on surfaces. • To describe and explain how pressure in fluids changes.	
End Point	To be able to describe how we get the oxygen we need for respiration from the gas exchange system. To be able to describe how we get the glucose we need for respiration	To be able to describe how energy is transferred through heating.	To be able to apply the rules for series and parallel circuits relating to current, and potential difference. To be able to explain why we can get an electric shock.	To be able to describe how to form an electromagnet and change its strength.	To be able to describe how forces affect the motion of different objects and calculate their speed. To be able to describe how applying a force can transfer energy from one store to another.	To be able to explain how an echo is formed and how we hear these.

	from the digestive system.					
Prior Knowledge	Students will have looked at chemical reactions and will apply this to a chemical reaction that occurs in the body. They will have studied the circulatory system and how this delivers oxygen to all cells in the body. They will have studied the simple functions of the basic parts of the digestive system in humans. As well as the nutrients needed for a balanced diet and how lifestyle factors affect our health.	In year 7 students have studied energy stores and transfers.	In year 7 students have studies series and parallel circuits and the rules for current in these circuits.	At KS2 students have studied how magnets work. They will know that a magnet produces a magnetic force to pull certain objects towards it as well as how they can repel other magnets. Students will have described magnets as having two poles and whether magnets will attract or repel each other. They will have studied magnetism as a non-contact force.	In year 7 students have studied different types of contact and non-contact forces and looked at the impact of balance and unbalanced forces. They have looked at how to measure a force using a Newton meter.	Students have studied how waves transfer energy in relation to light waves. In KS2 students study how sound is created and how humans hear this.
Key Misconceptions	Breathing and respiration are the same thing. Stomach acid breaks down food.	Energy can be produced.	An ammeter measures amps. A voltmeter measures volts.	All metals are magnetic. Magnets attract all metals. The larger the magnet the stronger the magnet.	Speed is how fast you are going. Pressure is a force Heavier objects exert more pressure	Sound travels through space.
Core Key Words	• respiration • small intestine • alveoli • diffusion • concentration • absorption • bacteria • enzyme •	• internal • kinetic • potential • thermal conductivity • conduction • insulator • convection • radiation •	• potential difference • current • Resistance • ohm • static • charge • electrostatic force • attract • repel • electrons	• magnetic field • pole • attract • repel • permanent • induced • electromagnet • solenoid	• speed • streamline • velocity • Newton's first law • accelerate • decelerate • elastic • extension • limit of proportionality • Hooke's law • Pressure • moment	• echo • frequency • amplitude • wavelength • ultrasound • longitudinal • vibrate

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Science Year 9

Topic	Inheritance	Natural World	Waves – Light	Systems	Properties and Bonding	Reactions and Energy
Enquiry Question	Should extinct species be brought back to life?	How do organisms interact and survive?	Does wavelength of light affect photosynthesis?	How do our bodies move?	What is the difference between 9 carat and 18 carat gold and why is this needed?	Gold can be found in the Earth's crust as a metal – can all metals be found this way?
Big Ideas/ Key concepts	Genetic information is passed from each generation to the next; this information and the environment affect the features, growth and development of organisms.	All organisms, including humans, depend on, interact with and affect the environments in which they live and other organisms that live there.	Waves radiate information. Understanding waves helps us to communicate.	Organisms are made of one or more cells, which need a supply of energy and molecules to carry out life processes.	Materials are either made of a single chemical substance or a mixture of substances which each have distinctive properties.	During chemical reactions, atoms are rearranged and new substances are formed.
Key Knowledge and skills	• To describe a simple model of chromosomes, gene, and DNA in heredity. • To describe the structure of DNA. • To describe how genes are passed on. • To describe the difference between inherited and environmental variation. • To describe the discovery of the structure of DNA. • To describe evolution through the process of natural selection. • To define the term extinction and state the causes of it.	• To describe how all life on Earth depends on the ability of photosynthetic organisms, such as plants and algae, to use sunlight in photosynthesis to build organic molecules that are an essential energy store. • To investigate factors affecting the rate of photosynthesis. • To describe how biotic factors affect the population of organisms. • To describe how abiotic factors affect the abundance of organisms. • To describe how organisms are affected	• To describe how energy can be transferred by waves. • To describe how light travels. • To explain how the eye produces an image. • To describe how a pin hole camera works. • To explain how we see different colours. • To investigate how the rate of photosynthesis is affected by the wavelength of light. • To describe the law of reflection and the difference between diffuse scattering and specular reflection. • To describe refraction.	• To describe the functions of the skeleton. • To describe how muscles work together in pairs. • To compare the differences between aerobic and anaerobic respiration. • To describe the process of anaerobic respiration in yeast as fermentation. • To compare the difference between anaerobic respiration in humans and anaerobic respiration in a unicellular organism (yeast)	• To describe the bonding in metals. • To explain why metals are malleable and good conductors of electricity in terms of their structure and bonding. • To explain why pure metals are soft but alloys are harder. • To describe the difference between a giant structure and a small molecule. • To describe and explain the different in melting/boiling points for small molecules and giant structures.	• To use chemical reactions to determine the order of metals and carbon in the reactivity series. • To investigate how reactivity of a metal affects its reaction with an acid and use this to determine the reactivity series. • To explain the use of carbon in obtaining metals from metal oxides. • To predict displacement reactions using the reactivity series. • To describe the reaction between a metal and an acid and name the salt produced.

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	• To explain the importance of maintaining biodiversity. • To describe the use of gene banks to preserve hereditary material.	by the accumulation of toxic materials. • To describe how decomposers are involved in the transfer of energy.				
End Point	To be able to describe how genes are passed on through generations and that the genes passed on can result in evolution.	To be able to describe and explain how different factors affect the rate of photosynthesis. To be able to describe and explain the impact of bioaccumulation.	To investigate and explain why the rate of photosynthesis is affected by the wavelength of light. To be able to explain why we can see our reflection in mirrors.	To be able to explain how our skeleton and muscles help us to move. To be able to compare the methods by which our bodies transfer the energy required to move.	To be able to explain why alloys are made. To be able to explain why small molecules have low melting/boiling points whereas giant structures have high meting/boiling points.	To be able to predict and explain the products of displacement reactions. To be able to describe how to produce a pure, dry salt.
Prior Knowledge	Students will know that the nucleus contains the genetic information as DNA. At KS2 students study Darwin's theory of evolution.	Students will have studied how energy is transferred in an ecosystem and the impact of adding a new predator on a food web. Students have looked at the process of photosynthesis and how a plant obtains the reactants needed for this reaction.	In year 7 students study energy stores and transfers. They will have come across light as a method for transferring energy. At KS2 students study how light travels. They look at how light travels in straight lines, can be reflected and refracted and how shadows are formed.	In year 7 and 8 students study respiration and how organisms get the reactants required for this reaction.	Students have studied the properties of solids, liquids, and gases in year 7 and of metals and non-metals in year 8.	Students have studied exothermic and endothermic reactions, the reactions of metals with oxygen as well as the reaction between acids and alkalis. They have investigated conservation of mass in different reactions.
Key Misconceptions	Organisms choose to evolve.	Arrows show what is being eaten.	Rays of light point out of the eyes. Light needs a medium to travel through.	Respiration is the same as breathing and only happens in the lungs.	Stronger and harder mean the same thing. Bonds are broken when a substance changes state.	The metal or metal oxide is added in excess so the reaction is complete.
Core Key Words	• DNA • gene • chromosome • variation	• predator • prey • algae • abiotic	• transverse • reflection • refraction • normal	• cranium • clavicle • humerus • vertebrae	• Pure • alloy • hard/soft • giant structure	• reactivity series • displacement • salt • chloride

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	• natural selection • evolution • Darwin • extinction • biodiversity • gene bank	• biotic • bioaccumulation • abundance	• incidence • translucent • transparent • opaque • pupil • retina • optic nerve • lens	• femur • bicep • tricep • antagonistic • aerobic • anaerobic • fermentation • lactic acid	• small molecule • force	• sulfate • ionic • excess

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Science Year 9

Topic	Electricity	Atoms and Elements	Energy	Cells
Enquiry Question	How does resistance make sure that energy is transferred to components?	Why aren't water pipes made of sodium?	Why is the oblivion rollercoaster faster than the runaway train?	Can we cure paralysis?
Big Ideas/ Key concepts	The everyday world is largely a consequence of electrical charge. Understanding electricity and magnetism helps us develop technology to improve lives.	All matter is made up of atomic nuclei and electrons. The behaviour and structural arrangement of atomic nuclei and electrons explains the properties of different materials.	Forces make things change. Understanding forces helps us to predict and control physical changes. Objects are made of particles with mass. Understanding particles helps us to design our world.	Organisms are made of one or more cells, which need a supply of energy and molecules to carry out life processes.
Key Knowledge and skills	• To define resistance and identify some factors that affect resistance. • To describe how to find resistance in a circuit. • To calculate resistance. • To explain why increasing temperature increases resistance. • To state and apply the rules for series and parallel circuits relating to current, potential difference and resistance. • To explain what causes resistance.	• To write formulae and balanced chemical equations • To write balanced half equations and ionic equations (HT ONLT). • To describe, explain and give examples of the specified processes of separation. • To describe why the new evidence from the scattering experiment led to a change in the atomic model. • To compare the plum pudding model and	• To describe all the changes involved in the way energy is stored when a system changes. • To calculate the changes in energy involved when a system is changed by heating, work done by forces, work done when a current flows. • To calculate the amount of energy associated with a moving object, a stretched spring and an object raised above ground level.	• To explain how the main sub-cellular structures are related to their functions. • To observe, draw and label a selection of cells using a light microscope. • To explain how the structure of different types of cells relate to their function. • To explain the importance of cell differentiation. • To understand how microscopy techniques have developed over time.

