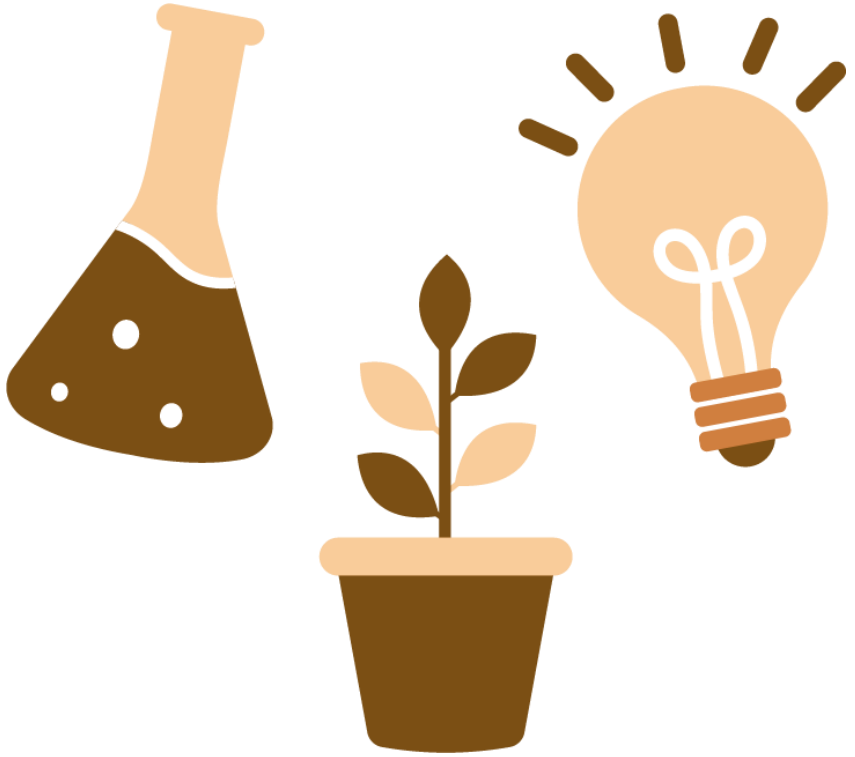
United Curriculum

Primary Science

For Teachers



United Curriculum
Primary
Part of United Learning

Contents

This document aims to provide science subject leaders and classroom teachers with an understanding of the rationale for the science curriculum, the core substantive and disciplinary knowledge that will be covered, as well as guidance on how to implement it in individual schools and classrooms.

United Curriculum Principles

Building on the Framework for Excellence, The United Learning Primary Curriculum has six core principles:

- **Entitlement**
  All pupils have the right to learn what is in the United Learning curriculum, and schools have a duty to ensure that all pupils are taught the whole of it
- **Coherence**
  Taking the National Curriculum as its starting point, our curriculum is carefully sequenced so that powerful knowledge builds term by term and year by year. We make meaningful connections within subjects and between subjects
- **Mastery**
  We ensure that foundational knowledge, skills and concepts are secure before moving on. Pupils revisit prior learning and apply their understanding in new contexts
- **Adaptability**
  The core content – the 'what' – of the curriculum is stable, but schools will bring it to life in their own local context, and teachers will adapt lessons – the 'how' – to meet the needs of their own classes
- **Representation**
  All pupils see themselves in our curriculum, and our curriculum takes all pupils beyond their immediate experience
- **Education with character**
  Our curriculum - which includes the taught subject timetable as well as spiritual, moral, social and cultural development, our co-curricular provision and the ethos and 'hidden curriculum' of the school – is intended to spark curiosity and to nourish both the head and the heart

Subject-specific rationales are built on these six principles.

United Curriculum Principles: Science

The United Curriculum for science provides all pupils, regardless of their background, with:

Substantive knowledge:

- Ensuring pupils **master** core content through the development of key concepts and **timely revisiting** of key knowledge
- Sequencing the curriculum and selecting knowledge to allow for gradual development of **vertical concepts** – the 'big ideas' in science – to provide firm foundations for KS3 and KS4
- **Preventing common misconceptions** that are often formed at an early age and prove problematic at the later stages of pupils' science education
- Purposefully teaching appropriate knowledge that **goes beyond the KS1 and KS2 national curriculum**, to aid current and future understanding, and to smooth the transition to KS3
- Encouraging pupils to apply and **make connections** between the disciplines of science, the wider curriculum and the wider world

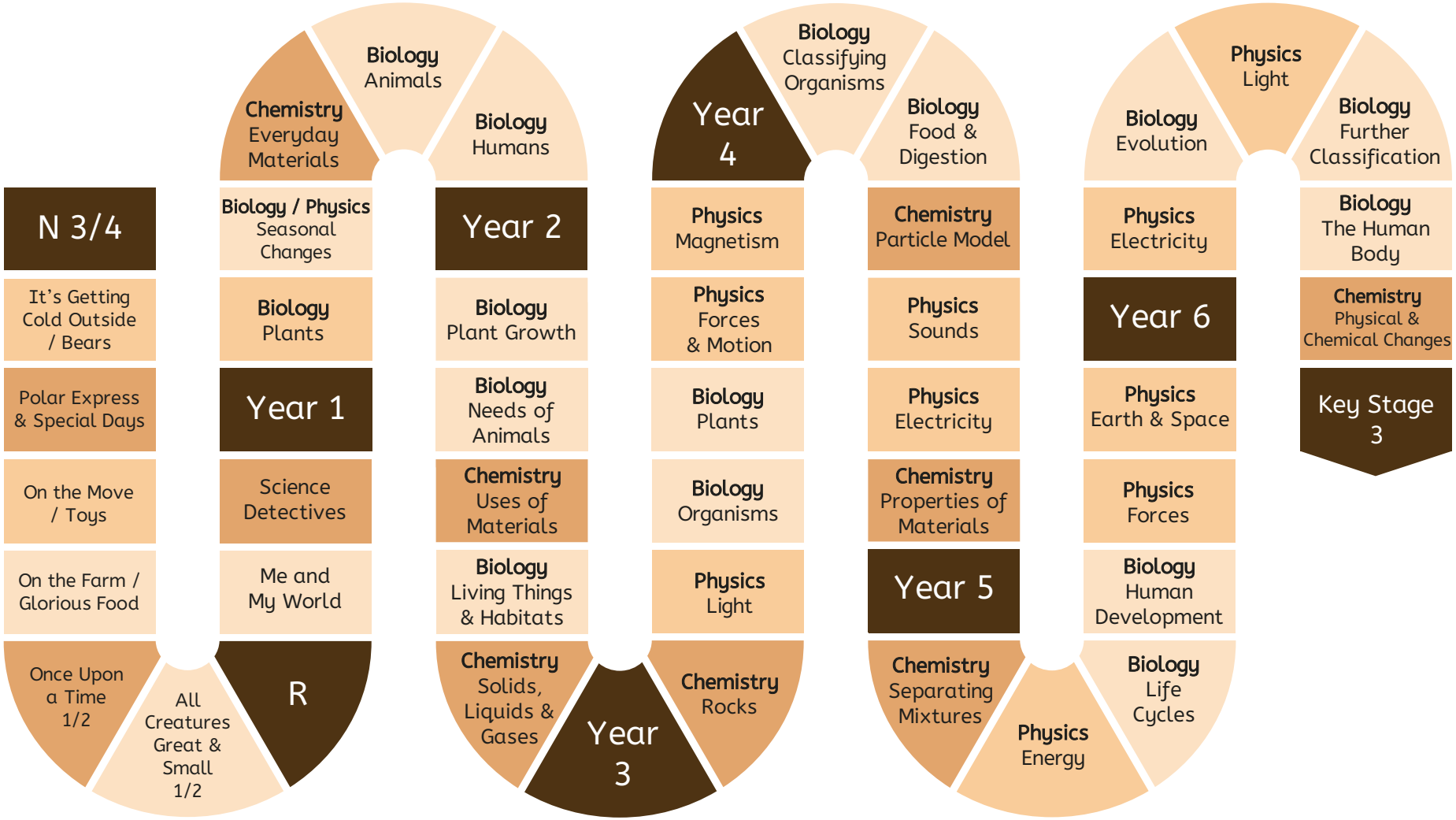
Disciplinary knowledge:

- Sequencing Working Scientifically elements so that they are **explicitly taught** and practised alongside the substantive knowledge, and regularly reviewed and built upon across the years and key stages
- Making deliberate and **explicit links to other curriculum areas** – particularly geography and mathematics – to ensure there is a consistent approach to teaching content, and that pupils are always **first taught content in the most relevant subject**. For example, pupils are taught how to construct bar charts or calculate the mean in mathematics before they are applied in science
- Planning practical tasks that have a **clear purpose**: to demonstrate or prove substantive concepts, or to allow pupils to deliberately practice working scientifically skills in a relevant context

Curiosity and excitement about science:

- Selecting examples and applications of science that **inspires pupils' curiosity** about the world and natural phenomena
- Ensuring that all pupils **can see themselves reflected** in the science curriculum, by highlighting present-day role models and the contributions of scientists from a wide range of backgrounds; and considering social and cultural values around scientific ideas

United Curriculum: Science



United Curriculum: Science

	N3-4	Reception	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Autumn 1	**It's getting cold outside / Bears** Weather where we live, habitats where bears live		**BIOLOGY** **Plants** Identifying and naming common plants and describing basic structures	**BIOLOGY** **Plant growth** Plants grow from seeds, and require water, light and a suitable temperature	**CHEMISTRY** **Rocks** Comparisons of types of rocks and how fossils are formed	**PHYSICS** **Light** Relationship between light and how we see; the formation of shadows	**CHEMISTRY** **Separating mixtures** Identifying and separating mixtures; reversible and non-reversible changes	**CHEMISTRY** **Separating mixtures** Identifying and separating mixtures; reversible and non-reversible changes
Autumn 2	**Polar express / Special days** Melting and freezing; natural and artificial materials		**BIOLOGY / PHYSICS** **Seasonal changes** Observing changes across four seasons and describing associated weather	**BIOLOGY** **Needs of animals** Animals need water, food and air to survive and to have offspring	**PHYSICS** **Light** Relationship between light and how we see; the formation of shadows	**CHEMISTRY** **Rocks** Comparisons of types of rocks and how fossils are formed	**BIO / CHEM / PHYSICS** **Energy** Introducing the concept of energy stores and energy transfers; relate this to prior knowledge	**BIO / CHEM / PHYSICS** **Energy** Introducing the concept of energy stores and energy transfers; relate this to prior knowledge
Spring 1	**On the Move / Toys** Exploring pushes, pulls and magnets		**CHEMISTRY** **Everyday materials** Distinguishing objects from their material, and describing simple properties	**CHEMISTRY** **Uses of materials** Comparisons of an object's material with its use; impact of bending, twisting on solid objects	**BIOLOGY** **Organisms** The role of muscles and skeletons; the importance of nutrients	**BIOLOGY** **Organisms** The role of muscles and skeletons; the importance of nutrients	**BIOLOGY** **Life cycles** Life cycles of a mammal, amphibian, insect, bird, and some reproduction processes	**PHYSICS** **Light** How light travels and is reflected, and how this allows us to see
Spring 2	**On the Farm / Food Glorious Food** Life cycles of farm animals and plants	**Spring in our step** Wildlife and weather in spring and winter; habitats around our school	**Consolidation and review**	**BIOLOGY** **Living things & habitats** Introduction to habitats, micro-habitats, and simple food chains	**BIOLOGY** **Plants** Features of flowering plants and what they need to survive	**BIOLOGY** **Plants** Features of flowering plants and what they need to survive	**BIOLOGY** **Human development** Human development to old age	**BIOLOGY** **Further classification** Further classification of organisms based on characteristics
Summer 1	**Once upon a time 1 / 2** Properties of materials and exploring mixtures		**BIOLOGY** **Animals** Naming reptiles, fish, amphibians, birds and mammals; carnivores, herbivores, omnivores	**CHEMISTRY** **Solids, liquids and gases** How the same substances can exist as solids, liquids and gases	**PHYSICS** **Forces & motion** Introducing pushes and pulls; opposing forces, and balanced forces	**PHYSICS** **Magnetism** Contact and non-contact forces, including friction and magnetism	**PHYSICS** **Forces** Gravity, air and water resistance and friction; introduction to pulleys	**BIOLOGY** **Functions of the human body** Human circulatory system; transport of nutrients within the body
Summer 2	**All creatures great and small 1 / 2** Life cycles of animals in trop. rainforests, sea, and grasslands	**Science detectives** Properties of materials and habitats around the world	**BIOLOGY** **Humans** Human body parts and senses	**Consolidation and review**	**PHYSICS** **Magnetism** Contact and non-contact forces, including friction and magnetism	**PHYSICS** **Forces & motion** Introducing pushes and pulls; opposing forces, and balanced forces	**PHYSICS** **Earth and space** Movements of planets and the Moon, and relationship to day and night	**CHEMISTRY** **Physical and chemical changes** Identifying physical and chemical changes

N3-4: Autumn 1

It's Getting Cold Outside / Bears

	Building on prior understanding	Pupils should be exposed to	How knowledge will be built upon
Substantive		• Identify appropriate clothes to go outside in different types of weather. • Some animals, like bears, **hibernate** in the **winter.** • Types of weather include **sunny**, **rainy**, **windy**, **snowy.** • We see **puddles** when it's rainy, **shadows** during the day and **rainbows** when there is sunshine and rain • **Habitats** are the places that living things live. • Different animals live in different **habitats.** • Feel, hear, smell and see natural materials of **grass**, **mud**, **water**, **rock** and **sand.**	• There are differences in the wildlife we see and the weather in spring and winter (Rec Spr2). • Examples of weather include sunny, rainy, windy, warm, cold, cloudy, drizzle, snow, stormy (with thunder and lightning) (Y2 Aut). • Evaporation and condensation; water cycle (Y4 Spr1).
Disciplinary		• M&O: Measure and observe using senses.	• M&O: Make systematic observations of an object (Y2 Aut).
VCs		• 5A: Describing the natural things in our local area. • 5B: Types of weather include sunny, rainy, windy, and snowy. • 6: Naming Sun, Earth and Moon. • 8: There is a wide variety of living things on Earth, including plants and animals.	• 5A: Describing beach, hill, forest, sea and river (Rec) and other physical features in our local area (Y1). • 5B: We experience different types of weather in different seasons (focus on spring and winter) (Rec). • 6: The Sun as a star in our universe; Earth as a planet and the Moon as a satellite (Y5). • 8: Living things, including humans, react to their surroundings with their senses (Y1).

Relevant **Development Matters (N3-4)** statements:

- Use all their senses in hands-on exploration of natural materials.
- Talk about what they see, using a wide vocabulary.

N3-4: Autumn 2

Polar Express / Special Days

	Building on prior understanding	Pupils should be exposed to	How knowledge will be built upon
Substantive		• **Melting** and **freezing** can be observed in the world around us. • Some objects **float** and some objects **sink** in water. • Materials can be **artificial** (man-made) or **natural.**	• Some materials are hard whilst others are soft, some can be described as rough whilst others are smooth, and some are dull whilst others are shiny (N3-4 Sum1).
Disciplinary	• M&O: Measure/observe using senses (N3-4 Aut1)	• A&P: Ask questions and make predictions about what will happen when something is tried.	• A&P: Make a prediction based on substantive knowledge (Y2 Aut).
VCs		• 1: The same thing (water) can look different when it is hot or cold (ice).	• 1: Matter can exist in three different states: as solids, liquids and gases. The amount and type of substance does not change when the matter changes state. (Y2)

Relevant **Development Matters (N3-4)** statements:

- Use all their senses in hands-on exploration of natural materials.
- Talk about what they see, using a wide vocabulary.

N3-4: Spring 1

On the Move / Toys

	Building on prior understanding	Pupils should be exposed to	How knowledge will be built upon
Substantive	• Materials can be **artificial** (man-made) or **natural** (N3-4 Aut2) • Some materials **float** and some **materials** sink in water (N3-4 Aut2)	• How **slow**/**fast** a vehicle moves along a track depends on how **hard**/**gently** it is **pushed**/**pulled**, **how** steep the slope is, or whether there is an **obstacle** in its way. • How **slow**/**fast** a boat moves across the water depends on how **hard**/**gently** we blow at them through straws. • Trains (and other vehicles) can be powered by **steam**, **diesel** or **electricity**. • Materials include **plastic**, **wood**, and **fabric.** • Magnetic materials are attracted to **magnets.** • Magnets can **repel** or **attract** each other, depending on which way they are held to each other.	• Common materials include **wood**, **paper**, **metal**, **glass**, **plastic, water**, **rock** and **fabric** (Y1 Spr). • Forces are pushes or pulls or twists (Y3 Sum1). • Forces can cause a change in speed, direction or shape of an object (Y3 Sum1). • Magnetism is the force exerted by magnets when they attract or repel each other (Y3 Sum2).
Disciplinary	• M&O: Measure/observe using senses (N3-4 Aut1) • A&P: Ask questions and make predictions about what will happen when something is tried (N3-4 Aut2)	• R&P: Use hoops to classify objects based on simple criteria.	• R&P: Use a table, Carroll diagram, Venn diagram to classify items based on properties (Y1).
VCs		• 2: Magnets can attract or repel other magnets. Magnets attract magnetic objects. • 3: We can push and pull objects to make them move. • 4: We have to push or pull objects to make them move; they do not move on their own.	• 2: The non-contact force of magnetism mean magnets can attract or repel other magnets and attract objects made of magnetic materials (Y3). • 3: We can move or change the shape of objects by pushing and pulling: by squashing, bending, twisting or stretching the materials (Y2).

Relevant **Development Matters (N3-4)** statements:

- Use all their senses in hands-on exploration of natural materials.
- Talk about what they see, using a wide vocabulary.

N3-4: Spring 2

On the Farm / Food Glorious Food

	Building on prior understanding	Pupils should be exposed to	How knowledge will be built upon
Substantive		• **Chicks** hatch from **eggs** and grow into **chickens.** • **Calves** grow to become **cows**, **lamb** grow to become **sheep**, **piglets** grow to become **pigs**, **foals** grow to become **horses**, **ducklings** grow to become **ducks.** • **Parents** and their **young** animals look similar and different. • Plants need **water** and **light** to grow.	• Young and adult animals in grassland, tropical rainforest and saltwater habitats (N3-4 Sum2). • Animals can be grouped into fish, amphibians, reptiles, birds and mammals (name common examples) (Y1 Sum1). • Plants need water, light and a suitable temperature to grow (Y2 Aut1). • Animals, including humans, reproduce. This means they have offspring that grow into adults (Y2 Sum2) • As animals grow they get bigger (Y2 Sum2). • Some animals change during their life cycle as the mature (e.g. tadpole to frog) (Y2 Sum2).
Disciplinary	• M&O: Measure/observe using senses (N3-4 Aut1). • A&P: Ask questions and make predictions about what will happen when something is tried (N3-4 Aut2).	***Plant a bean. Observe its stages of growth and care for it*** • M&O: Observe using a magnifying glass safely.	• M&O: Make systematic observations of an object (Y2 Aut).
VCs		• 9: Young animals grow into adult animals. The young look similar, but not the same, as the adults.	• 9: Plants and animals reproduce (have offspring) (Y2).

Relevant **Development Matters (N3-4)** statements:

- Talk about what they see, using a wide vocabulary.
- Plant seeds and care for growing plants.
- Understand the key features of the life cycle of an animal and a plant.
- Begin to understand the need to respect and care for the natural environment and all living things.

N3-4: Summer 1

Once Upon a Time 1 / 2

	Building on prior understanding	Pupils should be exposed to	How knowledge will be built upon
Substantive		• We need to mix materials in the right amount to bake a tasty cake. • Some materials will **dissolve** in water. • Some materials are **hard** whilst others are **soft**, some can be described as **rough** whilst others are **smooth**, and some are **dull** whilst others are **shiny.** • Clothes get **heavier** when they get wet, because we carry the clothes and the water.	• All materials are made of a single substance or a mixture of substances (Y2 Sum). • A solvent is a liquid that is used to dissolve other substances. A soluble substance that dissolves in a solvent is a called a solute. An insoluble substance is one that will not dissolve in a solvent. When a solute dissolves in a solvent, a solution is formed. A solution is a mixture. When no more solute can dissolve in the solvent, the solution is saturated. Solutes dissolve more quickly when the particles have more energy (i.e. when heated or stirred) (Y5 Aut1).
Disciplinary	• R&P: Use hoops to classify objects based on simple criteria (N3-4 Spr1). • A&P: Ask questions and make predictions about what will happen when something is tried (N3-4 Aut2).		
VCs			

Relevant **Development Matters (N3-4)** statements:

- Use all their senses in hands-on exploration of natural materials.
- Talk about what they see, using a wide vocabulary.

N3-4: Summer 2

All Creatures Great and Small 1 / 2

	Building on prior understanding	Pupils should be exposed to	How knowledge will be built upon
Substantive	• Parents and their young animals look similar and different (N3-4 Spr1).	• It is important to wear sun cream and sun hats when it is sunny. • Many fish develop from **eggs**, **larvae**, **fry**, to **adults.** • Many animals live in water, like turtles, orcas, dolphins, manta rays, sharks, seahorses and jellyfish. • Young turtles are called hatchlings, young orcas and dolphins are called calves, young manta rays are called pups, and young sea horses and jellyfish are larvae and then fry. • The Serengeti is a grassland, with habitats home to animals like zebras, lions, giraffes, hippos, vultures, snakes, toads and scorpions. • Young zebras are called foals, young vultures are called chicks, young lions are called cubs, young giraffes and hippos are called calves, young snakes are called snakelets, young toads are called tadpoles and young scorpions are known as scorplings.	• Animals, including humans, reproduce. This means they have offspring that grow into adults (Y2 Sum2). • As animals grow, they get bigger (Y2 Sum2). • Some animals change during their life cycle as the mature (e.g. tadpole to frog) (Y2 Sum2). • Light from the sun can be dangerous and there are ways to protect our eyes and skin (Y3 Aut2).
DK	• M&O: Measure/observe using senses (N3-4 Aut1). • A&P: Ask questions and make predictions about what will happen when something is tried (N3-4 Aut2).		
VCs	• 5A: Describe natural things in our local area (N3-4).	• 5A: Geographical features include beach, hill, forest, sea and river. • 10: There are many different kinds of plants and animals in the world today.	• 5A: **Geography** – Describe other physical features in our local area, including river, forest, soil and hill and coastal features of beach, cliff, sea and ocean (Y1). • 10: Biodiversity describes all the different living things in an area (Y2).

Relevant **Development Matters (N3-4)** statements:

- Talk about what they see, using a wide vocabulary.
- Understand the key features of the life cycle of an animal.
- Begin to understand the need to respect and care for the natural environment and all living things.

Reception: Spring 2

Spring In Our Step

	Building on prior understanding	Pupils should be exposed to	How knowledge will be built upon
Substantive	• **Habitats** are the places that living things live (N3-4 Aut1).	• There are differences in the **wildlife** we see and the **weather** in **spring** and **winter.** • **Insects** like ants, bees, and ladybirds are animals. • **Spiders** and insects live in the **habitats** around our school. • Some plants have flowers.	• The basic parts of a plant are leaves, flowers, roots, stem/trunk/branch (Y1 Aut1). • There are four seasons: spring, summer, autumn and winter (Y1 Aut2). • The weather changes gradually as we move from season to season (Y1 Aut2). • Some animals can be grouped into fish, amphibians, reptiles, birds and mammals (name common examples) (Y1 Sum1). • Invertebrates can be grouped based on their characteristics as snails and slugs; worms; spiders and insects (Y4 Aut1).
DK	• M&O: Measure/observe using senses (N3-4 Aut1).	• A&E: Notice patterns in the world around me.	• A&E: Make simple statements about the results of an enquiry (Y1 Spr1).
VCs	• 5B: Types of weather include sunny, rainy, windy, and snowy (N3-4).	• 5B: We experience different types of weather in different seasons (focus on spring and winter).	• 5B: The weather can change rapidly. The four different seasons have different weather patterns (Y1).

Relevant **Development Matters (Reception)** statements:

- Understand the effect of changing seasons on the natural world around them.
- Explore the natural world around them.
- Describe what they see, hear and feel whilst outside.

Relevant **Early Learning Goals** (for end of Reception):

- Explore the natural world around them, making observations and drawing pictures of animals and plants;
- Understand some important processes and changes in the natural world around them, including the seasons and changing states of matter.

Reception: Summer 2

Science Detectives

	Building on prior understanding	Pupils should be exposed to	How knowledge will be built upon
Substantive		• Fruits like apples, bananas, peaches and oranges have skins, flesh and seeds. • [A range of scientific themes, dependent on schools' context].	
Disciplinary		• Ask questions and explore scientific themes more independently.	
VCs		• [A range of scientific big ideas, dependent on schools' context].	

Relevant **Development Matters (Reception)** statements:

- Understand the effect of changing seasons on the natural world around them.
- Explore the natural world around them.
- Describe what they see, hear and feel whilst outside.

Relevant **Early Learning Goals** (for end of Reception):

- Explore the natural world around them, making observations and drawing pictures of animals and plants;
- Understand some important processes and changes in the natural world around them, including the seasons and changing states of matter.

Year 1: Autumn 1

Biology: Plants

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• There are differences in the wildlife we see and the weather in spring and winter (Rec Spr2). • Some plants have flowers (Rec Spr2).	• A **plant** is a **living** thing that usually grows in one place. • **Coniferous** plants keep their leaves all year round (e.g. pine, yew, juniper in UK). • **Deciduous** plants lose their leaves in winter (e.g. oak, silver birch, horse chestnut, sycamore, ash). • **Trees** are a type of plant that have a tall **stem** made of **wood.** • The basic parts of a plant are **leaves**, **flowers**, **roots**, **stem/trunk/branch.**	• Plant growth from germination (Y2). • Requirements for plant life (Y2, Y3). • Purpose of leaves, stem/trunk, roots and flowers (Y3). • Coniferous trees transport their seeds in cones; deciduous trees use seeds and flowers/fruit (Y3 Spr) • Classifying plants (Y4).
Disciplinary	• M&O: Measure/observe using senses (N3-4). • R&P: Use hoops to classify objects based on simple criteria (N3-4).	***Draw and label a scientific diagram of a plant*** • R&P: Draw a diagram, a simple scientific drawing that explains or informs. ***Classify trees as deciduous or coniferous using images of them at different times in the year*** • R&P: Use a table to classify items based on properties.	• R&P: Use Carroll diagrams (Y1 Spr), Venn diagrams (Y1 Sum), and a pair of axes (Y2) to classify items based on properties.
VCs	• 5A: Geographical features include beach, hill, forest, sea and river (EYFS).	• 5A: Some plants grow in soil. • 7: Plants are organised with roots, stem, leaves and flowers.	• 5A: Geography – Describe other physical features in our local area, including river, forest, soil and hill and coastal features of beach, cliff, sea and ocean (Y1). • 7: Humans are organised with organs like hearts and lungs, which do particular jobs. The skeleton and muscles allow the body to move (Y3).

Year 1: Autumn 2

Biology & Physics: Seasonal Changes

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• Types of weather include sunny, rainy, windy and snowy (N3-4 Aut1). • Identify appropriate clothes to go outside in different types of weather (N3-4 Aut1). • Some animals, like bears, hibernate in the winter (N3-4 Aut1). • There are differences in the wildlife we see and the weather in spring and winter (Rec Spr2). • Coniferous plants keep their leaves all year round (e.g. pine, yew, juniper in UK) (Y1 Aut). • Deciduous plants lose their leaves in winter (e.g. oak, silver birch, horse chestnut, sycamore, ash) (Y1 Aut). • Geography: We live on the Earth (Y1 Aut).	• **Weather** is a description of what the conditions are like in a particular place. • Examples of weather include sunny, rainy, windy, warm, cold, cloudy, drizzle, snow, stormy (with thunder and lightning). • The weather can change rapidly in one day (e.g. sunny morning and rainy afternoon). • The UK and our local area have daily weather patterns. • **Extreme weather** is very different from the weather that you would usually expect to see in the country. • There are four **seasons**: **spring**, **summer**, **autumn** and **winter.** • The **weather** changes gradually as we move from season to season. • Recognise differences between four seasons in terms of living things (trees lose leaves; flowers drop and we see different animals, such as butterflies in the summer). • **Daytime** is when the **Earth** is facing the **Sun**; nighttime is when the Earth is facing away from the Sun. • In the **summer** that there are more hours of **daylight** and in **winter** there are fewer hours of daylight. • The **Moon** is more visible at night.	• Earth rotates in 24 hours, meaning that only half of the Earth is facing the Sun at any one time; this creates night and day (Y5 Sum). • The Moon orbits the Earth in 28 days and, during this time, the sun shines on different parts (Y5 Sum). • Seasons are caused by the Earth's tilt (KS3).
Disciplinary		***Conduct geographical/scientific fieldwork and observe/collect data about the weather.*** • A&P: Scientists and geographers look for patterns in the world around them. • R&P: Record numerical or descriptive observations in a table. ***Use information from images of four seasons to identify and record differences in wildlife and weather in four seasons*** • M&O: Gather information from text/books/images.	• A&P: Scientists look for patterns in data to try to identify correlations (Y5). • M&O: Gather information from the internet (Y3).
VCs	• 5B: Types of weather include sunny, rainy, windy, and snowy. We experience different types of weather in different seasons (focus on spring and winter) (EYFS). • 6: Naming the Sun, Earth and Moon (EYFS).	• 5B: The weather can change rapidly. The four different seasons have different weather patterns. • 6: Daytime is when the Earth is facing the Sun; nighttime is when the Earth is facing away from the Sun.	• 5B: Global warming describes the increase in Earth's average temperatures (Y2). • 6: The Sun as a star in our universe; Earth as a planet and the Moon as a satellite (Y5).

Year 1: Spring

Chemistry: Everyday Materials

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• Feel, hear, smell and see **natural materials** of grass, mud, water, rock and sand (N3-4 Aut1). • Materials can be **artificial** (**man-made**) or **natural** (N3-4 Aut1). • Materials include plastic, wood, and fabric (N3-4 Aut1). • Some materials are hard whilst others are soft, some can be described as rough whilst others are smooth, and some are dull whilst others are shiny (N3-4 Aut1).	• An **object** is a 'thing' that can be seen and touched. • Objects have a name and often have a **purpose.** For example, a cup is the object, and its purpose is for drinking from. • The **material** is what an object is made of, for example a cup can be made of paper or plastic. • Common materials include **wood**, **paper**, **metal**, **glass**, **plastic, water**, **rock, rubber** and **cotton.** • Wood, water, rock, rubber and cotton are **natural materials**. • Paper, glass, and plastic are **artificial** (**man-made**) materials. • Materials have different **physical properties**, some materials are **hard** whilst others are **soft**, some can be described as **rough** whilst others are **smooth**, some are **dull** whereas others are **shiny**. • Materials can be grouped in a number of ways based on their physical properties. • The material that we choose to make an object from depends on its purpose (e.g. no chocolate kettle).	• Materials have physical properties that make them better or worse for certain uses, such as waterproof, absorbent, windproof, heatproof, malleable (Y2 Spr). • Materials such as wood, metal, plastic, brick, rock, paper and cardboard have these physical properties to different extents (Y2 Spr). • Different combinations of materials could be used to create different object, including a wall, a mop and a saucepan (Y2 Spr).
Disciplinary	• Use a table to classify items based on properties (Y1 Aut).	***Sort materials into a Carroll diagram based on their characteristics*** • A&P: Scientists group objects or living things based on their properties. • R&P: Use a Carroll diagram to classify items based on properties. ***Find the best material for a dog bed (waterproof and soft)*** • A&E: Make simple statements about the results of an enquiry.	• A&P: The thing that we measure is called the dependent variable; the thing we change is the independent variable (Y3).
VCs		• 1: Objects have a purpose and are made of different materials.	• 1: Materials have different properties, which make them suitable for specific purposes. (Y2)

Year 1: Summer 1

Biology: Animals

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• A plant is a living thing that usually grows in one place (Y1 Aut).	• **Animals** are different to **plants** because they usually move around, rather than stay in the same place. • Animals can be placed into different groups (**carnivores**, **herbivores** and **omnivores**) based the foods they eat. • Animals have different features, including **fins**, **wings**, **scales**, **legs**, **feathers**, **claws**, **paws** etc. • Some animals can be grouped into **fish**, **amphibians, reptiles**, **birds** and **mammals** (name common examples).	• Classification refers to a method used to place all living things into groups (Y4 Aut). • Organisms can be classified in a number of ways (Y4 Aut). • A species is a group of one type of organism, individuals in this group can breed with each other to produce offspring that can go on to breed (Y4 Aut). • Early classification from Aristotle placed animals into groups based on land, water and air, plants were grouped according to size, small, medium and large (Y4 Aut). • Fish, amphibians, reptiles, birds and mammals are all vertebrates (Y4 Aut). • Vertebrates have endoskeletons (Y4 Aut). • Vertebrates can be grouped in a number of ways based on their characteristics, e.g. warm/cold blooded; or physical features like fur, beak, wings etc. (Y4 Aut). • Invertebrates can be grouped based on their characteristics as snails and slugs; worms; spiders and insects (Y4 Aut).
Disciplinary	• A&P: Scientists group objects or living things based on their properties (Y1 Spr). • M&O: Gather information from text/books/images (Y1 Aut). • R&P: Use a Carroll diagram to classify items based on properties (Y1 Spr).	• A&P: Scientists conduct secondary research to learn from what other scientists have already learned. • R&P: Use a Venn diagram to classify items into two or three sets based on properties.	• A&E: Science is never 'complete', and scientists are always working to make models more accurate or to discover new explanations (Y5).
VCs	• 10: There are many different kinds of plants and animals in the world today (EYFS).	• 10: There are lots of types of animal, and some types can be grouped as amphibians, birds, fish, mammals and reptiles.	• 10: To help scientists make sense of the diversity of organisms, they are classified into different groups, such as animals as vertebrates and invertebrates. Each group has similar features (Y4).