	• To calculate the resistance of a component in a circuit.	the nuclear model of the atom. • To use the nuclear model to describe atoms. • To calculate the relative atomic mass of an element given the percentage abundance of its isotopes. • To explain how the position of an element in the Periodic Table is related to the arrangement of electrons in its atom. • To predict possible reactions and probable reactivity of elements from their position in the Periodic Table. • To describe the steps in the development of the Periodic Table. • To explain the differences between metals and non-metals and how their atomic structure relates to their position in the Periodic table. • To explain how the properties of the	• To investigate the specific neat capacity of one or more materials. • To give examples that illustrate the definition of power. • To describe with examples where there are energy transfers in a closed system that there is no net change to the total energy. • To describe, with examples, how in all system changes energy is dissipated, so that it is stored in less useful ways. • To explain ways of reducing unwanted energy transfers. • To describe how the rate of cooling of a building is affected by the thickness and thermal conductivity of its walls. • To describe ways to increase the efficiency of an intended energy transfer (HT ONLY). • To describe the main energy sources available.	• To explain how electron microscopy has increased understanding of sub-cellular structures. • To carry out calculations involving magnification, real size and image size. • To describe the stages in mitosis and the cell cycle. • To describe the function of stem cells in embryos, in adult animals and in the meristems in plants. • To explain how different factors affect the rate of diffusion. • To describe how the small intestine, lungs in mammals, gills in fish, roots and leaves in plants are adapted for exchanging materials. • To investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue. • To explain the difference between

		Noble gases, alkali metals and the halogens depend on the outer shell of electrons of the atoms. • To predict properties from given trends down the group. ***SEPARATE SCIENCE:*** • To describe the differences between group 1 and transition metals.	• To evaluate the use of energy resources.	diffusion, osmosis, and active transport. ***SEPARATE SCIENCE:*** • To describe and explain how to prepare an uncontaminated culture using aseptic techniques.
End Point	To be able to apply the rules for series and parallel circuits relating to current, potential difference and resistance. To be able to explain how resistance transforms electrical work done into heat, or other types of energy.	To be able to describe developments in the model of the atom and the periodic table. To be able to link these developments to the structure of the atom. To explain trends in reactivity and chemical properties from understanding of the Periodic Table.	To be able to describe how energy stores transfer from one store to another in a system. To be able to calculate Gravitational potential, kinetic and elastic potential energy stores. To be able to calculate the energy transferred using the specific heat capacity and specific latent heat of a substance.	To be able to describe how cells are adapted to the function. To be able to explain the purpose of the cell cycle and describe the stages within it. To be able to describe the processes by which substances move in and out of cells. To be able to explain how exchange surfaces are adapted for exchanging materials. ***SEPARATE SCIENCE:*** To be able to investigate the effect of antiseptics or antibiotics on bacterial growth.

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Prior Knowledge	In year 7 and 8 students have studies series and parallel circuits and the rules for current and potential difference in these circuits.	At KS3 students have studied the structure of the atom and the development of the Periodic Table.	Students will have learnt the energy stores and the energy transfers at KS3. Students calculate Gravitational potential, kinetic and elastic potential energy stores in year 9. Students will be able to describe what internal energy is from year 9. Students will be able to describe food as having chemical potential energy store from year 7.	At KS3 students have studied plant and animal cells. They have been introduced to stem cells and specialised cells. Students have covered diffusion and osmosis as methods of transport in cells.
Key Misconceptions	Current is flow of charge and is not used up.	Neutrons are negative. Relative mass and relative charge are the same for all subatomic particles. Mendeleev left gaps for undiscovered elements.	Energy can be created. Insulation makes things warm.	Nucleus of a cell contains protons and neutrons. Water moves from a high concentrated to a low concentration.
Core Key Words	• resistance • potential difference • current • power • Watts	• Element • compound • plum pudding • alpha particle • Niels Bohr • James Chadwick • electron • proton • neutron • nucleus • shell • ion • isotope • Dimitri Mendeleev	• system • joule, J • kinetic • gravitational • elastic • specific heat capacity • power • Watts, W • work done • dissipated • efficiency • renewable	• Nucleus • cytoplasm • ribosome • cell membrane • cell wall • mitochondria • synthesis • specialisation • differentiation • stem cell • mitosis • diffusion • osmosis

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		• Noble gases • alkali metals • halogens	• non-renewable • reliable	• active transport • concentration gradient

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Science

Science Year 10 (BIOLOGY)

Topic	Cells	Systems	Disease	Natural World 1 - Plants	Natural World 2 - Ecology
Enquiry Question	Can we cure paralysis?	If it takes Usain Bolt less than 10 seconds to run 100m why does it take him over 120 seconds to run 800m?	How has Science helped us to reduce mortality rates for communicable and non-communicable diseases?	The human population is growing exponentially, what can we do to make sure that we can grow enough crops to cope with demand?	Can we save the giant panda?
Big Ideas/ Key concepts	Organisms are made of one or more cells, which need a supply of energy and molecules to carry out life processes.	Organisms are made of one or more cells, which need a supply of energy and molecules to carry out life processes.	Organisms must stay in good health to survive and thrive; the health of an individual results from interactions between its body, behaviour, environment and other organisms.	Organisms are made of one or more cells, which need a supply of energy and molecules to carry out life processes. All organisms, including humans, depend on, interact with and affect the environments in which they live and other organisms that live there.	All organisms, including humans, depend on, interact with and affect the environments in which they live and other organisms that live there. Substances can move within and between the atmosphere, hydrosphere, geosphere and biosphere as part of large-scale Earth systems.
Key Knowledge and skills	• To explain how the main sub-cellular structures are related to their functions. • To observe, draw and label a selection of cells using a light microscope. • To explain how the structure of different types of cells relate to their function. • To explain the importance of cell differentiation. • To understand how microscopy techniques have developed over time. • To explain how electron microscopy has increased	• To describe the organisation of organisms. • To describe the nature of enzyme molecules and relate their activity to temperature and pH changes. • To carry out rate calculations for chemical reactions. • To explain enzyme action. • To describe how to test food. • To investigate the effect of pH on the rate of reaction of amylase enzyme.	• To evaluate the advantages and disadvantages of treating cardiovascular diseases by drugs, mechanical devices, or transplant. • To describe the relationship between health and disease and the interactions between different types of disease. • To explain the effect of lifestyle factors including diet, alcohol, and smoking on the incidence of non-communicable diseases at local to global levels.	• To explain how the structures of plant tissues are related to their functions. • To explain how the structure of root hair cells, xylem and phloem are adapted to their function. • To explain the effect of changing temperature, humidity, air movement and light intensity on the rate of transpiration. • To describe the process of transpiration and translocation, including the	• To describe the different levels of organisation in an ecosystem. • To describe the importance of interdependence and competition in a community. • To explain how a change in an abiotic or biotic factor would affect a given community. • To explain how organisms are adapted to live in their natural environment. • To describe feeding relationships within communities.

	understanding of sub-cellular structures. • To carry out calculations involving magnification, real size and image size. • To describe the stages in mitosis and the cell cycle. • To describe the function of stem cells in embryos, in adult animals and in the meristems in plants. • To explain how different factors affect the rate of diffusion. • To describe how the small intestine, lungs in mammals, gills in fish, roots and leaves in plants are adapted for exchanging materials. • To investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue. • To explain the difference between diffusion, osmosis, and active transport. ***SEPARATE SCIENCE:*** • To describe and explain how to prepare an uncontaminated culture using aseptic techniques.	• To describe the structure and function of the human heart and lungs. • To explain how the structure of blood vessels relates to their function. • To use simple compound measures such as rate and carry out rate calculations on blood flow. • To describe the functions of the components of blood. • To compare the processes of aerobic and anaerobic respiration. • To describe the body's response to exercise. • To explain the importance of sugars, amino acids, fatty acids and glycerol in the synthesis and breakdown of carbohydrates, proteins, and fats.	• To describe cancer as the result of changes in cells that lead to uncontrolled growth and division. • To explain how diseases caused by viruses, bacteria, protists, and fungi are spread in animals and plants. • To explain how the spread of disease can be reduced or prevented. • To describe the non-specific defence systems of the human body against pathogens. • To explain the role of the immune system in the defence against disease. • To explain how vaccination will prevent illness in an individual, and how the spread of pathogens can be reduced by immunising a large proportion of the population. • To explain the use of antibiotics and other medicines in treating disease. • To describe the process of discovery and development of potential new medicines. ***SEPARATE SCIENCE:***	structure and function of the stomata. • To describe photosynthesis as an endothermic reaction in which energy is transferred from the environment to the chloroplasts by light. • To explain the effects of temperature, light intensity, carbon dioxide concentration and amount of chlorophyll on the rate of photosynthesis. • To determine the limiting factor in the rate of photosynthesis (HT ONLY).	• To explain the importance of the carbon and water cycles to living organisms. • To explain the role of microorganisms in cycling materials through an ecosystem. • To describe human impact on land, water, and air pollution. • To describe some of the biological consequences of global warming. • To describe both positive and negative human interactions in an ecosystem and explain their impact on biodiversity. ***SEPARATE SCIENCE:*** • To explain how temperature, water and availability of oxygen affect the rate of decay of biological material. • To evaluate the impact of environmental changes on the distribution of species in an ecosystem given appropriate information. • To describe the differences between the trophic levels of organisms within an ecosystem.