Year 1: Summer 2

Biology: Humans

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• Animals can be grouped into fish, amphibians, reptiles, birds and mammals (name common examples) (Y1 Sum). • Animals can be placed into different groups (carnivores, herbivores and omnivores) based the foods they eat (Y1 Sum). • Materials have different **physical properties**, some materials are **hard** whilst others are **soft**, some can be described as **rough** whilst others are **smooth**, some are **dull** whereas others are **shiny** (Y1 Spr).	• Humans are **omnivores**, but some choose to eat only plants. • Humans are made of many different body parts including head, neck, back, ears, eyes, nose, mouth, arms, shoulders, elbows, hands, fingers, legs, knees, feet, toes, face. • Humans have five **senses**, smell, taste, touch, sight and hearing. • The five senses are each associated with different body parts (eyes, ears, nose, tongue).	• The main food groups are carbohydrates (starch and sugars), proteins, fats, dairy, fruit and vegetables (Y3 Spr). • Humans need a balanced diet which is made of main food groups (Y3 Spr). • Our skeleton is made up of bones that grow as we grow (Y3 Spr). • Humans and some other animals have skeletons (Y3 Spr). • Organs are parts of the body that do a particular job, the heart pumps blood around the body and the lungs are used for breathing which gets air into your body (Y3 Spr). • The skeleton protects organs, e.g. the skull protects the brain; and the ribcage protects the lungs, heart and other important organs (Y3 Spr). • The skeleton supports the body, e.g. the spine helps the body stand (Y3 Spr). • The skeleton helps the body move, e.g. pelvis and knee joints (Y3 Spr). • The muscles and skeleton are required to help the body move. When muscles contract they pull the bone (Y3 Spr). • Different animals hear different sounds (Y4 Spr). • Humans' hearing changes as we age (Y4 Spr). • **Sounds** are made when objects **vibrate**. Vibrations travel through a **medium** (e.g. air, water) to the ear. Vibrations enter the ear, our **inner ear** vibrates and we hear them as sound. (Y4 Spr). • The eye is made of many parts: the **pupil** is the circular black hole in the center of the eye, the **iris** is the coloured part of the eye that surrounds the pupil, and the **lens** is a structure found behind the pupil. The pupils allow light to enter the eye. The iris controls how much light enters the eye by changing the size of the pupil. The lens helps to focus the light rays entering the eye (Y6 Spr). • Many problems with our vision are caused by parts of the eye that are the not the right shape or size, or that have become cloudy. Many of these problems can be corrected through surgery or **prescription** glasses. People living with sight loss or blindness may use long canes or guide dogs when outside, talking books or **Braille**, and different devices in the home (Y6 Spr).
DK	• Draw a diagram, a simple scientific drawing that explains or informs (Y1 Spr).	***Draw a scientific diagram, labelling key human body parts***	
VCs		• 8: Living things, including humans, react to their surroundings with their senses. • 11: Humans have five senses. Some people have impairments, like visual and hearing impairments.	• 8: Organisms move, reproduce, are sensitive to their surroundings, grow, need oxygen, get rid of their waste, and need nutrition (MRS GOWN) (Y2). • 11: Causes of hearing (Y4) and visual (Y6) impairments and technologies and behaviours that reduce their impact.

Year 2: Autumn 1

Biology: Plant Growth

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• Plants need water and light to grow (N3-4 Spr2) • The basic parts of a plant are leaves, flowers, roots, stem/trunk/branch (Y1 Aut) • **Plants** are classed as **living things** because they **grow**, **move**, **reproduce**, and need **nutrition** (food) (Y1 Aut)	• A seed is **living.** • A seed is the **embryonic** stage of the plant life cycle. • A seed consists of three parts: the **seed coat**, the **endosperm** and the **embryo.** • **Germination** is the development of a plant from a **seed**. During germination, **roots** and **shoots** emerge and grow. • To **germinate,** a seed needs water and a certain temperature. • **Temperature** is a measure of how hot or cold something is. • Some plants grow from **bulbs**. A bulb is a resting stage for certain plants. They have a large underground food store, short **stems** and fleshy leaves. • When a plant grows it gets bigger. • Plants need **water**, **light** and a suitable **temperature** to grow. • Many plants make **fruits** or **vegetables**; some of these grow below ground.	• The four main stages of the plant's life cycle include germination, pollination, fertilisation and seed dispersal (Y3 Spr). • Pollination and fertilisation usually takes place in flowers. Dispersal is important to make sure there is enough space for seeds to germinate and plants to grow (Y3 Spr). • Seeds can be dispersed in a variety of ways (Y3 Spr). • Plants need air (oxygen and carbon dioxide), water, light, nutrients from the soil, space, and a suitable temperature to grow (Y3 Spr). • Requirements for life vary from plant to plant and they adapt to their environment (e.g. some plants need less space, a lower temperature, fewer nutrients etc.) (Y3 Spr). • Roots absorb nutrients from the soil and help anchor the plant (Y3 Spr). • The stem/trunk supports the plant and transports water up the plant. The xylem transports water and nutrients from the roots, and the phloem transports food from the leaves to the all parts of the plant (Y3 Spr). • Leaves use sunlight, carbon dioxide from the air and water to make their own food (Y3 Spr).
Disciplinary	• **Maths**: Use words to describe lengths and heights (Y1) • A&P: Ask questions and make predictions about what will happen when something is tried (N3-4, Aut2) • M&O: Measure/observe using senses (N3-4, Aut2) • R&P: Record numerical or descriptive observations in a table (Y1 Aut) • A&E: Make simple statements about the results of an enquiry (Y1 Spr)	***Investigate the conditions required for germination*** • A&P: Make a prediction based on substantive knowledge. • A&P: It is important that we keep as much as we can the same, apart from the thing we measure and the one thing we change. ***Investigate how light affects the growth of plants*** • M&O: Make systematic observations of an object.	• Explain findings using scientific knowledge (Y3). • The thing that we measure is called the dependent variable; the thing we change is the independent variable (Y3).
VCs	• 5A: Some plants grow in soil (Y1). • 7: Plants are organised with roots, stem, leaves and flowers (Y1).		

Year 2: Autumn 2

Biology: Needs of Animals

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• Talk about how they have changed from being a baby (N3-4 Aut1). • Habitats are the places that living things live and different animals live in different habitats (N3-4 Aut1). • Parents and their young look similar and different to each other (N3-4 Spr2). • Names of animals and their young (e.g. calves and cow, lamb and sheep) (N3-4). • Animals can be grouped into fish, amphibians, reptiles, birds and mammals (name common examples) (Y1 Sum). • Animals can be placed into different groups: carnivores, herbivores and omnivores) (Y1 Sum). • Temperature is a measure of how hot or cold something is (Y2 Aut). • Plants need water, light and a suitable temperature to grow (Y2 Aut). • Plants are classed as living things because they grow, move, reproduce, and need nutrition (food) (Y1 Aut).	• A **natural resource** is a material or substance that is produced by the **environment** (not man made) and may be used to support life. • Food and water are natural resources. • Animals, including humans, need **food** to survive. • Humans need to eat a healthy and **balanced diet**. This should include all the **nutrients** that we need, should be high in fruits and vegetables and low in fats, salt and sugars. • Animals, including humans, need **water** and **oxygen** to survive. • Animals, including humans, the **right temperature** to survive. • Animals, including humans, **reproduce**. This means they have **offspring** that grow into adults. • As animals **grow,** they get bigger. • Some animals change **form** as they get older (e.g. tadpole to frog). • Humans need **exercise** to stay healthy. • Humans need to practise **hygiene** to stay healthy.	• Life cycles of hedgehogs, peregrine falcons, frog and ladybird, including metamorphosis (Y5 Spr1). • Living things grow, need air and nutrients, react to their surroundings, move, get rid of their waste, reproduce (Y2 Spr). • Living things are adapted to their environment. This means they may not be able to survive in other habitats (Y2 Spr). • The main food groups are carbohydrates (starch and sugars), proteins, fats, dairy, fruit and vegetables (Y3 Spr). • Humans need a balanced diet which is made of main food groups (Y3 Spr). • Vitamins, minerals and fibre are needed and being deficient in these causes diseases (Y3 Spr).
Disciplinary	• A&P: Scientists conduct secondary research to learn from what other scientists have already learned (Y1 Sum). • A&P: Scientists group objects or living things based on their properties (Y1 Spr). • M&O: Gather information from text/books/images (Y1). • R&P: Use a Carroll diagram to classify items based on properties (Y1 Spr).	***Gather information from images and/or text and group animals into those that change form as they grow and those that do not.***	• Using and drawing a classification key to classify organisms (Y4).
VCs	• 8: Living things, including humans, react to their surroundings with their senses (Y1). • 9: Young animals grow into adult animals. The young look similar, but not the same, as the adults (EYFS). • 11: Humans need to practise good hygiene, like brushing teeth and washing hands (EYFS).	• 5B: The air is all around us on Earth. Air has oxygen in it. • 8: All living things need food, oxygen, water and certain temperature conditions. • 9: Plants and animals reproduce (have offspring). • 11: Humans need to exercise, practise good hygiene and eat a healthy and balanced diet to stay healthy. Their diet should be high in fruits and vegetables and low in fats, sugar and salt.	• 5B: The air has (oxygen and) carbon dioxide in it (Y3). • 8: Organisms move, reproduce, are sensitive to their surroundings, grow, need oxygen, get rid of their waste, and need nutrition (MRS GOWN) (Y2). • 9: Sexual/asexual reproduction (Y5). • 11: A balanced diet includes the right proportions of carbohydrates, proteins, fats, fibre, vitamins and minerals (Y3).

Year 2: Spring 1

Chemistry: Uses of Everyday Materials

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• An object is a 'thing' that can be seen and touched (Y1 Spr). • Objects have a name and often have a purpose for example a cup is the object and its purpose is for drinking from (Y1 Spr). • The material is what an object is made of, for example a cup can be made of paper or plastic. Common materials include wood, paper, metal, glass, water, rock (Y1 Spr). • Materials have different physical properties, some materials are hard whilst others are soft, some can be described as rough whilst others are smooth, some are dull whereas others are shiny. (Y1 Spr). • Materials can be grouped in a number of ways based on their physical properties (Y1 Spr). • The material that we choose to make an object from depends on its purpose (e.g. no chocolate kettle) (Y1).	• **Matter** is all the 'stuff' that we experience in everyday life, including air, water, tables and us! • Materials have different **physical properties** such as **malleable**, **waterproof**, **heatproof**, **windproof** and **absorbent**. • These physical properties make the materials more suitable for certain uses. • Everyday materials such as **wood**, **metal**, **plastic**, **brick**, **rock**, **paper** and **cardboard** have these physical properties but to different extents. • Different combinations of materials can be used to create different objects, for example a saucepan or a mop. • The shape of some solid objects made from some materials can be changed by **squashing**, **bending**, **twisting** or **stretching** the material. • **Sustainability** means meeting the needs of the people today, whilst meeting the needs of people of the future. • One way to use materials more sustainably is to **reduce**, **reuse** and **recycle** wherever possible.	• There are three states of matter: solid, liquid and gas (Y2 Sum). • Physical properties include being malleable, windproof, hard/soft, opaque/transparent, magnetic, electrical conductivity, thermal conductivity, and boiling and melting points (Y5 Sum). • Chemical properties are properties that scientists need specialist equipment to measure (Y5 Sum).
Disciplinary	• A&P: It is important that we keep as much as we can the same, apart from the thing we measure and the one thing we change (Y1 Spr). • M&O: Make systematic observations of an object (Y2 Aut) • R&P: Use a Carroll diagram to classify items based on properties (Y1 Spr). • A&E: Make simple statements about the results of an enquiry (Y1 Spr).	***Classify materials based on the extent of its properties by using a pair of axes*** • R&P: Use a pair of axes to classify items based on the extent to which it displays two properties. ***Investigate the best material to use to make an umbrella that is waterproof and windproof*** • A&P: There are four main stages of enquiry (A&P, M&O, R&P, A&E). • A&P: Scientists identify potential hazards in their experiments and plan ways to reduce them. • A&E: Ask further questions that could be explored to extend findings.	
VCs	• 1: Objects have a purpose and are made of different materials. (Y1) • 2: We can push and pull objects to make them move (EYFS).	• 1: All the 'stuff' encountered in everyday life, including air, water and different kinds of solid substances, is called matter. Different materials are recognisable by their properties. Materials have different properties, which make them suitable for specific purposes. • 2: We can move or change the shape of objects by pushing and pulling: by squashing, bending, twisting or stretching the materials.	• 1: Matter can exist in three different states: as solids, liquids and gases (Y2). Properties of materials can be physical (such as hardness) or chemical (such as toxicity). (Y4) • 2: Forces act in pairs. Forces acting against each other are opposing. Unbalanced forces will change the shape or movement of an object (Y3).

Year 2: Spring 2

Biology: Living Things & Their Habitats

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• Animals can be placed into groups (carnivores, herbivores and omnivores) based on the foods they eat (Y1 Sum). • Geography: Deserts are places where there is very little precipitation (Y2 Spr). • Geography: Hot deserts have a very hot and dry climate (Y2 Spr). • Geography: Cold deserts have a very cold and dry climate (Y2 Spr). • Temperature is a measure of how hot or cold something is (Y2 Aut). • Plants need water, light and a suitable temperature to grow (Y2 Aut). • Animals, including humans, need **food, water**, **oxygen** and the **right temperature** to survive (Y2 Aut).	• Everything in the world can be categorised as either **alive**, used to be alive or has never been alive. • Living things are called **organisms.** • Organisms **m**ove, **r**eproduce, are **s**ensitive to their **s**urroundings, **g**row, need **o**xygen, get rid of their **w**aste, and need **n**utrition (MRS GOWN). • Animals move from place to place, while plants move on the spot. • **Habitats** are the places that living things live. A very small habitat is called a **micro-habitat**, and these can be found within larger habitats. • **Flora** describes plant life; **fauna** describes animal life. • A **species** is a group of living things that are the same type. • **Biodiversity** is a word we use to describe all of the living things in an area. • Animals and plants in a habitat depend on each other, e.g. for food or shelter. • Animals get their food from plants and other animals. This food provides the **energy** animals need. • Most plants produce their own food and are called **producers**. • In a **food chain**, the arrows show where the **energy** is being transferred from and to. • Living things are **adapted** to their **environment**. This means they may not be able to survive in other habitats. • Some animals and plants are adapted to life in a **hot desert**: **camels** and **cacti.** Some animals and plants are adapted to life in a **cold desert**: **Arctic fox, polar bear, penguin** and **shrubs.**	• The main food groups are carbohydrates (starch and sugars), proteins, fats, dairy, fruit and vegetables. Humans need a balanced diet of these (Y3 Spr). Vitamins, minerals and fibre are needed and being deficient in these causes diseases (Y3 Spr). • Different animals have different nutritional needs (Y3 Spr). • A food chain starts with a producer (usually a plant) who can produce its own food. Organisms that eat producers are called consumers (Y4 Aut). • A predator hunts prey to eat (Y4 Aut). • A food web shows the transfer of energy between different organisms. Animals and plants need to digest food to transfer energy from it (Y4 Aut). • An ecosystem is made up of all organisms living in an area and the non-living features of the environment (Y4 Aut). • In a food chain, an amount of energy from the Sun (a chemical store) is transferred to the plant by light. The energy is then transferred along the food chain as the different organisms are eaten (Y5 Aut). • Living things move, reproduce, are sensitive to their surroundings, grow, respire, excrete, and need nutrition (MRS GREN).
Disciplinary	• A&P: There are four main stages of enquiry (A&P, M&O, R&P, A&E) (Y2). • A&P: Scientists look for patterns in the world around them (Y1 Spr). • A&E: Make simple statements about the results of an enquiry (Y1 Spr).	***Examine microhabitats using a magnifying glass and counting the number and type of organisms found in an area*** • M&O: Observe using a magnifying glass safely.	• A&P: Scientists look for patterns in data to try to identify correlations (Y5).
VCs	• 8: All living things need food, oxygen, water and certain temperature conditions (Y2). • 9: There are lots of different kinds of animals and plants in the world today (EYFS). • 10: There are many different kinds of plants and animals in the world today (EYFS).	• 4: All living things need food to give them energy. All food chains start with a producer (a living thing that makes its own food). The arrows in a food chain show where energy is being transferred from and to. • 8: Most plants make their own food. Animals' food comes from eating plants (herbivores) or by eating animals (carnivores), which have eaten plants or other animals. These relationships can be represented in a food chain. Plants and animals are often dependent on each other. Organisms are adapted to their environment. If conditions in a habitat change, organisms may not be able to survive. Organisms move, reproduce, are sensitive to surroundings, grow, need oxygen, get rid of waste, and need nutrition (MRS GOWN). • 9: A species is a group of living things of the same type. • 10: Biodiversity describes all the different living things in an area. Living things are adapted to their environments. If the environment changes, the organisms may no longer be adapted and may struggle to survive.	• 4: In most plants, sunlight, carbon dioxide and water are used to make food in the leaves (Y3). • 8: Feeding relationships can be shown in food webs (Y4). Living things move, reproduce, are sensitive to their surroundings, grow, respire, excrete, and need nutrition (MRS GREN) (Y6). • 9: A species is a group of one type of organism. Individuals in this group can breed with each other to produce offspring that can go on to reproduce (Y4). • 10: Living things are found in certain environments because they have the features that enable them to survive there. This happens because of natural selection (Y6).