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			• To describe how monoclonal antibodies are produced. • To describe some of the ways monoclonal antibodies are produced. • To describe physical and chemical plant defence responses.		• To construct accurate pyramids of biomass from appropriate data. • To describe pyramids of biomass and explain how biomass is lost between the different trophic levels. • To calculate the efficiency of biomass transfers between trophic levels by percentages or fraction of mass. • To explain how this affects the number of organisms at each trophic level. • To describe some of the biological factors affecting levels of food security. • To describe and explain some possible biotechnical and agricultural solutions, including genetic modification, to the demands of a growing population. •
End Point	To be able to describe how cells are adapted to the function. To be able to explain the purpose of the cell cycle and describe the stages within it.	To be able to explain how the respiratory system and digestive system are adapted to transfer the reactants for respiration to the blood. To be able to explain how the circulatory system provides the reactants needed for respiration to the cells.	To be able to describe how lifestyle factors affect our health and evaluate different methods of treatment. To be able to explain how our body protect us from disease. To be able to describe and explain the advances in	To be able to describe how plants get the water and carbon dioxide for photosynthesis. To be able to describe how the glucose made in photosynthesis is transported round the plant and for what it is used.	To be able to explain the changes in biodiversity through investigation and understanding of human impacts on the environment. ***SEPARATE SCIENCE:*** To be able to investigate the effect of temperature on the

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	To be able to describe the processes by which substances move in and out of cells. To be able to explain how exchange surfaces are adapted for exchanging materials. ***SEPARATE SCIENCE:*** To be able to investigate the effect of antiseptics or antibiotics on bacterial growth.	To be able to explain the effects of exercise of the body.	medicine that allow us to prevent and treat disease. ***SEPARATE SCIENCE:*** To be able to evaluate the advantages and disadvantages of monoclonal antibodies. To be able to apply scientific knowledge to detect and identify plant diseases.	To be able to explain the factors that affect the rate of photosynthesis.	rate of decay of fresh milk by measuring pH change. To be able to explain how efficiency of biomass transfers between trophic levels impacts on the number of organisms at each trophic level. To be able to describe and explain some possible biotechnical and agricultural solutions, including genetic modification, to the demands of a growing population.
Prior Knowledge	At KS3 students have studied plant and animal cells. They have been introduced to stem cells and specialised cells. Students have covered diffusion and osmosis as methods of transport in cells.	At KS3 students have learnt about the organs of digestive system and the gaseous exchange system. They have learnt about diffusion and some examples of how the lungs are adapted for gas exchange.	At KS3 students have learnt about how our lifestyle can affect our gas exchange system and digestive system. They have studied bacterial cells and their importance to the digestive system.	At KS3 students have studied the structure of the leaf and photosynthesis.	At KS3 students describe what is found in an ecosystem and the impact of one organism on an ecosystem. They will explain predator prey relationships and describe how food chains transfer energy. Students will have looked at the impact of bioaccumulation on organisms in a food chain and the importance of insect pollination on human food security. Global warming and air pollution are also covered in the Year 11 topic Earth and Environment 1.
Key Misconceptions	Nucleus of a cell contains protons and neutrons.	Respiration creates energy.	All diseases are caused by pathogens.	Translocation is the movement of glucose.	Humans are not part of the ecosystem.

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	Water moves from a high concentrated to a low concentration.	During exercise, blood vessels move to the surface of the skin. Substrates have an active site. The substrate is the same shape as the active site on the enzyme. Respiration is another word for breathing.	Antibiotics can be used to treat any infection.	Chloroplasts and chlorophyll are the same. Plants do not respire.	The environment is static. Bigger animals are always at the top of the food chain.
Core Key words	• Nucleus • cytoplasm • ribosome • cell membrane • cell wall • mitochondria • synthesis • specialisation • differentiation • stem cell • mitosis • diffusion • osmosis • active transport • concentration gradient	• active site • denatured • amylase • lipase • protease • bile • glucose • amino acids • fatty acids • glycerol • artery • vein • capillaries • aorta • vena cava • pulmonary vein • pulmonary artery • aerobic • anaerobic • oxygen debt • metabolism	• communicable • coronary heart disease (CHD) • diabetes • benign • malignant • pathogen • virus • bacteria • protist • fungi • antibody • antitoxin • phagocytosis • vaccination • antibiotic • Fleming	• epidermal • palisade mesophyll • spongy mesophyll • xylem • phloem • meristem • stomata • guard cell • transpiration • translocation • photosynthesis • limiting factor • inverse square law (HT ONLY)	• population • community • habitat • ecosystem • abiotic • biotic • extremophile • quadrat • transect • abundance • distribution • carbon cycle • water cycle • biodiversity • peat bog • deforestation • global warming

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Science Year 10 (CHEMISTRY)

Topic	Properties and Bonding	Reactions and Energy 1	Reactions and Energy 2	Quantitative Chemistry	Chemical Methods
Enquiry Question	How is your pencil like a diamond?	How do indigestion tablets work?	Why are some batteries rechargeable?	How many water molecules are in a teaspoon of water?	How do we detect drug cheats at the Olympics?
Big Ideas/ Key concepts	All matter is made up of atomic nuclei and electrons. The behaviour and structural arrangement of atomic nuclei and electrons explains the properties of different materials. Materials are either made of a single chemical substance or a mixture of substances which each have distinctive properties. The amount of a substance is measured in moles.	During chemical reactions, atoms are rearranged and new substances are formed. Materials are either made of a single chemical substance or a mixture of substances which each have distinctive properties. The amount of a substance is measured in moles.	During chemical reactions, atoms are rearranged and new substances are formed.	Materials are either made of a single chemical substance or a mixture of substances which each have distinctive properties. The amount of a substance is measured in moles.	Materials are either made of a single chemical substance or a mixture of substances which each have distinctive properties. The amount of a substance is measured in moles.
Key Knowledge and skills	• To explain chemical bonding in terms of electrostatic forces and the transfer or sharing of electrons. • To describe ionic, covalent, and metallic bonds. • To describe the limitations of dot and cross, ball and stick, two and three-dimensional diagrams to represent chemical structures. • To predict the states of substances at different temperatures. • To explain the different temperatures at which changes of state occur.	• To describe the reactions of metals with water or dilute acids and place these metals in order of reactivity. • To explain how the reactivity of metals is related to the tendency of the metal to form its positive ion. • To deduce an order of reactivity of metals based on experimental results. • To evaluate specific metal extraction processes. • To identify the substances which are oxidised or reduced in terms of gain or loss of oxygen.	• To distinguish between exothermic and endothermic reactions based on temperature change. • To evaluate uses and applications of exothermic and endothermic reactions. • To use reaction profiles to identify reactions as exothermic or endothermic. • To calculate the energy transferred in chemical reactions using bond energies (HT ONLY). • To calculate the mean rate of a reaction.	• To balance chemical equations. • To calculate relative formula mass. • To explain any observed mass changes in a non-enclosed system during a chemical reaction. • To make estimations of uncertainty around a measurement. • To use relative formula mass to calculate the number of moles in a given mass and vice versa (HT ONLY). • To calculate masses of substances shown in a	• To use melting point and boiling point data to distinguish pure from impure substances. • To identify formulations. • To explain how paper chromatography separates mixtures. • To suggest how chromatographic methods can be used to distinguish pure from impure substances. • To interpret chromatograms and determine R_f values from chromatograms.