Year 2: Summer

Chemistry: Solids, Liquids and Gases

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• Melting and freezing can be observed in the world around us (N3-4 Aut2). • An object is a 'thing' that can be seen and touched (Y1 Spr). • Objects have a name and often have a purpose for example a cup is the object and its purpose is for drinking from (Y1 Spr). • Matter is all the 'stuff' that we experience in everyday life, including air, water, tables and us! (Y2 Spr1). • The shape of some solid objects made from some materials can be changed by squashing, bending, twisting or stretching the material (Y2 Spr1).	• All **materials** are made of a single **substance** or a **mixture** of **substances.** • **Matter** is what all 'stuff' is made from. • There are three **states of matter**: **solids**, **liquids** and **gases.** • Substances can exist as solids, liquids and gases. • The three states of matter have different properties. • Liquids take the shape of the container they are in, when you move the liquid into a different container the shape will change. • Solids keep their shape unless a force is put on it. They will change their shape if you cut them or squash them. • Gases have no fixed shape or volume, they spread out to fill a container. If they are not in a container, they will keep spreading out. • We can decide if a substance is in its solid, liquid or gaseous state by looking at its properties. • One substance can exist in the different states, when the substance is in a different state it is still the same substance. • The Earth is getting warmer. We call this **global warming**. Global warming will cause solid ice to melt and become liquid water.	• The different substances in their different forms (solids, liquids and gases) are all made of particles (Y4 Spr). • The particles in the different states of matter are arranged differently (Y4 Spr). • Substances can change from one state of matter to another. Solids can change to become a liquid (melting), liquids can change to become a gas (evaporating), gases can change to become liquids (condensing) and liquids can change to become a solid (freezing) (Y4 Spr). • Materials change state at different temperatures, i.e. they have different melting and boiling points (Y4 Spr). • The water cycle relies on evaporation and condensation. Water is collected in the oceans from rivers; it evaporates and then condenses to form clouds; it then precipitates and the cycle begins again (Y4 Spr).
Disciplinary	• A&P: Scientists group objects or living things based on their properties (Y1 Spr).	***Classify different substances as solids, liquids or gases.***	
VCs	• 1: All the 'stuff' encountered in everyday life, including air, water and different kinds of solid substances, is called matter. (Y2) • 5B: Geography – Weather is short term; climate is long-term weather patterns (Y2).	• 1: Matter can exist in three different states: as solids, liquids and gases. The amount and type of substance does not change when the matter changes state. • 5B: Global warming describes the increase in Earth's average temperatures.	• 1: If a material could be divided into smaller and smaller pieces, it would be found to be made of particles, which smaller than can be seen even with a microscope. These particles are not in a material; they are the material. The particles of a substance are arranged differently when it is solid, liquid or gas. (Y4) • 5B: Geography – The greenhouse effect keeps the Earth warm; the enhanced greenhouse effect causes global warming (Y5).

Year 3: Autumn 1

Chemistry: Rocks

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• Materials can be artificial (man-made) or natural (N3-4 Aut1). • **Geography**: We live on Earth (Y1 Aut). • Materials have physical properties that make them better or worse for certain uses, such as waterproof, absorbent, windproof, heatproof, malleable. Materials such as wood, metal, plastic, brick, rock, paper and cardboard have these physical properties to different extents (Y2 Spr). • Living things are called organisms (Y2 Spr). • Everything in the world is either living (or used to be living) or not-living (Y2 Sum). • The word **fauna** is a word used to describe animal life (Y2 Spr2). • Some animals can be grouped into **fish**, **amphibians, reptiles**, **birds** and **mammals** (name common examples) (Y1 Sum). • A species is a group of living things that are the same type (Y2 Spr).	• A rock is a naturally occurring material which is made up of different minerals. • The Earth's crust is it's the outermost layer of our planet. It is made of rocks and minerals. • Natural rocks are either **igneous**, **sedimentary** or **metamorphic.** • Man-made rocks, like concrete, are called **anthropic** rocks. • **Igneous** rock is formed when **magma** or **lava** cools down. • **Sedimentary** rock is formed when layers of small **sediments** are **compressed** over a long period of time. Igneous rock can become sedimentary rock if it breaks down into small pieces and forms layers. • **Metamorphic** rock is formed when igneous or sedimentary rock is put under lots of **pressure.** • Different rocks have different properties, including **permeable/impermeable.** • A **fossil** is physical evidence of an ancient plant or animal , this could be their **preserved** remains or other **traces** that they made when they were alive. • **Trace fossils** are not physical remains of organisms; they are indirect evidence of life. Examples include imprints of, or marks left by, an organism, such as a footprint, imprint of a feather or poo. • Fossils can be formed when an organism or trace is buried under sediment. The remains break down slowly and, as layers of sediment build up, the layers are squashed, turning them into sedimentary rock. Fossils can also form when dead organisms are frozen in ice or preserved in amber. • **Megafauna** are very large animals. Fossils provide evidence for megafauna that are extinct. • When there are no living individuals of a species, that species is **extinct**. • **Soil** is a mixture of tiny pieces of rock, dead plants and animals, air and water. Different soils have different properties.	• **History:** Rocks that build historical monuments including Stonehenge and the Great Pyramid in Egypt (Y3). • **History:** Importance of fossils in archaeology (Y6). • **Geography:** Beneath the Earth's solid crust is a hot layer called the mantle (Y3). • **Geography:** Volcanic eruptions release magma (Y3 Spr). • Fossils provide evidence for evolution, because they show how organisms have changed over time (Y6 Aut). • The rock cycle and the formation of igneous, sedimentary and metamorphic rocks (KS3). • The composition of the Earth (KS3). • Earth as a source of limited resources and the efficacy of recycling (KS3).
Disciplinary	• A&P: Scientists group based on their properties (Y1 Spr). • M&O: Make systematic observations (Y2 Aut). • R&P: Use a pair of axes to classify items based on the extent to which it displays two properties (Y2 Spr).	***Make observations about rocks using senses and magnifying glass, and classify them in a Carroll diagram/pair of axes***	
VCs	• 5A: Some plants grow in soil (Y1). • 9: A species is a group of living things of the same type (Y2).	• 5A: Rocks are formed when placed under pressure. Much of the solid surface of the Earth is covered in soil, which is a mixture of pieces of rock of various sizes and the remains of organisms. Some soil also contains air, water and some nutrients. There are three main kinds of rock: igneous, sedimentary and metamorphic, which each have different composition and properties. • 9: When there are no living individuals of a species to reproduce, the species is extinct. • 10: We know about extinct and dead species from fossils. These are the preserved remains (or traces) of organisms that lived many years ago.	• 5A: **Geography** – The Earth has four layers. Its upper layer of tectonic plates move. Shield and composite volcanoes can form at plate boundaries, which produce lava, pyroclastic flows and lahars (Y3). • 10: Fossils provide evidence for evolution (Y6).

Year 3: Autumn 2

Physics: Light

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• We see shadows during the day (N3-4 Aut1). • It is important to wear sun cream and sun hats when it is sunny (N3-4 Sum2). • Daytime happens when we are facing the sun; nighttime happens we are facing away from the sun (Y1 Aut). • The Moon is more visible at night (Y1 Aut). • Humans have five senses, smell, taste, touch, sight and hearing (Y1 Sum2). • The five senses are each associated with different body parts (eyes, ears, nose, tongue) (Y1 Sum 2). • Materials have different physical properties, some materials are hard whilst others are soft, some can be described as rough whilst others are smooth, some are dull whereas others are shiny (Y1 Spr1).	• **Light** travels in straight lines. • We see when light enters our eyes. • **Darkness** is the absence of light. • **Sources** of light **emit** their own light, and others **reflect** light; both occur in nature as well as man-made objects. • Some materials are more **reflective** than others. • **Opaque**, **translucent** and **transparent** materials allow no, some or all light to pass through them. • **Shadows** form behind an opaque object when light from a source is blocked. • The shape and position of shadows changes with the angle of the light source. • The size of shadows changes when the distance of the light source changes. • Light from the Sun can be dangerous and there are ways to protect our eyes and skin.	• In ray diagrams, straight lines with arrows show where the energy is being transferred from and to by light (Y6). • On a flat surface, all light meeting a surface from one direction will be reflected in the same direction. This is known as specular reflection (Y6 Spr). • On a rough surface, light will be reflected in all directions. This is known as diffuse reflection (Y6 Spr). • Specular reflection between mirrors allow us to see the objects that do not directly reflect light into our eyes (e.g. periscope) (Y6 Spr). • When light meets an opaque object, some of the light is reflected and some of it is absorbed (Y6 Spr). • White light, which comes from most light sources we use in the classroom, contains all the colours of the visible spectrum (Y6 Spr). • When a light meets a surface, some colours are absorbed and some are reflected. We see the colour(s) that are reflected (Y6 Spr). • Objects appear black if they absorb all the colours in white light, and reflect none. Objects appear white if they reflect all the colours in white light, and absorb none (Y6).
Disciplinary	• Mathematics: Measure length and height (cm/m) (Y2). • A&P: There are four main stages of enquiry (A&P, M&O, R&P, A&E) (Y2 Spr). • A&P: It is important that we keep as much as we can the same, apart from the thing we measure and the one thing we change (Y2 Aut).	***Investigate how the height of a shadow varies as the distance between light source and object changes*** • A&P: A dependent variable is what you measure; an independent variable is what you change; controlled variables are things that stay the same. • A&P: Scientists identify factors in an investigation that should be controlled, and try to find ways to control them. • A&P: Recognise risk and build a plan to minimise them. • A&P: Select most appropriate equipment to measure (the variables). • A&P: Write an appropriate method.	• A&P: Scientists must work out if the factor is the cause of the outcome in a correlation (Y5).
VCs	• 6: Naming the Sun, Earth and Moon (EYFS). Daytime is when the Earth is facing the Sun; nighttime is when the Earth is facing away from the Sun (Y1).	• 2: Objects can affect other objects even when they are not in contact with them. Light reaches our eyes, even though the light source may be far away. • 6: The Sun emits light, some of which reaches Earth. The Moon reflects light from the Sun.	• 2: Sound comes from objects that vibrate and can be detected at a distance from the source, because the air or other material around is made to vibrate. Sounds are heard when the vibrations in the air reach our ears (Y4). • 6: The Sun as a star in our universe; Earth as a planet and the Moon as a satellite (Y5).

Year 3: Spring 1

Biology: Organisms

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• Some animals hibernate in winter (N3-4 Aut1). • Animals can be placed into groups (carnivores, herbivores and omnivores) based on the foods they eat (Y1 Sum). • Humans are omnivores, but some choose to eat only plants (Y1 Sum). • Humans need to eat a healthy and balanced diet. This should include all the nutrients that we need, should be high in fruits and vegetables and low in fats and sugars (Y2 Aut). • Humans are made of many different body parts including head, neck, back, ears, eyes, nose, mouth, arms, shoulders, elbows, hands, fingers, legs, knees, feet, toes, ears, eyes, nose, mouth, arms, legs, hands, feet, toes (Y2 Aut). • Living things **m**ove, **r**eproduce, are **s**ensitive to their **s**urroundings, **g**row, need **o**xygen, get rid of their **w**aste, and need **n**utrition (MRS GOWN) (Y2 Spr). • Living things are called organisms (Y2 Spr). • Animals get their food from plants and other animals, this food provides the energy animals need (Y2 Spr). • Rural areas include farmland. This can be for either **pastoral** or **arable farming. (Y1 Spr Geograph**	• The main food groups are **carbohydrates** (**starch** and **sugars**), **proteins**, **fats**, **fibre**, **vitamins and minerals.** • Humans need a **balanced diet** which is made of main food groups. • **Plant-based** diets can be balanced. • Eating foods that are in season can reduce **food waste**. • **Vitamins**, **minerals** and **fibre** are needed and being deficient in these causes **diseases.** • Different animals have different **nutritional** needs. • Our **skeleton** is made up of bones that grow as we grow. • Humans and some other animals have skeletons. • **Organs** are parts of the body that do a particular job, the **heart** pumps blood around the body and the **lungs** are used for breathing which gets air into your body. • The skeleton **protects** organs, e.g. the skull protects the brain; and the ribcage protects the lungs, heart and other important organs. • The skeleton **supports** the body, e.g. the spine helps the body stand. • The skeleton **helps the body move**, e.g. pelvis and knee joints. • The **muscles** and skeleton are required to help the body move. When muscles **contract** they pull the bone. • Some organisms have **endoskeletons**, some have **exoskeletons**, and some have neither. • Endoskeletons grow with the organism. Exoskeletons do not grow, so need to be shed and replaced. • One way we can reduce food waste is eating fruit and vegetables that are not perfect in shape. • A plant-based diet can be a healthy diet.	• Invertebrates can be placed into groups based on their skeletons; endoskeletons, exoskeletons, or hydrostatic skeletons (Y4 Aut). • There are four main types of teeth: incisors, canines, pre-molars and molars. They each have a different purpose (Y4 Aut). • Herbivores, carnivores and omnivores have these types of teeth in different proportions (Y4 Aut). • Animals and plants need to digest food to transfer energy from it (Y4 Aut). • The digestive system is the group of organs that help your body digest food (Y4 Aut). • The heart is a muscle that pumps blood around the body through blood vessels (Y6 Sum).
Disciplinary	• R&P: Draw a diagram, a simple scientific drawing that explains or informs.	• Science is studied as three disciplines: biology (study of organisms), chemistry (study of materials) and physics (study of energy). ***Label the main bones on a diagram of a human skeleton, give the function of each bone.***	• A&P: Science is studied as three disciplines: biology (study of organisms), chemistry (study of properties of matter and how it interacts with energy) and physics (study of energy) (Y5).
VCs	• 7: Plants are organised with roots, stem, leaves and flowers (Y1). • 10: There are lots of types of animal, and some types can be grouped as amphibians, birds, fish, mammals and reptiles (Y1). • 11: Humans need to exercise, practise good hygiene and eat a healthy and balanced diet to stay healthy. Their diet should be high in fruits and vegetables and low in fats, sugar and salt (Y2).	• 7: Humans are organised with organs like hearts and lungs, which do particular jobs. The skeleton and muscles allow the body to move. • 10: To help scientists make sense of the diversity of organisms, they are classified into different groups. Each group has similar features. • 11: A balanced diet includes the right proportions of the main food groups of carbohydrates (starch and sugars), proteins, fats, fibre, vitamins and minerals. Animals, including humans, may get diseases (like scurvy) if they are deficient in vitamins and minerals.	• 7: A cell is the smallest building block of living things. All organisms are made of cells. There are lots of different types of cell (e.g. sex cells), which each have different purposes (Y5). • 10: Classification of organisms (Y6).

Year 3: Spring 2

Biology: Plants

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• Coniferous plants keep their leaves all year round; deciduous plants lose their leaves in winter (e.g. oak, silver birch, horse chestnut, sycamore, ash) (Y1 Aut). • The basic parts of a plant are leaves, flowers, roots, stem/trunk/branch. Trees are a type of plant that have a tall stem made of wood. (Y1 Aut). • Germination is the development of a plant from a seed , during germination roots and shoots emerge and grow (Y1 Aut). • Plants need water, light and a suitable temperature to grow (Y2). • A seed is living. A seed is the embryonic stage of the plant life cycle. A seed consists of three parts: the seed coat, the endosperm and the embryo. To germinate, a seeds needs water and a certain temperature (Y2 Aut). • Many plants make fruits or vegetables; some of these grow below ground (Y2 Aut). • Living things **m**ove, **r**eproduce, are **s**ensitive to their **s**urroundings, **g**row, need **o**xygen, get rid of their **w**aste, and need **n**utrition (MRS GOWN) (Y2 Spr). • Living things have adapted to their environment. This means they may not be able to survive in other habitats (Y2 Spr). • Soil is a mixture of particles of rock, dead plants and animals, air and water (Y2 Aut).	• **Oxygen** and **carbon dioxide** are found in the air. • Plants need air (oxygen and carbon dioxide), water, light, nutrients from the soil, space, and a suitable temperature to grow. • Requirements for life vary from plant to plant and they are adapted to their **environment**. • **Roots** absorb **nutrients** from the soil and help anchor the plant. • The **stem/trunk** supports the plant and transports water up the plant. The **xylem** transports water and nutrients from the roots, and the **phloem** transports food from the leaves to the all parts of the plant. • Leaves use sunlight, carbon dioxide from the air and water to make their own food. • The four main stages of the plant's life cycle include **germination**, **pollination**, **fertilisation** and **seed dispersal.** • **Coniferous** trees transport their seeds in cones; **deciduous** trees us e seeds and flowers/fruit. • **Pollination** and **fertilisation** usually takes place in flowers. Dispersal is important to make sure there is enough space for seeds to germinate and plants to grow. • **Pollinators** like bees and other insects, bats and hummingbirds are vital for the reproduction of many plants. • Seeds can be dispersed by wind (e.g. sycamore), by animals in their droppings (e.g. things that are eaten, like a raspberry), attached to animal fur (e.g. goosegrass), or seeds can be **self-propelled** (pea pod).	• The male part of the plant is called the stamen, made up of the anther and filament, and the anther produces pollen grains (Y5 Spr). • The female parts of the plant are the ovary (which produces the female sex cells which are contained in the ovule) and the stigma which collects pollen (Y5 Spr). • Sexual reproduction is two parents - usually male and female - create a new organism by mixing their gene (Y5 Spr). Asexual reproduction does not involve sex cells or fertilisation. Only one parent is needed, and the offspring are (genetically) identical to the parent and each other (Y5 Spr). • Potatoes develop tubers and daffodils have bulbs, which will grow to be identical copies of the plant (Y5 Spr). • **Geography**: Adaptations of some plants in rainforests (e.g. buttress roots) (Y4 Spr).
Disciplinary	• **Mathematics**: Measure length and height (cm/m) (Y2); Interpret and construct block diagrams (Y2). • A&P: Dependent, independent and control variables (Y3 Aut). • A&P: Make a prediction based on substantive knowledge (Y2). • A&P: Scientists identify factors in an investigation that should be controlled, and try to find ways to control them.	***Investigate the impact of light on the growth of plants, drawing a block diagram to illustrate results*** • R&P: Design a table to collect data with the appropriate number of rows and columns and correct headings. ***Research methods of seed dispersal of different plants*** • M&O: Gather information from the internet.	
VCs	• 4: All living things need food to give them energy. All food chains start with a producer (a living thing that makes its own food) (Y2). • 5B: The air is all around us on Earth. Air has oxygen in it (Y2). • 8: Most plants make their own food (Y2). • 9: Plants and animals reproduce (have offspring) (Y2).	• 4: In most plants, sunlight, carbon dioxide and water are used to make food in the leaves. • 5B: Air has carbon dioxide in it. • 8: Plants make their own food using sunlight, carbon dioxide and water. • 9: When a plant reproduces, it goes through stages of pollination, fertilisation and seed dispersal. The seed will then germinate and grow into a plant.	• 4: The process of photosynthesis, and how the glucose it produces is used to make other sugars (KS3). • 8: Transfer of biomass (KS3). • 9: Asexual reproduction in plants (Y5).