	• To explain properties of substances. • To compare giant structures, small molecules, and polymers. • To compare the properties and structure of pure metals and alloys. • To compare the properties of diamond, graphite, and fullerenes. ***SEPARATE SCIENCE:*** • To compare 'nano' dimensions to typical dimensions of atoms and molecules.	• To write ionic equations for displacement reactions and identify which species oxidised and reduced (HT ONLY). • To predict the products of neutralisation reactions. • To describe how to make pure, dry soluble salts. • To use the pH scale to identify acidic or alkaline solutions. • To explain the terms, dilute and concentrated, and weak and strong in relation to acids (HT ONLY). • To describe neutrality and relative acidity in terms of the effect on hydrogen ion concentration and the numerical value of pH (HT ONLY). • To predict the products of the electrolysis of ionic compounds in the molten state and as aqueous solutions. • To explain how to extract metals using electrolysis. ***SEPARATE SCIENCE:*** • To describe how to carry out titrations using strong acids and strong alkalis. • To calculate the chemical quantities in titrations.	• To draw tangents to curves to measure the rate of reaction. • To calculate the gradient of a tangent to the curve as a measure of instantaneous rate (HT ONLY). • To explain, using collisions theory, the effects of changing concentration, pressure, surface area and temperature on the rate of reaction. • To explain catalytic action in terms of activation energy. • To describe what happens in a reversible reaction. • To make qualitative predictions about the effect of changes on systems at equilibrium (HT ONLY). ***SEPARATE SCIENCE:*** • To interpret data for relative reactivity of different metals and evaluate the use of cells. • To evaluate the use of hydrogen fuel cells in comparison with rechargeable cells and batteries. • To write half equations for the electrode reactions in the hydrogen fuel cell.	balanced equation (HT ONLY). • To calculate the masses of reactants and products from the balanced equation and the mass of a given reactant or product (HT ONLY). • To balance an equation given the masses of reactants and products (HT ONLY). • To explain the effect of a limiting quantity of a reactant on the amount of products it is possible to obtain (HT ONLY). • To calculate the mass of solute in a given volume of solution of known concentration. • To explain how the mass of a solute and the volume of a solution is related to the concentration of the solution (HT ONLY). ***SEPARATE SCIENCE:*** • To calculate the percentage yield of a product from the actual yield of a reaction. • To calculate atom economy of a reaction to form a desired product from the balanced equation. • To explain how the concentration of a solution in mol/dm^3 is related to the	• To describe the test and result for hydrogen, oxygen, carbon dioxide and chlorine. ***SEPARATE SCIENCE:*** • To identify metal ions from flame tests or reactions with sodium hydroxide solution. • To write balanced equations for the reactions to produce the insoluble hydroxides. • To identify non-metal ions from their reactions.

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				mass of the solute and volume of the solution. • To calculate the volume of a gas at room temperature and pressure from its mass and relative formula mass. • Calculate volumes of gaseous reactants and products from a balanced equation and a given volume of a gaseous reactant or product.	
End Point	To be able to explain why different substances have different properties. ***SEPARATE SCIENCE:*** To evaluate the use of nanoparticles for a specified purpose and explain the possible risks.	To be able to explain how acids and alkalis react. To be able to explain how metals are extracted depending on their reactivity. ***SEPARATE SCIENCE:*** To be able to determine the reacting volumes of solutions of a strong acid and a strong alkali by titration.	To be able to explain what happens during reactions in terms of energy. To be able to explain how the rate of reaction can be changed. ***SEPARATE SCIENCE:*** To be able to evaluate the use of cells and fuel cells.	To be able to calculate mases in reactions using molar ratios. ***SEPARATE SCIENCE:*** To be able to explain why a particular reaction pathway is chosen to produce a specified product given appropriate data such as atom economy, yield, rate, equilibrium position and usefulness of by-products.	To be able to explain how to analyse chemical substances using chemical tests and chromatography. ***SEPARATE SCIENCE:*** To be able to use chemical tests to identify the ions in unknown single ionic compounds.
Prior Knowledge	At KS3 students have studied the properties of solids, liquids, and gases; metals and non-metals as well as metals and alloys. They have also looked at ceramics, composites, and polymers.	At KS3 students have studies acids and alkalis, neutralisation reactions as well as the reactions between metals and acids. They will be able to name the salts produced when different metals react with different acids. In atoms and elements, they will have looked at the reactivity of alkali metals and the halogens.	At KS3 students have studied exothermic and endothermic reactions. They have looked at how temperature and concentration affect the time taken for magnesium to dissolve and linked this to rate of reaction.	Students will have an understanding of conservation of mass. Some students will have calculated relative formula mass of simple molecules.	At KS3 students have studied pure and impure substances as well as separation techniques including chromatography.

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Key Misconceptions	Bonds are broken when changes of state occur.	Increasing acidity increases the pH.	In an exothermic reaction less energy is required to break the bonds than to form new ones. To increase the rate of reactions more collisions are needed. Temperature (or other factor) increases the rate of reaction.	The mole is a unit of weight. The mass of a substance stays the same.	The solvent in chromatography is always water. Chromatography produces 100% pure substances.
Core Key words	• ionic • covalent • metallic • intermolecular • delocalised • electron • electrostatic • giant structure • small molecule • polymer • state symbol • alloy • diamond • graphite • graphene • fullerene • carbon nanotubes	• oxidation • reduction • REDOX (HT ONLY) • neutralisation • salt • filtration • evaporation • crystallisation • pH • electrolysis • aqueous • molten • cryolite • half equation • cathode • anode	• exothermic • endothermic • reaction profile • bond energy • tangent • collision theory • concentration • pressure • surface area • temperature • catalyst • activation energy • equilibrium • Le Chatelier's Principle	• conservation of mass • relative atomic mass • relative formula mass • uncertainty • mole • Avogadro's constant • limiting reactant • concentration • solute • solution • solvent • volume	• pure • impure • formulation • chromatography • mobile phase • stationary phase • solvent • R_f value • Hydrogen • Oxygen • Carbon dioxide • Limewater • Chlorine • Litmus paper

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Science Year 10 (PHYSICS)

Topic	Matter	Electricity	Atomic Physics	Forces 1	Waves
Enquiry Question	How do engineers design vessels to withstand high pressures and temperatures, such as submarines and spacecraft?	Why do birds not get electrocuted when they sit on a wire?	Is it safe to go to Chernobyl?	How is a bungee jump made safe? ***SEPARATE SCIENCE:*** Why is it difficult to make a good cup of tea high up a mountain?	How do we communicate by mobile phone?
Big Ideas/ Key concepts	Objects are made of particles with mass. Understanding particles helps us to design our world.	The everyday world is largely a consequence of electrical charge. Understanding electricity and magnetism helps us develop technology to improve lives.	Objects are made of particles with mass. Understanding particles helps us to design our world.	Forces make things change. Understanding forces helps us to predict and control physical changes.	Waves radiate information. Understanding waves helps us to communicate.

Key Knowledge and skills	• To draw simple diagrams to model the differences between solids, liquids, and gases.
	• To explain the differences in density between the different states of matter in terms of the arrangement of atoms or molecules.
	• To determine the density of regular and irregular shaped objects.
	• To describe how, when substances change state, mass is conserved.
	• To interpret heating and cooling graphs that include changes of state.
	• To distinguish between specific heat capacity and specific latent heat.
		• To draw and interpret circuit diagrams.
		• To investigate how length of wire affects resistance in the wire.
		• To investigate how combinations of resistors in series and parallel affect the resistance and explain qualitatively why adding resistors in series increases the total resistance whilst adding resistors in parallel decreases the total resistance.
		• To explain that, for some resistors, the value of R remains constant but that in others it can change as current changes.
			• To describe the structure of the atom.
			• To describe the impact of the absorption or emission of electromagnetic radiation on the atom.
			• To describe the difference between isotopes.
			• To describe why new evidence from the scattering experiment led to a change in the atomic model.
			• To describe the development of the model of the atom.
			• To apply knowledge of nuclear radiation to the uses of radiation and evaluate the best sources of
				• To identify quantities as scalar or vector.
				• To describe the interaction between pairs of objects which produce a force on each object.
				• To calculate the resultant of two forces that act in a straight line.
				• To use free body diagrams to describe qualitatively examples where several forces lead to a resultant force on an object (HT ONLY).
				• To use vector diagrams to illustrate resolution of forces (HT ONLY).
				• To describe the energy transfer involved when work is done.
					• To describe the difference between longitudinal and transverse waves.
					• To describe evidence that, for both ripples on a water surface and sound waves in air, it is the wave and not the water or air itself that travels.
					• To describe a method to measure:
					  ○ the speed of sound waves in air.
					  ○ the speed of ripples on water.
					  ○ the speed on waves in a solid.
					• To give examples that illustrate the transfer of energy by electromagnetic waves.

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	• To explain how the motion of the molecules in a gas is related to both its temperature and its pressure. • To explain qualitatively the relation between the temperature of a gas and its pressure at constant volume. ***SEPARATE SCIENCE:*** • To use the particle model to explain how increasing the volume in which a gas is contained, at constant temperature, can lead to a decrease in pressure. • To calculate the change in pressure of a gas or the volume of a gas when either the pressure or volume is increased or decreased. • To explain how, in a given situation eg a bicycle pump, doing work on an enclosed gas leads to an increase in the temperature of the gas.	• To explain the design and use of a circuit to measure the resistance of a component by measuring current through, and potential difference across, the component. • To describe the difference between series and parallel circuits. • To calculate current, potential difference and resistance in dc series circuits. • To solve problems for circuits which include resistors in series using the concept of equivalent resistance. • To explain the difference between direct and alternating potential difference. • To explain that a live wire may be dangerous even when a switch in the mains circuit is open. • To explain the dangers of providing any connection between the live wire and earth. • To explain how the power transfer in any circuit device is related to the potential difference across it and the current through it, and to	radiation to use in a given situation. • To write balanced equation to show alpha decay and beta decay. • To explain the concept of half-life and how it is related to the random nature of radioactive decay. • To determine the half-life of a radioactive isotope. • To calculate the net decline, expressed as a ratio, in a radioactive emission after a given number of half-lives (HT ONLY). • To compare the hazards associated with contamination and irradiation. ***SEPARATE SCIENCE:*** • To explain why the hazards associated with radioactive material differ according to the half-life involved. • To describe and evaluate the uses of nuclear radiations for exploration of internal organs, and for control or destruction of unwanted tissue. • To evaluate the perceived risks of using nuclear radiations in relation to	• To convert between newton-metres and joules. • To explain why, to change the shape of an object, more than one force must be applied. • To describe the difference between elastic deformation and inelastic deformation caused by stretching forces. • To describe the difference between a linear and non-linear relationship between force and extension and calculate a spring constant in linear cases. • To calculate work done in stretching. • To calculate relevant values of stored energy and energy transfers. ***SEPARATE SCIENCE:*** • To describe examples in which forces cause rotation. • To calculate the size of a force, or its distance from a pivot, acting on an object that is balanced. • To explain how levers and gears transmit the rotational effects of forces. • To explain why, in a liquid, pressure at a point	• To construct ray diagrams to illustrate the refraction of a wave at the boundary between two different media. • To use wave front diagrams to explain refraction in terms of the change of speed that happens when a wave travels from one medium to another. • To investigate how infrared radiation absorbed or radiated by a surface depends on the nature of that surface. • To draw conclusions about the risk and consequences of exposure to radiation. • To explain why each type of electromagnetic wave is suitable for the practical application (HT ONLY). ***SEPARATE SCIENCE:*** • To show how changes in velocity, frequency and wavelength, in transmission of sound waves from one medium to another, are inter-related. • To construct ray diagrams to illustrate the reflection of a wave at a surface. • To describe the effects of reflection, transmission

		the energy changes over time. • To describe how domestic appliances transfer energy from batteries or ac mains to the kinetic energy of electric motors or the energy of heating devices. • To describe the relationship between the power ratings for domestic appliances and the changes in stored energy when they are in use. • To explain why the National Grid system is an efficient way to transfer energy. ***SEPARATE SCIENCE:*** • To describe the production of static electricity, and sparking, by rubbing surfaces. • To describe evidence that charged objects exert forces of attraction or repulsion on one another when not in contact. • To draw the electric field for an isolated charged sphere and explain the concept of an electric field.	given data and consequences. • To draw/interpret diagrams representing nuclear fission and how a chain reaction may occur.	increases with the height of the column of liquid above that point and with the density of the liquid. • To calculate the differences in pressure at different depths of liquid. • To describe the factors which influence floating and sinking. • To describe a simple model of the Earth's atmosphere and of atmospheric pressure. • To explain why atmospheric pressure caries with height above a surface.	and absorption of waves at material interfaces. • To describe, with examples, processes which convert wave disturbances between sound waves and vibrations in solids. • To explain why such processes only work over a limited frequency range and the relevance of this to human hearing. • To explain in qualitative terms, how the differences in velocity, absorption and reflection between different types of wave in solids and liquids can be used both for detection and exploration of structures which are hidden from direct observation. • To describe how the study of seismic waves provided new evidence that led to discoveries about parts of the Earth which are not directly observable. • To construct ray diagrams to illustrate the similarities and differences between concave and convex lenses. • To explain how colour of an object is related to the differential absorption,

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					transmission and reflection of different wavelengths of light by the object. • To explain the effect of viewing objects through filters or the effect on light of passing through filters. • To explain why an opaque object has a particular colour. • To explain that all bodies emit radiation and that the intensity and wavelength distribution of any emission depends on the temperature of the body.
End Point	To be able to explain the changes in energy for specific latent heat and specific heat capacity. To be able to explain how temperature affects the pressure of a gas. ***SEPARATE SCIENCE:*** To be able to explain the relationship between pressure, volume and temperature.	To be able to explain how energy is transferred efficiently and safely from a power station to our homes. ***SEPARATE SCIENCE:*** To be able to explain how the transfer of electrons between objects can explain the phenomenon of static electricity. To be able to explain how the concept of an electric field helps to explain the non-contact force between charged objects as well as other electrostatic phenomenon.	To be able to explain why some elements become radioactive. To be able to describe the behaviour of radioactive elements. To be able to carry out calculations associated with radioactive element behaviour. ***SEPARATE SCIENCE:*** To evaluate the hazards and uses of radioactive emissions.	To be able to describe the interactions between forces. To be able to perform calculations associated with forces and their interactions. ***SEPARATE SCIENCE:*** To be able to explain moments, lever and gears. To be able to explain pressure differences in fluids.	To be able to describe the behaviour and interactions of different types of waves. To be able to carry out calculations associated with wave behaviour. ***SEPARATE SCIENCE:*** To be able to investigate the reflection of light by different types of surface and the refraction of light by different substances. To be able to explain how the temperature of a body is related to the balance between incoming radiation absorbed and radiation emitted and show how

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					radiation affects the temperature of the Earth.
Prior Knowledge	Students will have studied the particle model at KS3 to understand and explain how the structure of solids, liquids and gases affect their properties. They will also have studied internal energy and how it changes as a substance heats up or cools down, or changes state.	Students will be familiar with a series and a parallel circuit. Students will be familiar with simple circuit symbols such as lamp, cell, battery, ammeter, and voltmeter. Students have been introduced to Ohm's law and V=IR.	Students will have knowledge of structure of the atom along with masses and charges of subatomic particles. Students have knowledge of the development of the model atom in year 8.	Students will have done simple resultant forces calculations and labelled simple diagrams with force arrows. Some students will recall the name of some common forces such as friction and weight. Forces studied in years 7, 8 and 9.	Students will have studied how waves transfer energy in relation to light and sound waves. They will have studied reflection and refraction of light as well as how echoes are formed. They will be able to compare light and sound waves.
Key Misconceptions	To change state you need to break bonds. Particles in a liquid are not close together. When you heat an object the temperature always increases.	Electricity flows round the circuit. Potential difference is the same as power. A voltmeter measures volts. An ammeter measures amps. mW is megawatts. Two resistors in parallel will have a larger resistance than each resistor alone. Charge and charged particle are the same thing.	Radioactive decay can be affected by temperature. Half-life means the time taken for the radioactive material to disappear.	Mass is the same as weight. Kilogram is written as KG and not kg. We use a weighing scale to measure mass. Kinetic is a type of force. If a resultant force is 0N then the object is always stationary.	Amplitude is the distance between the peak and trough. Only objects like a mirror reflects. That a trace of a sound on an oscilloscope shows that it is a transverse wave. Microwaves are an oven and are only used for cooking food. The primary colours of light are red, blue and yellow.
Core Key words	• Density • mass • volume • regular • irregular • displacement • sublimate • internal energy	• diode • variable resistor • LED • LDR • thermistor • charge • coulombs, C • current	• emission • absorption • photon • isotope • ion • plum pudding • alpha particle scattering experiment	• scalar • vector • contact • non-contact • vector • resultant • balanced • gravity	• transverse • longitudinal • time period • frequency • hertz, Hz • amplitude • wavelength

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	• specific heat capacity • specific latent heat • pressure • kinetic energy • potential energy	• potential difference • resistance • ohms, Ω • series • parallel • mains electricity • power • National Grid • Transformers	• Niels Bohr • James Chadwick • radioactive decay • activity • becquerel, Bq • alpha • beta • gamma • half life • contamination • irradiation	• weight • gravitational field strength • work done • extension • spring constant • limit of proportionality	• electromagnetic spectrum • refraction • wave front (HT ONLY) • oscillations

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Science Year 11 (BIOLOGY)