Year 3: Summer 1

Physics: Forces & Motion

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• How slow/fast a vehicle moves along a track depends on how hard/gently it is pushed/pulled, how steep the slope is, or whether there is an obstacle in its way (N3-4 Spr1). • How slow/fast a boat moves across the water depends on how hard/gently we blow at them through straws (N3-4 Spr1). • Solids keep their shape unless a force is put on it. They will change their shape if you cut or squash them (Y2 Sum).	• **Forces** are **pushes** or **pulls.** • Forces arise when objects interact with each other. • Forces can cause a change in speed, direction or shape of an object. • Forces act in particular **directions.** • We use arrows to show the size of the force and the direction it acts in. • Forces that act in opposite directions are called **opposing forces**. • Forces that act in opposite directions and are equal are described as **balanced forces**. • When forces are balanced, there is no change in the speed, direction or shape of an object. • Forces that act in opposite directions and are not equal are described as **unbalanced forces**. • When forces are unbalanced, there is a change in the speed, direction and/or shape of an object. • **Friction** is a force between two surfaces that are sliding or trying to slide over each other. • The bumpier or rougher the surfaces, the more friction there will be.	• Contact forces require contact between two objects (e.g. friction). Non-contact forces can affect an object at a distance (e.g. magnetism) (Y3 Sum2). • Magnetism is a non-contact force exerted by magnets when they attract or repel each other (Y3 Sum2). • Gravity is a non-contact force (Y5 Sum). • Air and water resistance are contact, frictional forces (Y5 Sum).
Disciplinary	• Mathematics: Measure length and height (cm/m) (Y2). • A&P: Science is studied as three disciplines: biology (study of organisms), chemistry (study of materials) and physics (study of energy) (Y3 Spr). • A&P: Dependent, independent and control variables (Y3 Aut). • R&P: Design a table to collect data with the appropriate number of rows and columns and correct headings. • A&E: Make simple statements about the results of an enquiry.	***Investigate how the surface of a ramp affects the distance a car will travel*** • M&O: Taking multiple readings allows you to see if your data is repeatable and helps you identify anomalous results. Anomalous results should be discarded and re recorded. • M&O: Data is repeatable if the same person repeats the investigation and gets the same results; data is reproducible if the investigation is repeated by a different person and the results are the same. • A&E: Draw conclusions (e.g. 'the greater the… , the greater the…').	• The difference between accurate data and precise data (KS3). • Using the mean as a method of analysing a set of data (Y6).
VCs	• 3: We can move or change the shape of objects by pushing and pulling: by squashing, bending, twisting or stretching the materials (Y2).	• 3: Forces act in pairs. Forces acting against each other are opposing. If opposing forces equal, they are balanced, and the object's motion will stay the same; this includes staying stationary. If opposing forces are unequal, they are unbalanced will change an object's speed, direction or shape. Friction is a force that will slow an object down (Y3).	• 3: Friction is an example of a contact force (Y3).

Year 3: Summer 2

Physics: Magnetism

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• Magnetic materials are attracted to magnets (N3-4 Spr1). • Magnets can repel or attract each other, depending on which way they are held to each other (N3-4 Spr1). • Objects have a name and often have a purpose. For example, a cup is the object, and its purpose is for drinking from. The material is what an object is made of, for example a cup can be made of paper or plastic (Y1 Spr). • Forces are pushes or pulls (Y3 Sum). • Forces can cause a change in speed, direction or shape of an object (Y3 Sum). • Forces act in particular directions (Y3 Sum). • Forces that act in opposite directions are called opposing forces (Y3 Sum). • Forces that are equal and act in opposite directions are described as balanced forces, they cancel each other out (Y3 Sum). • Friction is a force between two surfaces that are sliding or trying to slide over each other. • **Geography:** The North Pole and the South Pole are at the top and bottom of the Earth (Y1 Spr).	• **Contact** forces require contact between two objects (e.g. friction). **Non-contact** forces can affect an object at a distance (e.g. magnetism). • Friction is a contact force because it requires the two objects to be touching. • **Magnetism** is the force exerted by magnets when they attract or repel each other. • Magnets can exert a force at a distance, so is a non-contact force. • Magnets have a **north** and a **south pole**. • If opposite poles are facing, the magnets will be **attracted** to one another (the magnets pull towards each other). If the same poles are facing, the magnets will **repel** (the magnets will push away from each other). • Magnets attract objects made from magnetic materials. • Some metals are magnetic but not all are. Plastics, wood, fabric, glass are all non-magnetic. • The closer to the poles of the magnet, the stronger the magnetic force. • Magnetic forces act at a distance (non-contact force) and can act through materials. • A stronger magnet can attract an object through thicker layer of material compared to a weaker magnet. • The stronger the magnet, the heavier the object it can attract.	• Force is measured in newtons (Y5 Sum), • Gravity is a non-contact force that pulls all objects towards each other (Y5 Sum), • The greater the mass of an object, the greater the gravitational pull around it (Y5 Sum), • Gravity is most commonly experienced as the pull of the Earth (and all objects on it) towards each other (Y5 Sum), • The Earth's gravitational pull is so large that all objects - regardless of how heavy they are - are pulled towards Earth at the same rate (Y5 Sum), • Air resistance is a frictional force that acts between air and a moving object to slow it down (Y5 Sum), • Water resistance is a frictional force that acts between water and a moving object to slow it down (Y5 Sum),
Disciplinary	• Mathematics: Measure length and height (cm/m) (Y2). • A&P: Dependent, independent and control variables (Y3 Aut). • A&E: Draw conclusions (e.g. 'the greater the… , the greater the…').	***Test which materials are magnetic, and use this knowledge to make predictions about which objects will be magnetic.*** • A&E: Use findings of an investigation to make further predictions. • A&E: Suggest ways to improve practical procedures to obtain more accurate measurements.	
VCs	• 2: Magnets can attract or repel other magnets. Magnets attract magnetic objects (EYFS). • 3: Friction is a force that will slow an object down (Y3).	• 2: The non-contact force of magnetism mean magnets can attract or repel other magnets and attract objects made of magnetic materials. • 3: Friction is an example of a contact force.	• 2: The non-contact force of gravity pulls objects towards the centre of the Earth (Y5).

Year 4: Autumn 1

Biology: Classifying Organisms

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• Insects like ants, bees, and ladybirds are animals. Spiders and insects live in the habitats around our school (Rec Spr2). • Plants are classed as living things because they grow, move, reproduce, and need nutrition (Y1 Aut). Animals move from place to place, while plants move on the spot (Y2 Spr). • Animals can be grouped into fish, amphibians, reptiles, birds and mammals (name common examples) (Y1 Sum). • Animals, including humans, reproduce. This means they have offspring that grow into adults (Y2 Aut). • Living things are called organisms (Y2 Spr). • Habitats are the places that living things live. A very small habitat is called a microhabitat (Y2 Spr). • Biodiversity is all the living things in an area (Y2 Spr). • A species is a group of living things that are the same type (Y2 Spr). • The Earth is getting warmer. We call this global warming. Global warming will cause solid ice to melt and become liquid water (Y2 Sum). • Some organisms have endoskeletons, some have exoskeletons, and some have neither (Y3 Aut). • Pollinators like bees and other insects, bats, hummingbirds are vital for the reproduction of many plants. (Y3 Spr2).	• **Classification** refers to a method used to place all living things into groups. **Organisms** can be classified in a number of ways. • Fish, amphibians, reptiles, birds and mammals are all **vertebrates**. • Vertebrates have **endoskeletons.** • Vertebrates can be grouped in a number of ways based on their characteristics, e.g. **warm/cold blooded**; or physical features like fur, beak, wings etc. • **Invertebrates** can be grouped based on their characteristics as **snails** and **slugs**; **worms**; **spiders** and **insects.** • Invertebrates can be placed into groups based on their skeletons; **endoskeletons**, **exoskeletons**, or **hydrostatic skeletons.** • Plants can be grouped into **flowering** and **non-flowering** plants. • A **species** is a group of one type of organism. Individuals in this group can breed with each other to produce **offspring** that can go on to **reproduce.** • Protecting biodiversity is important as the different species depend on each other to provide food, shelter and many other resources. This is called **interdependence**. • Many things threaten biodiversity, including the loss of habitats (from global warming, building and extracting resources), agriculture, and hunting.	• Invertebrates can be grouped based on their characteristics as poriferans (sponges) cnidarians, echinoderms, molluscs, annelids, platyhelminths and arthropods (spiders, insects, crustaceans and myriapods). Plants can be grouped into moss, ferns, conifers and flowering plants (Y6 Spr) • Fungi are different to plants and animals. They cannot make their own food (like animals) but do not move (like plants) (Y6 Spr). • Micro-organisms are organisms that are so small that we cannot see them with our eyes alone (Y6 Spr). • Some fungi are microorganisms (e.g. yeast), but not all are (e.g. mushrooms) (Y6 Spr). • Bacteria are microorganisms, some bacteria can cause disease in other organisms (Y6 Spr). • Variation occurs within and between species (Y6 Aut).
Disciplinary	• M&O: Observe using a magnifying glass safely.	***Exploring classification debates (e.g. duck-billed platypus)*** • A&P: Identify scientific evidence that has been used to support or refute ideas. ***Use a classification key to sort organisms*** • R&P: Use a classification key to identify an object. ***Draw a classification key to identify four animals, and then several leaves (using a magnifying glass)*** • R&P: Draw a dichotomous classification key to help others identify an object.	• A&E: Science is never 'complete' and scientists are always working to make models more accurate or to discover new explanations (Y5)
VCs	• 9: A species is a group of living things of the same type (Y2).	• 9: A species is a group of one type of organism. Individuals in this group can breed with each other to produce offspring that can go on to reproduce.	

Year 4: Autumn 2

Biology: Food & Digestion

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• **Deciduous** plants lose their leaves in winter (e.g. oak, silver birch, horse chestnut, sycamore, ash) (Y1 Aut). • Animals can be placed into groups (carnivores, herbivores and omnivores) based on the food they eat. Humans are omnivores, but some choose to eat only plants (Y1 Sum). • Animals get their food from plants and other animals; this food provides the energy animals need. • Humans need to practise hygiene to stay healthy (Y2 Aut). • Most plants produce their own food and are called producers (Y2 Spr). • In a food chain, the arrows show where the energy is being transferred from and to (Y2 Spr). • Different animals have different nutritional needs (Y3 Spr). • Organs are parts of the body that do a particular job, like the heart pumps blood around the body and the lungs are used for breathing, which gets air into the body (Y3 Spr).	• A food chain starts with a **producer** (usually a plant) who can produce its own food. Organisms that eat producers are called **consumers** (primary and secondary). • A **predator** hunts **prey** to eat. • A **food web** shows the transfer of energy between different organisms (include water as well as land organisms). • An **ecosystem** is made up of all organisms living in an area and the non-living features of the environment. • There are four main types of teeth: **incisors**, **canines**, **pre-molars** and **molars**. They each have a different purpose. • **Herbivores**, **carnivores** and **omnivores** have teeth types in different proportions. • Babies' teeth develop before they are born, **deciduous** (milk) teeth push through the gums when a child is about 6 months. • **Deciduous** teeth fall out from the age of 5 and are replaced with adult teeth. • Bacteria can cause tooth decay. • Animals and plants need to **digest** food to transfer energy from it. • The **digestive** system is the group of organs that help your body digest food. Digestion in humans is **chemical** and **mechanical.** • Chemical and mechanical digestion takes place in the mouth (saliva and chewing). • Food travels down the **oesophagus** from the mouth into the **stomach.** • In the **stomach**, mechanical (churning) and chemical digestion takes place to break down food further. • Food is further broken down by enzymes (chemical digestion) in the **small intestines** where most of the nutrients are absorbed. • Water is absorbed in the **large intestine**, leaving behind the **faeces**. • **Faeces** are mainly made of food we could not digest; faeces are stored in the **rectum** and pass out of the human body via the **anus**.	• Each organ and muscle in the human body needs oxygen and nutrients (from breathing in and eating/digesting) (Y6 Sum). • Blood carries oxygen, nutrients and carbon dioxide around the body (Y6 Sum). • Nutrients are absorbed by the blood along the small intestine, and transported to other organs in the body (Y6 Sum). • Some bacteria are helpful for other organisms (e.g. those that help break down food in our digestive system) and those that form part of a symbiotic relationship (Y6 Spr). • The role of enzymes in chemical digestion (KS3). • The interdependence of organisms in an ecosystem and how organisms affect and are affected by their environment to include the accumulation of toxic materials (KS3).
Disc.	• R&P: Draw a diagram, a simple scientific drawing that explains or informs (Y1 Spr).	***Explain the digestion process using a prop to others in school or at home*** • R&P: Present information orally using a prop or demonstration. • R&P: Drawings can be **labelled** and **annotated**.	
VCs	• 4 & 8: All food chains start with a producer (a living thing that makes its own food). The arrows in a food chain show where energy is being transferred from and to (Y2). • 8: Plants and animals are often dependent on each other (Y2). • 11: Humans need to practise good hygiene, like brushing teeth and washing hands, to stay healthy (EYFS).	• 4 & 8: The arrows in a food web show where energy is being transferred from and to. • 11: Bacteria are tiny living things. Some are useful for humans, and some can cause diseases. Bacteria can cause tooth decay.	• 4: Many processes and phenomena are explained in terms of energy exchanges. Energy cannot be created or destroyed. When energy is transferred from one object to others, the total amount of energy in the universe remains the same; the amount that one object loses is the same as the other objects gain. Two examples of energy stores are thermal stores and chemical stores of energy (Y5). • 4 & 8: Food chains, food webs and the transfer of biomass (KS3). • 11: Bacteria are microorganisms (Y6).