Topic	Coordination and Control	Inheritance	Natural World 2
Enquiry Question	How do goal keepers save a penalty?	Can we genetically modify humans?	Can we save the giant panda?
Big Ideas/ Key concepts	Organisms are made of one or more cells, which need a supply of energy and molecules to carry out life processes. Genetic information is passed from each generation to the next; this information and the environment affect the features, growth and development of organisms.	Genetic information is passed from each generation to the next; this information and the environment affect the features, growth and development of organisms. Differences between organisms cause species to evolve by natural selection of better adapted individuals. The great diversity of organisms is the result of evolution.	All organisms, including humans, depend on, interact with and affect the environments in which they live and other organisms that live there. Substances can move within and between the atmosphere, hydrosphere, geosphere and biosphere as part of large-scale Earth systems.
Key Knowledge and skills	• To explain what homeostasis is. • To explain how the structure of the nervous system is adapted to its functions. • To explain how the various structures in a reflex arc relate to its function. • To investigate the effect of a factor on human reaction time. • To describe the principles of hormonal coordination and control by the human endocrine system. • To explain how insulin controls blood glucose levels in the body. • To compare Type 1 and Type 2 diabetes and explain how they can be treated. • To explain how glucagon interacts with insulin in a negative feedback cycle (HT ONLY). • To describe the roles of hormones in human reproduction, including the menstrual cycle. • To explain the interactions of FSH, oestrogen, LH, and progesterone, in the control of the menstrual cycle (HT ONLY). • To evaluate different hormonal and non-hormonal methods of contraception.	• To compare mitosis and meiosis • To explain how meiosis halves the number of chromosomes in gametes and fertilisation restores the full number. • To describe the structure of DNA and define genome. • To predict the results of a single gene cross. • To evaluate the economic, social, and ethical issues concerning embryo screening. • To carry out a genetic cross to show sex inheritance. • To describe how the genome and its interaction with the environment influence the development of the phenotype of an organism. • To explain how evolution occurs through natural selection of variants that give rise to phenotypes best suited to their environment. • To explain the impact of selective breeding of food plants and domesticated animals. • To describe the process of genetic engineering and explain the potential benefits and risks of genetic engineering in agriculture and in medicine and that some people have objections.	• To describe the different levels of organisation in an ecosystem. • To describe the importance of interdependence and competition in a community. • To explain how a change in an abiotic or biotic factor would affect a given community. • To explain how organisms are adapted to live in their natural environment. • To describe feeding relationships within communities. • To explain the importance of the carbon and water cycles to living organisms. • To explain the role of microorganisms in cycling materials through an ecosystem. • To describe human impact on land, water, and air pollution. • To describe some of the biological consequences of global warming. • To describe both positive and negative human interactions in an ecosystem and explain their impact on biodiversity. ***SEPARATE SCIENCE:***

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	• To explain the use of hormones in modern reproductive technologies to treat fertility (HT ONLY). • To explain the role of thyroxine and adrenaline in the body (HT ONLY). ***SEPARATE SCIENCE:*** • To identify the cerebral cortex, cerebellum and medulla on a diagram of the brain, and describe their functions. • To explain some of the difficulties of investigating brain function and treating brain damage and disease. • To relate the structures of the eye to their functions. • To describe how the eye focuses on near and far objects. • To interpret ray diagrams, showing myopia and hyperopia, and demonstrate how spectacles correct them. • To explain how the body lowers or raises body temperature, • To explain the effect on cells of osmotic changes in body fluids. • To describe the function of the kidneys in maintaining water balance of the body. • To describe the effect of ADH on the permeability of kidney tubules. • To describe the effects of some plant hormones and the different ways people use them to control plant growth.	• To describe the evidence for evolution. • To describe factors which may contribute to the extinction of a species. • To describe the impact of developments in biology on classification systems. ***SEPARATE SCIENCE:*** • To explain the advantages and disadvantages of asexual and sexual reproduction for any organism. • To describe the structure of DNA. • To recall a simple description of protein synthesis. • To explain how the structure of DNA affects the protein made. • To describe how genetic variants may influence phenotype. • To explain how a change in DNA structure may result in a change in the protein synthesised by a gene. • To explain the potential benefits and risks of cloning in agriculture and in medicine and that some people have ethical objections. • To describe the work of Darwin and Wallace in the development of the theory of evolution by natural selection. • To explain the impact of these ideas on biology. • To describe the steps which give rise to a new species. • To describe the development of our understanding of genetics including the work of Mendel.	• To explain how temperature, water and availability of oxygen affect the rate of decay of biological material. • To evaluate the impact of environmental changes on the distribution of species in an ecosystem given appropriate information. • To describe the differences between the trophic levels of organisms within an ecosystem. • To construct accurate pyramids of biomass from appropriate data. • To describe pyramids of biomass and explain how biomass is lost between the different trophic levels. • To calculate the efficiency of biomass transfers between trophic levels by percentages or fraction of mass. • To explain how this affects the number of organisms at each trophic level. • To describe some of the biological factors affecting levels of food security. • To describe and explain some possible biotechnical and agricultural solutions, including genetic modification, to the demands of a growing population.
End Point	To be able to explain how the nervous system responds to stimuli and why this is important. To be able to describe how the endocrine system controls blood glucose levels and the menstrual cycle.	To be able to explain how organisms inherit features from their parents. To be able to describe processes which cause species to change over time and how this can be tracked using classification.	To be able to explain the changes in biodiversity through investigation and understanding of human impacts on the environment. ***SEPARATE SCIENCE:***

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	To be able to explain how hormones are used in modern reproductive technologies. ***SEPARATE SCIENCE:*** To be able to explain how the structures of the eye and the brain relate to their functions. To explain how the body maintains body temperature and water balance. To be able to investigate the effect of light or gravity on the growth of newly germinated seeds.	***SEPARATE SCIENCE:*** To be able to explain the importance of the structure of DNA. To be able to explain the potential benefits and risks of cloning in agriculture and in medicine and that some people have ethical objections. To be able to explain why the importance of Mendel's discovery was not recognised until after his death.	To be able to investigate the effect of temperature on the rate of decay of fresh milk by measuring pH change. To be able to explain how efficiency of biomass transfers between trophic levels impacts on the number of organisms at each trophic level. To be able to describe and explain some possible biotechnical and agricultural solutions, including genetic modification, to the demands of a growing population.
Prior Knowledge	At KS3 students have studies the menstrual cycle and contraception. They will have an understanding of hormones as chemical messengers from their study of puberty.	In Year 9 students have studied DNA as the unit of inheritance and have studied evolution through the process of natural selection. They will have described how genes are passed on through generations and that the genes passed on can result in evolution. At KS2 students have classified living things into different groups based on their similarities and differences from the widest category of kingdom to the most specific, species.	At KS3 students describe what is found in an ecosystem and the impact of one organism on an ecosystem. They will explain predator prey relationships and describe how food chains transfer energy. Students will have looked at the impact of bioaccumulation on organisms in a food chain and the importance of insect pollination on human food security. Global warming and air pollution are also covered in the Year 11 topic Earth and Environment 1.
Key Misconceptions	The brain is the only part of the nervous system that controls the body. Hormone only affect the body in one way. The endocrine system is separate from the nervous system.	Genetic traits are solely determined by a single gene. Dominant traits are always more common than recessive traits. Genetic traits can be controlled or altered by individuals. Evolution is "just a theory" and therefore not supported by evidence. Evolution explains how life began on Earth. Evolution is incompatible with religious beliefs.	Humans are not part of the ecosystem. The environment is static. Bigger animals are always at the top of the food chain.

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Core Key words			
	• Homeostasis • stimuli • receptor • sensory neurone • relay neurone • motor neurone • effector • response • reflex • endocrine system • hormone • insulin • glycogen • glucagon (HT ONLY) • negative feedback (HT ONLY) • FSH • LH • oestrogen • progesterone • IVF • thyroxine • adrenaline	• gamete • chromosome • gene • allele • dominant • recessive • homozygous • heterozygous • genotype • phenotype • meiosis • polydactyly • cystic fibrosis • evolution • variation • mutation • Darwin • selective breeding • genetic engineering • fossil • extinction • MRSA • classification • domain • kingdom • phylum • class • order • family • genus • species	• population • community • habitat • ecosystem • abiotic • biotic • extremophile • quadrat • transect • abundance • distribution • carbon cycle • water cycle • biodiversity • peat bog • deforestation • global warming

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Science Year 11 (CHEMISTRY)

Topic	Quantitative Chemistry	Organic Chemistry	Chemical Methods	Earth and The Environment 1	Earth and The Environment 2
Enquiry Question	How many water molecules are in a teaspoon of water?	Why is crude oil so useful?	How do we detect drug cheats at the Olympics?	Why did google become carbon neutral?	How did google become carbon neutral?
Big Ideas/ Key concepts	Materials are either made of a single chemical substance or a mixture of substances which each have distinctive properties. The amount of a substance is measured in moles.	Materials are either made of a single chemical substance or a mixture of substances which each have distinctive properties. The amount of a substance is measured in moles.	Materials are either made of a single chemical substance or a mixture of substances which each have distinctive properties. The amount of a substance is measured in moles.	Substances can move within and between the atmosphere, hydrosphere, geosphere and biosphere as part of large-scale Earth systems.	Substances can move within and between the atmosphere, hydrosphere, geosphere and biosphere as part of large-scale Earth systems.
Key Knowledge and skills	• To balance chemical equations. • To calculate relative formula mass. • To explain any observed mass changes in a non-enclosed system during a chemical reaction. • To make estimations of uncertainty around a measurement. • To use relative formula mass to calculate the number of moles in a given mass and vice versa (HT ONLY). • To calculate masses of substances shown in a balanced equation (HT ONLY). • To calculate the masses of reactants and products from the balanced equation and the mass of a given reactant or product (HT ONLY).	• To describe what crude oil is made up of. • To explain how fractional distillation works in terms of evaporation and condensation. • To recall how boiling point, viscosity, and flammability change with increasing molecular size. • To write balanced equations for complete combustion. • To describe the conditions used for catalytic cracking and steam cracking. • To describe the test for alkenes. • To balance chemical equations for cracking. • To explain how modern life depends on the uses of hydrocarbons. ***SEPARATE SCIENCE:***	• To use melting point and boiling point data to distinguish pure from impure substances. • To identify formulations. • To explain how paper chromatography separates mixtures. • To suggest how chromatographic methods can be used to distinguish pure from impure substances. • To interpret chromatograms and determine R_f values from chromatograms. • To describe the test and result for hydrogen, oxygen, carbon dioxide and chlorine. ***SEPARATE SCIENCE:*** • To identify metal ions from flame tests or reactions	• To describe the Earth's atmosphere today. • To interpret evidence and evaluate different theories about the Earth's early atmosphere. • To describe the main changes in the atmosphere over time and some of the likely causes of these changes. • To describe and explain the formation of deposits of limestone, coal, crude oil, and natural gas. • To describe the greenhouse effect in terms of the interaction of short and long wavelength radiation with matter. • To recall two human activities that increase the amounts of each of the greenhouse gases carbon dioxide and methane.	• To give examples of natural products that are supplemented or replaced by agriculture and synthetic products. • To distinguish between finite and renewable resources. • To distinguish between potable water and pure water. • To describe the differences in treatment of ground water and salty water. • To give reasons for the steps used to produce potable water. • To comment on the relative ease of obtaining potable water from waste, ground, and salt water. • To evaluate alternative biological methods of metal extraction (HT ONLY). • Top carry out simple comparative LCAs for

	• To balance an equation given the masses of reactants and products (HT ONLY). • To explain the effect of a limiting quantity of a reactant on the amount of products it is possible to obtain (HT ONLY). • To calculate the mass of solute in a given volume of solution of known concentration. • To explain how the mass of a solute and the volume of a solution is related to the concentration of the solution (HT ONLY). ***SEPARATE SCIENCE:*** • To calculate the percentage yield of a product from the actual yield of a reaction. • To calculate atom economy of a reaction to form a desired product from the balanced equation. • To explain how the concentration of a solution in mol/dm^3 is related to the mass of the solute and volume of the solution. • To calculate the volume of a gas at room temperature and pressure from its mass and relative formula mass.	• To describe the reactions and conditions for the addition of hydrogen, water and halogens to alkenes. • To draw fully displayed structural formulae of the first four members of the alkenes and the products of their addition reactions with hydrogen, water chlorine, bromine and iodine. • To describe what happens when any of the first four alcohols react with sodium, burn in air, are added to water, react with an oxidising agent. • To recall the main uses of these alcohols. • To describe what happens when any of the first four carboxylic acids react with carbonates, dissolve in water, react with alcohols. • To explain why carboxylic acids are weak acids in terms of ionisation and pH. • To recognise addition polymers and monomers from diagrams. • To draw diagrams to represent the formation of a polymer from a given alkene monomer.	with sodium hydroxide solution. • To write balanced equations for the reactions to produce the insoluble hydroxides. • To identify non-metal ions from their reactions.	• To evaluate the quality of evidence in a report about global climate change. • To describe uncertainties in the evidence base. • To recognise the importance of peer review of results and of communicating results to a wide range of audiences. • To describe potential effects of global climate change. • To describe actions to reduce emissions of carbon dioxide and methane and give reasons why actions may be limited. • To describe how carbon monoxide, soot, sulphur dioxide and oxides of nitrogen are produced by burning fuels and their impact on the environment.	shopping bags made from plastic and paper. • To evaluate ways of reducing the use of limited resources. ***SEPARATE SCIENCE:*** • To describe experiments and interpret results to show that both air and water are necessary for rusting. • To explain sacrificial protection in terms of relative uncertainty. • To recall uses of specific alloys. • To interpret and evaluate the composition and uses of alloys given appropriate information. • To explain how low density and high density poly(ethene) are both produced from ethene. • To explain the difference between thermosoftening and thermosetting polymers in terms of their structures. • To recall some examples of composites. • To compare quantitatively the physical properties of glass and clay ceramics, polymers, composites and metals.

	• Calculate volumes of gaseous reactants and products from a balanced equation and a given volume of a gaseous reactant or product.	• To explain the basic principles of condensation polymerisation by reference to the functional groups in the monomers and the repeating units in the polymers.			• To explain how the properties of materials are related to their uses and select appropriate materials. • To apply the principles of dynamic equilibrium to the Haber process. • To recall the names of the salts produced when phosphate rock is treated with nitric acid, sulfuric acid and phosphoric acid. • To compare the industrial production of fertilisers with laboratory preparations of the same compound.
End Point	To be able to calculate mases in reactions using molar ratios. ***SEPARATE SCIENCE:*** To be able to explain why a particular reaction pathway is chosen to produce a specified product given appropriate data such as atom economy, yield, rate, equilibrium position and usefulness of by-products.	To be able to explain how fuels and plastics are formed. ***SEPARATE SCIENCE:*** To be able to describe the reactions of different organic compounds. To be able to describe the difference between addition and condensation polymerisation.	To be able to explain how to analyse chemical substances using chemical tests and chromatography. ***SEPARATE SCIENCE:*** To be able to use chemical tests to identify the ions in unknown single ionic compounds.	To be able to explain how the levels of gases have changed from Earth's early atmosphere to the atmosphere today.	To be able to explain and evaluate how Earth's natural resources are used sustainably. ***SEPARATE SCIENCE:*** To be able to explain the trade-off between rate of production and position of equilibrium and explain how the commercially used conditions for the Haber process are related to the availability and cost of raw materials and energy supplies, control of equilibrium position and rate.

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Prior Knowledge	Students will have an understanding of conservation of mass. Some students will have calculated relative formula mass of simple molecules.	At KS3 students have studied distillation as a method of separating liquids with different boiling points. They will have studied the formation of crude oil and understand what fossil fuels are. Students will have an understanding of combustion.	At KS3 students have studied pure and impure substances as well as separation techniques including chromatography.	Students will have studied the composition of the Earth's atmosphere and the impact of burning fossil fuels on the atmosphere. Students who study Geography GCSE will have studied global warming and the enhanced greenhouse effect. Global warming and its effects are also covered in the Year 11 Natural World unit.	Students will have studied renewable and non-renewable energy resources at KS3. They will have studied filtration and distillation at KS3, and osmosis is covered in Year 10 Cells.
Key Misconceptions	The mole is a unit of weight. The mass of a substance stays the same.	All hydrocarbons are fossil fuels. Cracking only breaks down large alkanes into smaller alkanes. Hydrocarbons are only used as fuels.	The solvent in chromatography is always water. Chromatography produces 100% pure substances.	Oxygen was always present in the Earth's atmosphere. The hole in the ozone layer causes global warming. Carbon dioxide is the only greenhouse gas.	Renewable resources are reused. All water can be made potable. Sustainable development is only about conserving resources.
Core Key words	• conservation of mass • relative atomic mass • relative formula mass • uncertainty • mole • Avogadro's constant • limiting reactant • concentration • solute • solution • solvent • volume	• crude oil • hydrocarbon • alkane • fractional distillation • evaporation • condensation • viscosity • flammability • combustion • cracking • alkene • bromine water	• pure • impure • formulation • chromatography • mobile phase • stationary phase • solvent • R_f value • Hydrogen • Oxygen • Carbon dioxide • Limewater • Chlorine • Litmus paper	• atmosphere • condensed • dissolved • photosynthesis • greenhouse effect • wavelength • absorb • emit • carbon dioxide • methane • peer review • global warming • climate change • acid rain • carbon footprint	• sustainable development • potable • sterilise • desalination • reverse osmosis • distillation • sewage • aerobic • anaerobic • bioleaching • phytomining • life cycle assessment • recycle

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Science Year 11 (Physics)