Year 4: Spring 1

Chemistry: Particle Model

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• We see puddles when it's rainy, shadows during the day and rainbows when there is sunshine and rain (N3-4 Aut1). • Melting and freezing can be observed in the world around us (N3-4 Aut1). • Geography: Precipitation is the fall of water as rain, sleet, snow or hail (Y2 Spr). • All materials are made of a single substance or a mixture of substances (Y2 Sum). • There are three states of matter: solids, liquids and gases (Y2 Sum). • Liquids take the shape of the container they are in, when you move the liquid into a different container the shape will change (Y2 Sum). • Solids keep their shape unless a force is put on it. They will change their shape if you cut them or squash them (Y2 Sum). • Gases have no fixed shape or volume, they spread out to fill a container. If they are not in a container, they will keep spreading out (Y2 Sum). • One substance can exist in the different states, when the substance is in a different state it is still the same substance (Y2 Sum).	• The different **substances** in their different forms (solids, liquids and gases) are all made of **particles.** The **particles** in the different states of matter are arranged differently. • In solids, the particles are packed tightly together, they vibrate slowly, and are unable to move away from their neighbours. • In liquids, the particles are close together but can slide past each other. • In gases, the particles are spread out and can move freely. • Substances can change from one state of matter to another. • The process that changes a substance from solid to a liquid is called **melting**. • The process that changes a substance from liquid to a gas is called **evaporation**. Evaporation is different from boiling. • The process that changes a gaseous substance to liquid is called **condensation**. • The process that changes a liquid substance to solid is called **freezing.** • Substances change state at different temperatures. • Different substances are different states at **room temperature.** • The **water cycle** relies on **evaporation** and **condensation**. Water is collected in the oceans from rivers; it evaporates and then condenses to form clouds; it then **precipitates,** and the cycle begins again.	• Geography: Water cycle: Evaporation from the air, and transpiration from trees means that water vapour rises into the air. It condenses to form clouds and precipitation occurs when the clouds get heavy. Surface runoff is the flow of water overground; throughflow is the flow of water underground (Y5 Spr). • Conservation of material and of mass, and reversibility, in melting, freezing, evaporation, sublimation, condensation, dissolving (KS3). • Similarities and differences, including density differences between solids, liquids and gases (KS3). • Brownian motion of gases (KS3). • Diffusion in terms of the particle model (KS3). • Energy changes on changes of state (KS3).
Disciplinary	• Mathematics: Measure temperature (°C) and volume (ml/litres) (Y3) • A&P: dependent, independent and control variables (Y3). • A&P: Scientists identify factors in an investigation that should be controlled, and try to find ways to control them (Y3). • A&P: Scientists identify potential hazards in their experiments and plan ways to reduce them (Y2 Aut). • R&P: Label and annotate a diagram (Y4 Aut2).	***Investigate the effect of temperature on the rate of evaporation*** • A&P: Set a hypothesis to test. • A&E: Scientists use models to help explain their ideas.	• A&P: Scientists must work out if the factor is the cause of the outcome in a correlation (Y5).
VCs	• 1: Matter can exist in three different states: as solids, liquids and gases. The amount and type of substance does not change when the matter changes state (Y2).	• 1: If a material could be divided into smaller and smaller pieces, it would be found to be made of particles, which smaller than can be seen even with a microscope. These particles are not in a material; they are the material. The particles of a substance are arranged differently when it is solid, liquid or gas. • 5B: The water cycle involves evaporation of water from oceans and condensation of water, which falls as precipitation.	• 1: A pure substance is one that contains only one type of particle. A mixture is created when two or more substances are mixed. The two types of particle are mixed together, but the particles themselves stay the same (Y5). • 5B: Geography – Addition of transpiration and surface runoff as aspects of water cycle (Y5).

Year 4: Spring 2

Physics: Sounds

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• Humans have features that are associated with each sense (eyes, ears, nose, mouth and tongue) (Y1 Sum). • In a solid the particles are packed tightly together, they vibrate slowly, and are unable to move away from their neighbours (Y4 Spr). • In a liquid the particles are close together, but they can slide past each other (Y4 Spr). • In a gas the particles are spread out and can move freely (Y4 Spr).	• **Sounds** are made when objects **vibrate**. • Sounds are transmitted from a source to a detector. • Vibrations travel through a **medium** (e.g. air, water) to the ear. • Vibrations enter the ear, our **inner ear** vibrates and we hear them as sound. • Vibrations are passed on from one particle to the next, and so it travels more easily when particles are closer together (solids and liquids). • Sound cannot travel in a **vacuum.** • The **volume** of a sound is how loud or quiet it is. • Louder sounds are caused by bigger vibrations, smaller sounds are caused by smaller vibrations. • The **pitch** of a sound is how high or low it is. • Sounds get fainter as the distance from the sound source increases. • Different animals hear different sounds. • Humans' hearing changes as we age.	• Sound cannot travel in a vacuum, in space (Y5 Sum). • Frequencies of sound waves, measured in hertz (Hz) (KS3). • Echoes, reflection and absorption of sound (KS3). • Sound needs a medium to travel in (KS3). • The speed of sound in air, water and solids (KS3). • Sound produced by vibrations of objects, in loudspeakers, detected by their effects on microphone diaphragm and the ear drum (KS3). • Sound waves are longitudinal waves (KS3). • The auditory range of humans and animals (KS3).
Disciplinary	• A&P: A dependent variable is what you measure; an independent variable is what you change; controlled variables are things that stay the same (Y3 Aut2).	***Investigate the tautness on pitch using an app*** • M&O: Gather information using a data logger (e.g. sound meter app; heart rate app).	• M&O: Gather information using other data loggers (Y6).
VCs	• 2: Objects can affect other objects even when they are not in contact with them. Light reaches our eyes, even though the light source may be far away (Y3). • 11: Humans have five senses. Some people have impairments, like visual and hearing impairments (Y1).	• 2: Sound comes from objects that vibrate and can be detected at a distance from the source, because the air or other material around is made to vibrate. Sounds are heard when the vibrations in the air reach our ears. • 11: Humans with hearing loss may use closed captions, hearing aids and/or sign language.	• 2: There is attraction and repulsion between objects that are electrically charged. Visible light and other forms of radiation can travel through any empty space (KS3).

Year 4: Summer 1

Physics: Electricity

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• Common materials include wood, paper, metal, glass, water, rock (Y1 Spr). • Materials have different physical properties, some materials are hard whilst others are soft, some can be described as rough whilst others are smooth, some are dull whereas others are shiny (Y1 Spr). • Materials can be grouped in a number of ways based on their physical properties (Y1 Spr). • The material that we choose to make an object from depends on its purpose (e.g. no chocolate kettle) (Y1 Spr).	• **Electrical appliances** have a purpose and require electricity to work (e.g. toaster, kettle, fan, phone, game). • Electrical appliances should be switched off when not in use. • A **lamp** in a **circuit** will only light if there is a **complete circuit**. • A complete circuit must have at least one cell and have all the **components** connected in a loop. If it is missing any of these things it is an **incomplete circuit.** • **Switches** complete or break a circuit. • A **short circuit** can be created by accident by connecting just the wire to the cell in a circuit. They can be dangerous. • Components include **wire**, **lamp**, **buzzer**, **motor** or **switch.** • Materials that allow electricity to pass through them easily are called **electrical conductors.** • Metals and water are good conductors of electricity. • Materials that do not allow electricity to pass through them easily are called **electrical insulators.** • Plastic, rubber, wood, glass, paper and fabric are electrical insulators.	• In a circuit that has a battery, the battery is the chemical store of energy. Energy is transferred electrically to the device in the circuit but the device does not store the energy, the device changes the way the energy is transferred (Y5 Aut). • There are recognised symbols for cell, lamp, buzzer, motor, and switch. Wires are represented with straight lines (Y6 Aut). • Increasing the voltage in a circuit will increase the brightness of a lamp and increase the volume of a buzzer (Y6 Aut). • The more components in the circuit, the dimmer the lamps in the circuit (Y6 Aut). • As long as batteries have the same voltage, the size of the battery does not affect the brightness of the lamp/loudness of the buzzer (though the smaller batteries will not last as long as the larger ones) (Y6 Aut).
Disciplinary	• A&P: Dependent, independent and control variables (Y3 Aut). • A&P: Scientists identify factors in an investigation that should be controlled, and try to find ways to control them (Y3 Aut). • A&P: Scientists identify potential hazards in their experiments and plan ways to reduce them (Y2 Aut). • A&E: Use findings of investigation to make further predictions (Y3 Sum). • R&P: Design a table to collect data with the appropriate number of rows and columns and correct headings (Y3 Spr).	***Investigate which materials are electrical conductors and which are electrical insulators*** • A&P: Draw diagram of the investigation. • R&P: Present information in a written format.	
VCs	• 4: We have to push or pull objects to make them move; they do not move on their own.	• 4: A cell in a complete circuit can make a bulb light or buzzer sound. This will not happen without a cell.	• 4: A cell is a chemical store of energy, and this energy will be transferred to components in the circuit (Y5).

Year 4: Summer 2

Chemistry: Properties of Materials

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• Materials have different physical properties, some materials are hard whilst others are soft, some can be described as rough whilst others are smooth, some are dull whereas others are shiny (Y1 Spr). • Materials have different physical properties such as malleable, waterproof, heatproof, windproof and absorbent. (Y2 Spr). • The shape of some solid objects made from some materials can be changed by squashing, bending, twisting, or stretching the material (Y2 Spr). • Opaque, translucent and transparent materials allow no, some or all light to pass through them (Y3 Aut). • Magnets attract magnetic objects (Y3 Sum). • Materials that allow electricity to pass through them easily are called electrical conductors (Y4 Sum). • Materials that do not allow electricity to pass through them easily are called electrical insulators (Y4 Sum).	• **Physical properties** are properties that we can measure or observe in the classroom. • Physical properties include electrical conductivity; melting and boiling points; thermal conductivity; being malleable; windproof; hard/soft; and magnetic. • Energy will be transferred from places with a higher temperature to places with a lower temperature. • **Thermal conductors** allow energy to be transferred through them easily when they are heated. Metals are good thermal conductors. • **Thermal insulators** do not allow energy to be transferred through them easily when heated. Thermal insulators include trapped air, plastic and wood. • Elasticity is a physical property. Elastic materials can stretch and then return to its original form. • **Chemical properties** are properties that scientists need specialist equipment to measure. • Chemical properties include how easy a substance is to set on fire (**flammability**) or how poisonous something is (**toxicity**). • As we learn more about a substance's properties, we may decide to stop using it to make certain objects (e.g. lead in pencils is toxic; asbestos is a good insulator but is toxic).	• Differences between physical and chemical changes (Y6 Sum). • The varying physical and chemical properties of different elements (KS3). • The properties of metals and non-metals (KS3). • The chemical properties of metal and non-metal oxides with respect to acidity (KS3). • Properties of ceramics, polymers and composites (KS3).
Disciplinary	• A&P: Scientists conduct secondary research to learn from what other scientists have already learned (Y1 Sum). • A&P: Scientists identify factors in an investigation that should be controlled, and try to find ways to control them (Y3 Aut). • M&O: Gather information from text/books/images (Y1 Aut) and the internet (Y3 Spr). • A&E: Ask further questions that could be explored to extend findings (Y2 Spr). • A&E: Identify scientific evidence that has been used to support or refute ideas (Y4 Aut).	***Investigating the physical properties (thermal conductivity; malleability; transparency; magnetism; electrical conductivity etc.) of materials, using own knowledge or setting up comparative tests.*** ***Conduct secondary research to identify an object that was once made of one material but, when new evidence showed other chemical or physical properties, are now made of new materials (e.g. asbestos insulation; lead pencils; plastic bottles).***	
VCs	• 1: Materials have different properties, which make them suitable for specific purposes (Y2). • 11: Humans need to practise good hygiene, like brushing teeth and washing hands, to stay healthy (EYFS).	• 1: Properties of materials can be physical (such as hardness) or chemical (such as toxicity). • 11: Some substances are toxic; this means they can be poisonous. Humans and other organisms need to avoid these to stay healthy.	• 11: Barrier methods that the body uses to prevent toxic substance damaging health (KS3).

Year 5: Autumn 1

Chemistry: Separating Mixtures

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• Magnets attract magnetic objects (Y3 Sum). • Some metals are magnetic but not all are. Plastics, wood, fabric, glass are all non-magnetic materials (Y3 Sum). • Matter exists in three states: solids, liquids and gases. Materials are different states at room temperature (Y2 Sum). • When matter changes states, the melt, freeze (Y2 Sum) and condense and evaporate (Y4 Spr). • Particle arrangement of solids, liquids and gases (Y4 Spr). • Physical properties include electrical conductivity; melting and boiling points; thermal conductivity; being malleable; windproof; hard/soft; and magnetic (Y4 Sum).	• A **pure substance** is one that contains only one type of particle. • A **mixture** is two or more different substances, e.g. air, steel. • **Mixtures** can be made of two gases (e.g. air), two solids (e.g. steel), two liquids (e.g. squash and water), or a liquid and a solid (e.g. salt water). • A **solution** is made when one substance **dissolves** in another substance called a solvent. A solution is a mixture; it is made of more than one type of particle. • The substance that dissolves is called the **solute**. The substance that it dissolves in is called the **solvent**. • A substance that will dissolve in a solvent is **soluble** in that solvent. If it does not dissolve, it is **insoluble** in that substance. • When no more solute can dissolve in the solvent, the solution is **saturated.** • The higher the temperature of the solvent, the greater the mass of solute that can be dissolved. • Two solids can be separated by using **magnets** or **filters** (e.g. sieve). • A solid and a liquid can be separated by using **filtration** (if the solid is insoluble) or **evaporation** (if the solid is soluble). • A **reversible** change is a change that can be undone, where the original substances can be recovered. • An **irreversible** change is a change that cannot be undone, where the original substances cannot be recovered.	• Physical and chemical changes (Y6 Sum) • Simple techniques for separating mixtures: distillation and chromatography (Y6 Sum) • The concept of a pure substance (KS3) • Diffusion in terms of the particle model (KS3) • The identification of pure substances (KS3)
Disciplinary	• Write an appropriate method (Y2 Aut) • Identify dependent, independent and control variables (Y3 Aut2) and set a hypothesis (Y4 Spr1) • Data is repeatable if the same person repeats the investigation and the results are the same; data is reproducible if the investigation is repeated by a different person and the results are the same (Y3 Sum1) • **Mathematics**: Measure temperature in °C using a thermometer (Y2)	***Investigate the effect of temperature on the mass of the solute that can be dissolved.*** ***Separate a mixture including coarse sand, water, salt and lumps of a magnetic material.***	
VCs	• 1: If a material could be divided into smaller and smaller pieces, it would be found to be made of particles, which smaller than can be seen even with a microscope. These particles are not in a material; they are the material (Y4). • 5B: The air is all around us on Earth (Y2). Air has oxygen (Y2) and carbon dioxide (Y3) in it.	• 1: A pure substance is one that contains only one type of particle. A mixture is created when two or more substances are mixed. The two types of particle are mixed together, but the particles themselves stay the same. • 5B: Air is a mixture of lots of different gases, including oxygen and carbon dioxide.	• 1: A chemical change is where a new substance – that is made of a different type of particle – is formed (Y6). • 5B: There is less and less air further away from the Earth's surface; space is a vacuum (Y5).

Year 5: Autumn 2

Physics: Energy

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	**Biology**: • In a food chain, the arrows show where the energy is being transferred from and to (Y2 Spr). • Leaves use sunlight, carbon dioxide from the air, and water to make their own food (Y3 Spr). They are called producers (Y2 Spr). • A food web shows the transfer of energy between different organisms (Y4 Aut). • Animals and plants need to digest food to transfer energy from it (Y4 Aut). **Physics**: • A complete circuit must have a power source (cell/batteries) and have all the components connected in a loop. If it is missing any of these things it is an incomplete circuit (Y4 Sum). • Appliances use electricity to serve a purpose (e.g. toaster, kettle etc.) (Y4 Sum). • Sounds are made when objects vibrate. These vibrations cause the air particles surrounding them to vibrate and collide, causing the vibrations to pass between particles (Y4 Spr). **Geography:** • Fossil fuels are materials made from fossils over millions of years, like coal and oil. Humans use these to run cars and electrical items (Y5 Aut).	• **Energy** is needed by both living and nonliving things. • Energy can be **transferred** from one **store** to another store. • When energy is removed from one store and is transferred to another store, the amount of energy in the first store goes down and the amount of energy in the second store goes up. • Energy is not used up; it is just moved around from store to store. • **Energy stores** are needed for something to happen. • **Energy resources** such as oil, gas, coal, food and other fuels can be depleted. • Fossil fuels and batteries are examples of **chemical energy stores**. • Energy can be stored **thermally** in the surroundings. • Different foods (fuels) store more chemical energy per unit mass than others. • The **Sun** is an example of a chemical energy store. • In a **food chain,** an amount of energy from the Sun (a **chemical store**) is transferred to the plant by light. The energy is then transferred along the food chain as the different organisms are eaten. • Not all the chemical energy stored in an organism is passed to the next organism in a food chain because a) not all of the organism is eaten and b) some energy is transferred from the organism to the thermal store of the surroundings. • In a circuit that has a cell/battery, the cell/battery is the chemical store of energy. • In a circuit, energy is transferred electrically to the device in the circuit, but the device does not store the energy; the device changes the way the energy is **transferred**.	• Coal, oil and gas are all used to generate electricity. The store of chemical energy in the fuel is transferred electrically to the appliances that we use in the home (Y6 Aut). • A battery is a store of chemical energy (KS3). • Energy can be transferred electrically using an electric current (KS3). • Energy can be transferred electrically from the battery using an electric current to a device like a lamp or a buzzer (KS3). • Devices such as bulbs do not store the energy. During this process the energy is transferred to a different store (KS3). • Appliances are items that transfer electrical energy to a different store, e.g. light to the surroundings (KS3).
D	• A&E: Scientists use models to help explain their ideas (Y4 Spr).		
VCs	• 4: All living things need food to give them energy. The arrows in a food web show where energy is being transferred from and to (Y4). • 8: Plants make their own food using sunlight, carbon dioxide and water (Y3).	• 4: Many processes and phenomena are explained in terms of energy exchanges. Energy cannot be created or destroyed. When energy is transferred from one object to others, the total amount of energy in the universe remains the same; the amount that one object loses is the same as the other objects gain. Two examples of energy stores are thermal stores and chemical stores of energy. • 8: Energy is transferred to the Earth by light. When making their own food, plants transfer some of this energy to their chemical store. As other organisms eat these producers, some energy in this chemical energy store is transferred.	• 4: Objects have energy because of their chemical composition, their movement, their temperature, their position in a gravitational or other field, or because of compression or distortion of an elastic material (KS3).