Topic	Forces 2	Waves	Magnetism	Space (Separate Science only)
Enquiry Question	Why do aeroplanes have a top speed?	How do we communicate by mobile phone?	How can electromagnets be used to make a lift move up and down?	What is dark matter and what is causing the universe to expand even faster?
Big Ideas/ Key concepts	Forces make things change. Understanding forces helps us to predict and control physical changes.	Waves radiate information. Understanding waves helps us to communicate.	The everyday world is largely a consequence of electrical charge. Understanding electricity and magnetism helps us develop technology to improve lives.	Understanding the uniqueness of the Earth and the vastness of space gives us perspective and awe.
Key Knowledge and skills	• To express a displacement in terms of both magnitude and direction. • To calculate speed of objects. • To calculate average speed for non-uniform motion. • To explain qualitatively that motion in a circle involves constant speed but changing velocity (HT ONLY). • To draw, interpret and determine speed from a distance-time graph. • To estimate the magnitude of everyday accelerations. • To draw velocity-time graphs and determine acceleration. • To determine the distance travelled from a velocity-time graph (HT ONLY). • To apply Newton's First Law to explain the motion of objects moving with uniform velocity and objects where speed and/or direction changes. • To explain that inertial mass is a measure of how difficult it is to change the velocity of an object (HT ONLY).	• To describe the difference between longitudinal and transverse waves. • To describe evidence that, for both ripples on a water surface and sound waves in air, it is the wave and not the water or air itself that travels. • To describe a method to measure: ○ the speed of sound waves in air. ○ the speed of ripples on water. ○ the speed on waves in a solid. • To give examples that illustrate the transfer of energy by electromagnetic waves. • To construct ray diagrams to illustrate the refraction of a wave at the boundary between two different media. • To use wave front diagrams to explain refraction in terms of the change of speed that happens when a wave travels from one medium to another. • To investigate how infrared radiation absorbed or radiated by a	• To describe the attraction and repulsion between unlike and like poles for permanent magnets. • To describe the difference between permanent and induced magnets. • To describe how to plot the magnetic field pattern of a magnet using a compass. • To draw the magnetic field pattern of a bar magnet. • To explain how the behaviour of a magnetic compass is related to evidence that the core of the Earth must be magnetic. • To describe how the magnetic effect of a current can be demonstrated. • To draw the magnetic field pattern for a straight wire carrying a current and for a solenoid. • To explain how a solenoid arrangement can increase the magnetic effect of the current. • To show that Fleming's left-hand rule represents the relative orientation of the force, the current	• To explain how, at the start of a star's life-cycle, the dust and gas drawn together by gravity causes fusion reactions. • To explain that fusion reactions lead to an equilibrium between the gravitational collapse of a star and the expansion of a star due to fusion energy. • To describe the lifecycle of a star the size of the Sun. • To describe the life cycle of a star much more massive than the Sun. • To explain how fusion processes lead to the formation of new elements. • To explain qualitatively how for circular orbits, the force of gravity can lead to changing velocity but unchanged speed. • To explain qualitatively how for a stable orbit, the radius must change if the speed changes. • To explain qualitatively the red-shift of light from galaxies that are receding.

	• To investigate the effect of force on acceleration and the effect of mass on acceleration. • To apply Newton's Third Law to examples of equilibrium situations. • To explain methods to measure human reaction times. • To evaluate the effect of various factors on thinking distance based on given data. • To explain the factors which affect the distance required for vehicles to come to rest in an emergency, and the implications for safety. • To explain the dangers caused by large decelerations. • To estimate the forces involved in the deceleration of vehicles in typical situations on a road (HT ONLY). • To use the concept of momentum to describe and explain examples of momentum in an event. ***SEPARATE SCIENCE:*** • To interpret changing motion in terms of the forces acting. • To estimate how the distances for a vehicle to make an emergency stop varies over a range of speeds typical for that vehicle. • To apply equations relating force, mass, velocity and acceleration to explain how the changes involved are inter-related.	surface depends on the nature of that surface. • To draw conclusions about the risk and consequences of exposure to radiation. • To explain why each type of electromagnetic wave is suitable for the practical application (HT ONLY). ***SEPARATE SCIENCE:*** • To show how changes in velocity, frequency and wavelength, in transmission of sound waves from one medium to another, are inter-related. • To construct ray diagrams to illustrate the reflection of a wave at a surface. • To describe the effects of reflection, transmission and absorption of waves at material interfaces. • To describe, with examples, processes which convert wave disturbances between sound waves and vibrations in solids. • To explain why such processes only work over a limited frequency range and the relevance of this to human hearing. • To explain in qualitative terms, how the differences in velocity, absorption and reflection between different types of wave in solids and liquids can be used both for	in the conductor and the magnetic field. • To recall the factors that affect the size of the force on the conductor. • To explain how the force on a conductor in a magnetic field causes the rotation of the coil in an electric motor. ***SEPARATE SCIENCE:*** • To explain how electromagnetic devices work based on diagrams of the devices. • To explain how a moving-coil loudspeaker and headphones work. • To recall the factors that affect the size of the induced potential difference/induced current. • To recall the factors that affect the direction of the induced potential difference/induced current. • To apply the principles of the generator effect in a given context. • To explain how the generatore effect is used in an alternator to generate ac and in a dynamo to generate dc. • To draw/interpret graphs of potential difference generated in the coil against time. • To explain how a moving-coil microphone works. • To explain how the effect of an alternating current in one coil in inducing a current in another is used on transformers.	• To explain that the change of each galaxy's speed with distance is evidence of an expanding universe. • To explain how red-shift provide evidence for the Big Bang model. • To explain how scientists are able to use observations to arrive at theories such as the Big Bang theory. • To explain that there is still much about the universe that is not understood, for example dark mass and dark energy.

		detection and exploration of structures which are hidden from direct observation. • To describe how the study of seismic waves provided new evidence that led to discoveries about parts of the Earth which are not directly observable. • To construct ray diagrams to illustrate the similarities and differences between concave and convex lenses. • To explain how colour of an object is related to the differential absorption, transmission and reflection of different wavelengths of light by the object. • To explain the effect of viewing objects through filters or the effect on light of passing through filters. • To explain why an opaque object has a particular colour. • To explain that all bodies emit radiation and that the intensity and wavelength distribution of any emission depends on the temperature of the body.	• To explain how the ratio of the potential differences across the two coils depends on the ratio of the number of turns on each. • To calculate the current drawn from the input supply to provide a particular power output. • To apply the equation linking the p.d.s and number of turns in the two coils of a transformer to the currents and the power transfer involved, and relate these to the advantages of power transmission at high potential differences.	
End Point	To be able to describe how forces affect the motion of an object. To be able to perform calculations associated with forces and their effect on the motion of an object. ***SEPARATE SCIENCE:*** To be able to explain safety features such as: air bags, seat belts,	To be able to describe the behaviour and interactions of different types of waves. To be able to carry out calculations associated with wave behaviour. ***SEPARATE SCIENCE:*** To be able to investigate the reflection of light by different types of surface	To be able to describe how to produce electromagnets and explain how they work. To be able to explain how magnetic fields interact to produce motion. ***SEPARATE SCIENCE:***	***SEPARATE SCIENCE:*** To be able to describe our solar system and how the planets orbit. To be able to the life cycle of a star. To be able to explain the evidence for the big bang and the creation of the universe.

	gymnasium crash mats, cycle helmets and cushioned surfaces for playgrounds with reference to the concept of rate of change of momentum.	and the refraction of light by different substances. To be able to explain how the temperature of a body is related to the balance between incoming radiation absorbed and radiation emitted and show how radiation affects the temperature of the Earth.	To be able to explain how loudspeakers, microphones and transformers work.	
Prior Knowledge	At KS3 students study relative motion and will be able to describe how resultant forces affect the motion of an object. They will be able to describe Newton's first law and describe how applying a force can transfer energy from one energy store to another.	Students will have studied how waves transfer energy in relation to light and sound waves. They will have studied reflection and refraction of light as well as how echoes are formed. They will be able to compare light and sound waves.	At KS3 students study magnetism as a non-contact force and the interaction of two magnets as well as the formation of a magnetic field around a current carrying wire. They will be able to describe how to form and electromagnet and change its strength.	Students will be familiar with the order of the planets and day and night taught at KS2 and in year 7. Students will know that the planets orbit the Sun and that the Sun is a star.
Key Misconceptions	Distance and displacement are the same thing. That units for speed are always the same. A force is needed to key an object moving with constant velocity. That the shapes for the graphs for acceleration vs time and distance vs time mean the same thing. s means speed in equations. That Newton had one law. That thinking, breaking, and stopping distance is the time it takes. Reaction time only affects time. Not distance.	Amplitude is the distance between the peak and trough. Only objects like a mirror reflects. That a trace of a sound on an oscilloscope shows that it is a transverse wave. Microwaves are an oven and are only used for cooking food. The primary colours of light are red, blue and yellow.	Induced magnets have fixed poles. All metals are magnetic. The larger the magnet the stronger the magnet.	That a light year is a length of time. The vacuum of space is completely empty. The Earth is the centre of our Universe. The universe is expanding into something.

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	That a factor that increases stopping distance is the condition of breaks rather than poor condition of breaks.			
Core Key words	• displacement • speed • velocity • acceleration • terminal velocity • Newton's First law • Newton's second law • Newtons' third law • inertia • stopping distance • momentum (HT ONLY)	• transverse • longitudinal • time period • frequency • hertz, Hz • amplitude • wavelength • electromagnetic spectrum • refraction • wave front (HT ONLY) • oscillations	• pole • induced • electromagnet • attract • repel • magnetic field • Fleming's left-hand rule • motor effect • electromagnetic induction • solenoid • Tesla • magnetic flux density	• fusion • protostar • red giant • white dwarf • black dwarf • red giant • supernova • neutron star • black hole • orbit • red-shift • Big Bang theory