Year 5: Spring 1

Biology: Life Cycles

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon

Substantive	• Parents and their young animals look similar and different (N3-4 Spr2).
	• Germination is the development of a plant from a seed. During germination roots and shoots emerge and grow (Y2 Aut).
	• Some plants grow from bulbs (Y2 Aut).
	• A seed is the embryonic stage of the plant life cycle (Y2 Aut).
	• Animals, including humans, reproduce. This means they have offspring that grow into adults (Y2 Aut).
	• As animals grow they get bigger, some animals change during their life cycle as the mature (e.g. tadpole to frog) (Y2 Aut).
	• The four main stages of the plant's life cycle include germination, pollination, fertilisation and seed dispersal (Y3 Spr).
	• Pollination and fertilisation usually takes place in flowers. Dispersal is important to make sure there is enough space for seeds to germinate and plants to grow (Y3 Spr).
	• A species is a group of one type of organism, individuals in this group can breed with each other to produce offspring that can go on to breed (Y4 Aut).
	• Fish, amphibians, reptiles, birds and mammals are all vertebrates (Y4 Aut).
	• Invertebrates can be grouped based on their characteristics as snails and slugs; worms; spiders and insects (Y4 Aut).
		• A cell is the smallest building block of living things. All organisms are made of cells.
		• There are lots of different types of cell, which each have different purposes.
		• Plants and animals look similar to their parents in many features because information is passed from one **generation** to the next. This information comes from the parents' **genome**.
		• **Sexual reproduction** involves two parents - usually male and female - creating a new **organism** by mixing their **genomes.**
		• Sexual reproduction begins with **fertilisation** of an egg, which mixes the genes from two parents. Fertilisation can be internal or external.
		• After an egg is fertilised, an embryo will develop. Embryos develop inside the body in the **gestation** period for **viviparous** animals. Embryos develop outside the body in eggs for **oviparous** animals.
		• Viviparous animals are **born**, oviparous animals **hatch** from eggs, plant seeds **germinate.**
		• Almost all mammals are viviparous; all birds and most amphibians are oviparous.
		• Amphibians and most insects undergo **metamorphosis.**
		• Life cycle of:
		  • hedgehog: internal fertilisation, gestation, hoglet, adult.
		  • peregrine falcon: internal fertilisation, incubation in eggs, hatchling, fledgling, adult.
		  • frog: external fertilisation, frogspawn, tadpole, adult frog (metamorphosis).
		  • ladybird: internal fertilisation, eggs hatch, larva, pupa, adult.
		• Most plants have both male and female parts.
		• The male part of the plant is called the **stamen**, made up of the **anther** and **filament**, and the anther produces **pollen grains**.
		• The female parts of the plant are the **ovary** (which produces the female sex cells which are contained in the **ovule**) and the **stigma** which collects pollen.
		• **Asexual reproduction** does not involve sex cells or fertilisation. Only one parent is needed and offspring are (**genetically**) identical to the parent and each other.
		• Potatoes develop **tubers** and daffodils have **bulbs**, which will grow to be identical copies of the plant.
			• The human life cycle goes through the same stages as those for other animals: fertilisation, gestation, growth (Y5 Spr).
			• Humans are viviparous and a foetus develops inside the mother (or surrogate mother). A human embryo is considered a foetus at the end of the 8th week of pregnancy (Y5 Spr)
			• The gestation period for humans is 40 weeks
			• The bigger the animal, the longer the gestation period (Y5 Spr2).
			• A foetus is considered a baby when it is born (Y5 Spr).
			• Fertilisation in most humans is internal, but it can happen externally (in vitro fertilisation - IVF - which means 'in glass' fertilisation) (Y5 Spr).

Disciplinary	• A&P: Scientists conduct secondary research to learn from what other scientists have already learned (Y1 Spr). • A&P: Science is studied as three disciplines: biology (study of organisms), chemistry (study of properties of matter and how it interacts with energy) and physics (study of energy) (Y5). • M&O: Gather information from text/books/images (Y1 Aut) and the internet (Y3).	***Using images, text and the internet to research internal and external fertilisation, and viviparous and oviparous organisms***	
VCs	• 7: Humans are organised with organs like hearts and lungs, which do particular jobs. The skeleton and muscles allow the body to move (Y3).	• 7: A cell is the smallest building block of living things. All organisms are made of cells. There are lots of different types of cell (e.g. sex cells), which each have different purposes. • 9: An organism's genome is the information that controls how that individual organism will develop. In sexual reproduction, two parents contribute to the formation of offspring. They each pass down half their genome through specialised cells called sex cells. The two halves are combined during fertilisation. While it inherits genetic information from both parents, the offspring's genome is distinct, which means the offspring is not identical to a parent. Asexual reproduction involves only one parent. In this process, the offspring's genome is an exact copy of the parent's genome. The offspring is identical to the parent.	• 7: All organisms are made of one or more cells. All the basic functions of life – growth, reproduction, extracting energy from food – are the results of what happens inside cells. Cells are often aggregated into tissues, tissues into organs, and organs into organ systems (KS3). • 9: In a human body, most cells contain 23 pairs of chromosomes. These provide information that is needed to make more cells in growth and reproduction (KS3).

Year 5: Spring 2

Biology: Human Development

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• Talk about how they have changed from being a baby (N3-4 Aut1). • Humans are made of many different body parts including head, neck, back, ears, eyes, nose, mouth, arms, shoulders, elbows, hands, fingers, legs, knees, feet, toes, ears, eyes, nose, mouth, arms, legs, hands, feet, toes (Y1 Sum). • Plants and animals look similar to their parents in many features because information is passed from one generation to the next. This information comes from the parents genome (Y5 Spr). • Sexual reproduction is two parents - usually male and female - create a new organism by mixing their genomes (Y5 Spr). • Sexual reproduction begins with fertilisation of an egg, which mixes the genomes from two parents (Y5 Spr). • Fertilisation can be internal or external (Y5 Spr). • After an egg is fertilised, an embryo will develop (Y5 Spr) . • Almost all mammals are viviparous (Y5 Spr). • Embryos develop inside the body in the gestation period for viviparous animals. (Y5 Spr). • Viviparous animals are born, oviparous animals hatch from eggs, plant seeds germinate (Y5 Spr).	• The human life cycle goes through the same stages as those for other animals: **fertilisation**, **gestation**, **growth.** • Fertilisation in most humans is internal, but it can happen externally (**in vitro fertilisation** - IVF - which means 'in glass' fertilisation). • The human life cycle: **embryo**, **foetus**, **infant**, **child**, **adolescent**, **adult**, **senior.** • Human are **viviparous** and a **foetus** develops inside the mother (or **surrogate** mother). • A human embryo is considered a foetus at the end of the 8th week of pregnancy. • The **gestation** period for humans is 40 weeks. • The bigger the animal, the longer the gestation period. • A foetus is considered a baby when it is born. • **Cognitive**, **physical** and **social** and **emotional** development takes place at the greatest rate during infancy. • During **puberty**, adolescents' bodies change, e.g. pubic hair, voice deepen, hips widen. • **Primary aging** of adults occurs naturally as our bodies get older (e.g. slower reaction time, reduced hearing). • **Secondary ageing** relates to environmental factors, like poor diet, not enough exercise, smoking etc. • There are ages where humans at their peak for different things (e.g. reproduction, running etc.). • Different cultures around the world have different perceptions around the life cycle and ageing.	• The structure and function of the male and female reproductive systems (KS3). • The female menstrual cycle (KS3). • The male and female gametes, as specialised cells (KS3). • Fertilisation, gestation and birth (KS3). • The effect of maternal lifestyle on the foetus (through the placenta) (KS3).
Disciplinary	• Mathematics: Use coordinates in the first quadrant (Y4); Interpret and construct line graphs (Y4). • A&P: Scientists look for patterns in the world around them (Y1 Aut). • A&P: Set a hypothesis to test (Y4 Spr). • A&E: Draw conclusions (e.g. 'the greater the..., the greater the...') (Y4 Spr). • Geography: Recognise that people have differing opinions about environmental issues (Y4 Spr).	***Draw a scatter graph to suggest whether there is a relationship between animal size and length of gestation period*** • A&P: Scientists look for patterns in data to try to identify correlations. • R&P: Scatter graphs can help you decide if there is a relationship between two variables. ***Discuss one aspect of IVF that is appropriate to your class (e.g. who in the world has access; post code lottery within the UK)*** • A&E: Some people may agree or disagree with the use of some scientific discoveries.	• Debates around more divisive ethical issues and questions (KS3).
VCs	• 11: Humans need to exercise, practise good hygiene and eat a healthy and balanced diet to stay healthy. Their diet should be high in fruits and vegetables and low in fats, sugar and salt (Y2).	• 11: Healthy development includes cognitive, physical, social and emotional development. Most of this happens during infancy and childhood. Ageing happens naturally, and can be sped up by environmental factors like smoking. Some adults are unable to become pregnant. IVF and other treatments can be used.	• 11: The biological causes and effects of diseases (e.g. coeliac disease and emphysema), exercise, lifestyles (e.g. vaping) and deficiencies on the body (KS3).

Year 5: Summer 1

Physics: Forces

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	•Forces are pushes or pulls that act in particular directions. They can cause a change in speed, direction or shape of an object (Y3 Sum). •Forces that act in opposite directions are called opposing forces (Y3 Sum). •Forces that are equal and act in opposite directions are described as balanced forces. They 'cancel each other out' (Y3 Sum). •When forces are balanced, an object will move at a constant speed in the same direction. This includes being stationary (Y3 Sum). •Contact forces require contact between two objects (e.g. friction). Non-contact forces can affect an object at a distance (e.g. magnetism) (Y3 Sum). •Friction is a force between two surfaces that are sliding or trying to slide over each other (Y3 Sum). •Friction is a contact force because it requires the two objects to be touching (Y3 Sum). •The bumpier or rougher the surfaces, the more friction there will be (Y3 Sum).	• **Force** is measured in **newtons** (N). • **Gravity** is a **non-contact force** that pulls all objects towards each other. The greater the **mass** of the object, the greater the **gravitational pull** around it. Gravity is most commonly experienced as the pull of the Earth (and all objects on it) towards each other. • The Earth's **gravitational pull** is so large that all objects - regardless of how heavy they are - are pulled towards Earth at the same rate. • **Mass** is a measure of how much matter something is made from, which is measured in kg (or equivalent). The mass of an object is always the same. • **Weight** is a force, it is measured in newtons (N). • The weight of an object will differ depending on the force of gravity. • **Air resistance** is a **frictional force** that acts between air and a moving object to slow it down. • **Surface area** is the area that is facing the direction the object is travelling in. The larger the surface area of an object, the greater the air resistance. • **Water resistance** is a frictional force that acts between water and a moving object to slow it down. • **Levers**, **pulleys** and **gears** allow a smaller force to have a greater effect. Examples of levers, pulleys and gears include wheelbarrows, lifts, bicycle gears, in construction. • Levers consist of a **beam** and a **fulcrum** (**pivot**). **Effort** lifts a **load.** The greater the distance from the effort to the fulcrum, the less effort is required to move the load. • **Upthrust** is an upwards force that a liquid (and a gas) exerts on an object floating in it. • If **upthrust** is equal to the weight of an object it will float.	• The Earth's Moon is smaller than the Earth and has less mass, so its gravitational force is less (Y5 Sum). • Using force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces (KS3). • Moment as the turning effect of a force (KS3). • Forces associated with deforming object; stretching and squashing- springs (KS3). • Measurement of stretch or compression as force is changed (KS3). • Work done and energy changes in deformation (KS3). • Non-contact forces: gravity forces acting at a distance on earth and in space, forces between magnets and forces due to static electricity (KS3). • Opposing forces and equilibrium; weight held by stretched spring or supported on a compressed surface (KS3). • Forces being needed to cause objects to stop or start moving, or to change their speed or direction of motion (KS3). • Change depending on direction of force and its size (KS3).
Disciplinary	•Mathematics: Round numbers with 1 decimal place to the nearest whole number (Y4); Understand difference between discrete and continuous data (Y4); Interpret and construct bar and line graphs (Y4); Area is the space inside a shape and can be measured by counting squares (Y4). •A&P: Dependent, independent and control variables (Y3 Aut). •M&O: Taking multiple readings allows you to see if your data is repeatable, and helps identify outliers (Y3 Sum).	***Investigate how much force is required to pull objects over different surfaces*** • M&O: Measure force using a Newtonmeter. ***Investigate how surface area affects air resistance, and how shape affects water resistance*** • R&P: Line graphs can be used when data is continuous; bar charts can be used when data is discrete. • A&E: Make judgements on the accuracy of the data.	
VCs	•2: A non-contact force is one that can act at a distance (Y3). •3: Forces act in pairs. Forces acting against each other are opposing. If opposing forces equal, they are balanced, and the object's motion will stay the same; this includes staying stationary. If opposing forces are unequal, they are unbalanced will change an object's speed, direction or shape (Y3).	• 2: The non-contact force of gravity pulls objects towards the centre of the Earth. • 3: There is gravitational force between all objects, but it is only felt when one or more of the objects has a very large mass. The greater the mass, the greater the gravitational force. Objects on Earth are pulled to the centre of the Earth because the Earth's mass and therefore gravitational force is much larger than that of the objects.	• 3: The downward force of gravity on an object on the Moon is less than that on Earth because the Moon has less mass on Earth (Y5).

Year 5: Summer 2

Physics: Earth & Space

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• Geography: We live on the Earth (Y1 Aut). • Daytime is when the Earth is facing the sun; nighttime is when the Earth is facing away from the sun (Y1 Aut). • The Moon is more visible at night (Y1 Aut). • Animals, including humans, need food, water, oxygen and the right temperature to survive (Y2 Aut). • Light travels in a straight line (Y3 Aut). • Sources of light emit their own light, and others reflect light. (Y3 Aut). • Shadows form behind an opaque object when light from a source is blocked (Y3 Aut). • Sound travels through a medium; it cannot travel in a vacuum (Y4 Spr). • Gravity is a non-contact force that pulls all objects towards each other. • The greater the mass of the object, the greater the gravitational pull around it (Y5 Sum). • Air resistance is a frictional force that acts between air and a moving object to slow it down (Y5 Sum). • **Mass** is a measure of how much matter something is made from, which is measured in kg (or equivalent). The mass of an object is always the same. **Weight** is a force, it is measured in newtons (N). The weight of an object will differ depending on the force of gravity (Y5 Sum).	• The **universe** is made up of many **galaxies**. Our galaxy is called the **Milky Way.** • The **Milky Way** is made up of lots of **solar systems.** • Our solar system consists of a **star** (**Sun**), **planets** (which **orbit** a star), **satellites** (which orbit **planets**), and other bodies including **asteroids**, **meteoroids**, **meteors** and **meteorites.** The Sun is at the centre of the solar system - the **heliocentric model.** • The sun, planets and **moons** are approximately **spherical** bodies. • Planets orbit the Sun in the same **plane**; moons orbit planets. They are held in their orbits by **gravity**. • The Earth takes 365.25 days to orbit the sun (one year). Every four years our Earth year is one day longer, this is called a **leap year**, this year accounts for the four 0.25 days. • There are eight planets (M, V, E, M, J, S, U and N). Each planet has different characteristics, e.g. temperature; time taken to orbit the sun; number of moons; size. • The Earth **rotates** on its **axis** once every 24 hours, so only half of the Earth is facing the Sun at any one time; this creates night and day. • The Earth's rotation means that the sun appears to 'rise' in the east and 'set' in the west. • The Moon orbits the Earth in 28 days and, during this time, the sun shines on different parts of it. This creates phases of the Moon, including **new moon**, **crescent**, **quarter moon**, **gibbous moon** and **full moon.** • Space is a **vacuum**, which means there are no particles. • The Earth's Moon has less **mass,** so its **gravitational** force is less. • Geography: Vertical lines called meridians split the Earth into 24 different time zones. • Geography**:** Each time zone is x hours ahead or behind London, at the Prime Meridian. • Geography: Some countries choose to operate in multiple time zones.	• The Earth's tilt creates seasons, and different day lengths at different times of the year (KS3). • Calculating gravity force on different planets and stars (KS3). • The light year as a unit of astronomical distance (KS3). • Movement of stars and constellations (KS3).
Disc.	• Mathematics: Number of minutes in an hour; hours in a day (Y3); Number of days in a month, year and leap year (Y3). • A&E: Identify scientific evidence that has been used to support or refute ideas (Y4 Aut).	***Look for patterns between a planet's distance from the Sun and its temperature and size.*** ***Consider how the number of planets that humans consider to be planets has changed over time.*** • A&E: Science is never 'complete' and scientists are always working to make models more accurate or to discover new explanations.	• Scientists seek to understand how accurate their results are, and how confident they can be in their findings (KS3).
VCs	• 3: There is gravitational force between all objects, but it is only felt when one or more of the objects has a very large mass. The greater the mass, the greater the gravitational force. Objects on Earth are pulled to the centre of the Earth because the Earth's mass and therefore gravitational force is much larger than that of the objects (Y5). • 5B: Air is a mixture of lots of different gases, including oxygen and carbon dioxide. • 6: The Sun emits light, some of which reaches Earth. The moon reflects light from the Sun (Y3).	• 3: The downward force of gravity on an object on the Moon is less than that on Earth because the Moon has less mass on Earth. • 5B: There is less and less air further away from the Earth's surface; space is a vacuum. • 6: Our Sun is one of many stars that make up the Universe. The distances between us and the bodies in solar system is huge, and even bigger in the Universe.	• 3: How quickly an object's motion is changed depends on the force acting and the object's mass. The greater the mass of the object, the longer it takes to speed it up or slow it down (inertia). (KS3) • 6: The movements of galaxies suggest that the Universe is expanding from a past state called the 'big bang'. (KS3)

Year 6: Autumn 1

Physics: Electricity

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• A complete circuit must have a power source (cell/batteries) and have all the components connected in a loop. If it is missing any of these things it is an incomplete circuit (Y4 Sum). • A short circuit is the easiest route for electricity to travel and can be created by accident by connecting just the wire to the cell in a circuit. They can be dangerous (Y4 Sum). • Components include wire, lamp, buzzer, motor or switch Materials that allow electricity to flow through them easily are called electrical conductors; materials that do not are called electrical insulators (Y4 Sum). • Appliances use electricity to serve a purpose (e.g. toaster, kettle etc.) (Y4 Sum). • Energy can be transferred from one store to another store (Y5 Aut). • Fossil fuels, batteries and the Sun are all examples of chemical energy stores (Y5 Aut). • In a circuit that has a battery, the battery is a chemical store of energy. Energy is transferred electrically to the device in the circuit, but the device does not store energy. Instead, it changes the way that it is transferred (Y5 Aut). • Geography: Fossil fuels are materials made from fossils of organisms over millions of years, like coal and oil. Humans use these to run cars/electrical items (Y5 Aut).	• There are recognised **symbols** for cell, lamp, buzzer, motor, and switch. Wires are represented with straight lines. • As long as batteries have the same **voltage**, the size of the battery does not affect the brightness of the lamp/loudness of the buzzer (though the smaller batteries will not last as long as the larger ones). • Adding more cells in the circuit increases the voltage. Increasing the voltage in a circuit makes the lamp in the circuit get brighter or the buzzer get louder. • More than one lamp can be put into one circuit. They can be placed in **series** or in **parallel**. • In a **series** circuit, the lamps are placed in a **continuous** loop. In **parallel**, the lamps are placed in separate loops that both connect to the cell. • Connecting lamps in parallel means that if one lamp burns out the other will stay on and switches can be used to turn each lamp off independently. • Many of the **appliances** used in the home do not use batteries they use **mains electricity**. • Mains electricity is **generated** in a **power station** and transferred to our homes by overhead cables. Power stations can use both **renewable** and **non-renewable** sources of energy to generate electricity. • A **non-renewable energy resource** is one that is used much faster than it is created. Fossil fuels take millions of years to form but minutes to burn, so we will run out. Burning fossil fuels to transfer electrical energy is a non-renewable energy source. • **Renewable energy resources** quickly replenish themselves, meaning that we can use them again and again and we will not run out. **Wind**, **solar**, **geothermal** and **hydrological** power are all examples of renewable energy resources. • Coal, oil and gas are all used to generate electricity. The store of chemical energy in the fuel is transferred electrically to the appliances that we use in the home.	• Geography: Improving the environment, and places in the world that have climates or physical features that lend themselves to using renewable sources to generate electricity (Y6 Aut2). • Electric current is measured in amperes using an ammeter. Current is a flow of charge (KS3). • Current can be measured in parallel and series circuits. The current will be the same at all points in a series circuit (KS3). • Current splits where the circuit branches in a parallel circuit, currents add where branches meet (KS3). • Potential difference is measured in volts (V) using a voltmeter. It is measured across a component (KS3). • In a series circuit the sum of the potential difference across all components will equal the battery voltage. In a parallel circuit the potential difference across each of the components will be the same as that of the battery (KS3). • Resistance is measured in ohms and is the ratio of potential difference to current (KS3). Conducting and insulating components will differ in resistance (KS3).
Disciplinary	• Mathematics: Interpret/construct bar charts (Y3); discrete data is data you count; continuous data is data you can measure (Y4); interpret/construct bar, line graphs (Y4) • A&P: dependent, independent and control variables (Y3) • R&P: Line graphs can be used when data is continuous; bar charts can be used when data is discrete (Y5 Sum) • A&E: Draw conclusions (e.g. 'the greater the… , the greater the…') (Y4 Spr)	**Three different enquiries, where pupils will plan the most appropriate type of investigation and how they should present their results:** 1. **Investigating the effect of increasing voltage on the volume of a buzzer or the brightness of a lamp** 2. **Investigating the effect of changing the number of components in a circuit on the volume of a buzzer** • R&P: Decide which graph is most appropriate for the enquiry.	• Planning more complex investigations to answer more challenging questions (KS3).
VCs	• 4: Energy cannot be created or destroyed. When energy is transferred from one object to others, the total amount of energy in the universe remains the same; the amount that one object loses is the same as the other objects gain. Two examples of energy stores are thermal stores and chemical stores of energy (Y5).	• 4: Energy resources can be renewable (such as wind, solar, geothermal and hydrological) or non-renewable (such as fossil fuels).	• Geography: Use of energy resources to generate electricity (advantages and disadvantages). (Y6)

Year 6: Autumn 2

Biology: Evolution

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• Living things have adapted to their environment. This means they may not be able to survive in other habitats (Y2 Spr). • A fossil is physical evidence of an ancient plant or animal , this could be their preserved remains or other traces that they made when they were alive. Trace fossils are not physical remains of living things they are indirect evidence of life (Y3 Aut). • A species is a group of one type of organism, individuals in this group can breed with each other to produce offspring that can go on to breed. (Y4 Aut). • **Geography**: Animals and plants have adapted to life in the rainforest (buttress roots, lianas, spider monkey, toucan, and fire ants) (Y4 Spr). • Sexual reproduction is two parents - usually male and female - create a new organism by mixing their genomes (Y5 Spr). • **History**: Homo sapiens first lived in East Africa ~200,000 BC and migrated across the world over 1000s of years (Y5 Sum). • **Geography**: Flora and fauna that have adapted to life in the tundra (Arctic hare, polar bear) hot desert (cactus, camel, Saharan silver ant, cape ground squirrel) temperate forest (deciduous and coniferous trees, red squirrels, hedgehogs, and southern wood ants) coral reefs (soft coral, pistol shrimp & goby fish, octopus & grouper) (Y5 Sum).	• **Variation** occurs within and between **species.** • Variation can be **environmental** or **genetic**, or a mixture of both. • **Genetic** variation happens randomly through the mixing of **genomes** in **sexual reproduction**. • Some variation is **advantageous** to the organism in their environment; sometimes it is **disadvantageous**; and sometimes it gives no advantage/disadvantage. • An **organism** with **advantageous traits** are more likely to survive and reproduce, passing those traits to the next generation. This is called **natural selection.** • These advantageous traits - **adaptations** - can be **physiological**, **structural** and **behavioural.** • Over many generations, the species will **evolve** so that all organisms have this adaptation/advantageous trait. • **Homo sapiens** originated in many parts of Africa. • **Fossils** provide evidence for evolution, because they show how organisms have changed over time. • Scientists involved in the development of evolutionary biology include Al-Jahiz, Charles Darwin, Alfred Wallace, Mary Anning and Dr Danielle Lee.	• Hereditary is the process by which genetic variation is transmitted from one generation to the next (KS3). • Chromosomes are made of DNA. Small sections of DNA are called genes. We inherit genes from our parents, and this is how genetic variation is transmitted from one generation to the next (KS3). • Variation between individuals of the same species is either continuous or discontinuous, this variation means that some individuals will compete more successfully and are more likely to survive, this drives a process known as natural selection. In this process advantageous versions of genes are passed onto offspring (KS3). • Changes to the environment can lead to individuals of some species or even entire species less well adapted to their environment. This can lead to extinction. Biodiversity is important and we need to maintain it (KS3).
Disciplinary	• A&E: Identify scientific evidence that has been used to support or refute ideas (Y4 Aut). • R&P: Use a Venn diagram to classify items into two or three sets based on properties (Y1 Sum). • A&P: Science is never 'complete' and scientists are always working to make models more accurate or to discover new explanations (Y5 Sum).	***Sort variations within species in a Venn diagram, based on whether they are genetic, environmental or a mixture of both.*** ***Identify how evidence of fossils has been used to support to change the theory of the evolution of Homo sapiens.***	
VCs	• 10: Living things are adapted to their environments. If the environment changes, the organisms may no longer be adapted and may struggle to survive (Y2).	• 10: Variation exists within species, caused by genetic and environmental factors. Living things are found in certain environments because they have the features that enable them to survive there. This adaptation to their environment has come about because of the small differences that occur during reproduction, resulting in some individuals being better suited to the environment than others. In the competition for materials and food, those that are better adapted will survive and are more likely to pass on their adapted feature to their offspring. Fossils are evidence of evolution.	• 10: The natural selection of organisms has been going since the first form of life appeared on Earth 3.5 billion years ago. Multi-cellular organisms evolved around 2 billion years ago (KS3).

Year 6: Spring 1

Physics: Light

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• We see shadows during the day and rainbows when there is sunshine and rain (N3-4 Aut1). • Light travels in straight lines (Y3 Aut). • We see when light enters our eyes (Y3 Aut). • Darkness is the absence of light (Y3 Aut). • Sources of light emit their own light, and others reflect light; both occur in nature as well as man-made objects (Y3 Aut). • Opaque, translucent and transparent materials allow no, some or all light to pass through them (Y3 Aut). • Shadows form behind an opaque object when light from a source is blocked (Y3 Aut). • The shape and position of shadows changes with the angle of the light source (Y3 Aut). • The size of shadows changes when the distance of the light source changes (Y3 Aut). • Light from the sun can be dangerous and there are ways to protect our eyes and skin. (Y3 Aut). • Energy can be transferred from one store to another store (Y5 Aut). • Fossil fuels, batteries and the Sun are all examples of chemical energy stores (Y5 Aut). • When energy is transferred from one store to another, it can be transferred by light or electrically (Y5 Aut). • When energy is removed from one store and is transferred to another store, the amount of energy in the first store goes down and the amount of energy in the second store goes up (Y5 Aut). • Energy is not used up; it is just moved around from store to store (Y5 Aut).	• When light meets an opaque object, some of the light is reflected and some of it is absorbed. • Shadows have the same shape as the objects that cast them because light travels in straight lines. • The size and shape of shadows behind an **opaque** object can be explained using ray diagrams. • Objects **emit** (give out) or **reflect** light into the eye. We see things because light travels from **light sources** to our eyes, or from light sources to objects and then to our eyes • Objects would be invisible if they did not reflect light. • The eye is made of many parts: the **pupil** is the circular black hole in the center of the eye, the **iris** is the coloured part of the eye that surrounds the pupil, and the **lens** is a structure found behind the pupil. • The pupils allow light to enter the eye. • The iris controls how much light enters the eye by changing the size of the pupil. • The lens helps to focus the light rays entering the eye. • **White light**, which comes from most light sources we use in the classroom, contains all the colours of the **visible spectrum** (red, orange, yellow, green, blue, indigo, violet). • When a light meets a surface, some colours are **absorbed** and some are **reflected**. We see the colour(s) that are reflected. • Objects appear black if they absorb all the colours in white light and reflect none. Objects appear white if they reflect all the colours in white light, and absorb none. • Many problems with our vision are caused by parts of the eye that are the not the right shape or size, or that have become cloudy. Many of these problems can be corrected through surgery or **prescription** glasses. • People living with sight loss or blindness may use long canes or guide dogs when outside, talking books or **Braille**, and different devices in the home. • On a flat surface, all light meeting a surface from one direction will be reflected in the same direction. This is known as **specular reflection.** • On a rough surface, light will be reflected in all directions. This is known as **diffuse reflection.** • Specular reflection between mirrors allow us to see the objects that do not directly reflect light into our eyes (e.g. periscope).	• The transmission of light through materials, to include absorption, diffuse scattering and specular reflection at a surface (KS3). • Light waves can travel through a vacuum they do not require a medium (KS3). • Light waves travel at the speed of light (KS3). • The similarities and differences between light waves and waves in matter (KS3). • Use of ray model to explain imaging in mirrors, the pinhole camera, the refraction of light and the action of a convex lens in focusing (KS3). • The human eye (KS3). • Light transferring energy from a source to an absorber leading to chemical and electrical effects; photosensitive material in the retina and in cameras (KS3). • Colours and the different frequencies of light, white light and prisms; differential colour effects in absorption and diffuse reflection (KS3).
DK	• R&P: Draw a diagram, a simple scientific drawing that explains or informs.	***Draw ray diagrams to show how light travels and how shadows are formed***	
VCs	• 2: Objects can affect other objects even when they are not in contact with them. Light reaches our eyes, even though the light source may be far away (Y3). • 6: The Sun emits light, some of which reaches Earth. The Moon reflects light from the Sun (Y3).	• 11: Visual impairments include long and short sightedness, colour vision deficiency, and blindness. Some of these can be corrected, and some people with visual impairments will use Braille, magnifying devices, canes and/or guide dogs.	• 4: Energy can be transferred as radiation (KS3).

Year 6: Spring 2

Biology: Further Classification

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• Coniferous plants keep their leaves all year round; deciduous plants lose their leaves in winter (Y1 Aut). • The **stem/trunk** supports the plant and transports water up the plant. The **xylem** transports water and nutrients from the roots, and the **phloem** transports food from the leaves to the all parts of the plant (Y3 Spr2). • Seeds can be dispersed by wind (e.g. sycamore), by animals in their droppings (e.g. things that are eaten, like a raspberry), attached to animal fur (e.g. goosegrass), or seeds can be self-propelled (pea pod) (Y3 Spr2). • Classification refers to a method used to place all living things into groups. Organisms can be classified in a number of ways (Y4 Aut). • A species is a group of one type of organism, individuals in this group can breed with each other to produce offspring that can go on to breed (Y4 Aut). • Fish, amphibians, reptiles, birds and mammals are all vertebrates. Vertebrates have endoskeletons (Y4 Aut). • Vertebrates can be grouped in a number of ways based on their characteristics, e.g. warm/cold blooded; or physical features like fur, beak, wings etc. (Y4 Aut). • Invertebrates can be grouped based on their characteristics as snails and slugs; worms; spiders and insects (Y4 Aut). • Invertebrates can be grouped based on their skeletons; endoskeletons, exoskeletons, or hydrostatic skeletons (Y4). • Plants can be grouped into flowering and non-flowering plants (Y4 Aut). • A cell is the smallest building block of living things. All organisms are made of cells (Y5 Spr). • Asexual reproduction does not involve sex cells or fertilisation. Only one parent is needed, and the offspring are (genetically) identical to the parent and each other (Y5).	• **Invertebrates** can be grouped based on their characteristics as poriferans (sponges) cnidarians, echinoderms, molluscs, annelids, platyhelminths and arthropods. • **Arthropods** can be grouped into 4 sub-groups: spiders, insects, crustaceans and myriapods). • Plants can be grouped into mosses, ferns, conifers and flowering plants. • **Fungi** are different to plants and animals. They cannot make their own food (like animals) but do not move (like plants). • **Micro-organisms** are organisms that are so small that we cannot see them with our eyes alone. • Some **fungi** are microorganisms (e.g. yeast), but not all are (e.g. mushrooms). • **Bacteria** and viruses are microorganisms. • Some **bacteria** can cause disease in other organisms. • Some bacteria are helpful for other organisms (e.g. those that help break down food in our digestive system) and those that form part of a **symbiotic relationship.**	• Plants and animals are made of cells. There are similarities and differences between the cells of animals and plants (KS3). • Many plant cells have chloroplasts, and this enable plants to photosynthesise. The reactants of this process are carbon dioxide and water, and the products are sugar (glucose) and oxygen (KS3). • The differences between species and how this difference can drive natural selection. (KS3).
Disciplinary	• Gather information from text/books/images (Y2 Spr) and the internet (Y3 Spr). • R&P: Use a classification key to identify an object (Y4 Aut). • R&P: Draw a dichotomous classification key to help others identify an object (Y4 Aut). • R&P: Present information in a written format (Y4 Sum).	***Use and draw classification keys to help classify invertebrates and plants*** ***Research the harmful effects that bacteria can have on humans and other organisms, and present this information in a written format.***	
VCs	• 7: A cell is the smallest building block of living things. All organisms are made of cells (Y5).	• 7: Micro-organisms are organisms that are so small that we cannot see them with our eyes alone.	• 7: All organisms are made of one or more cells. All the basic functions of life – growth, reproduction, extracting energy from food – are the results of what happens inside cells. Cells are often aggregated into tissues, tissues into organs, and organs into organ systems (KS3).

Year 6: Summer 1

Biology: Functions of the Human Body

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	•Humans are made of many different body parts (Y1 Sum). •Humans need exercise to stay healthy (Y2 Aut). •Living things **m**ove, **r**eproduce, are **s**ensitive to their **s**urroundings, **g**row, need **o**xygen, get rid of their **w**aste, and need **n**utrition (MRS GOWN) (Y2 Spr) •Humans need a balanced diet of these food groups (Y3 Spr). •Organs are parts of the body that do a particular job, the heart pumps blood around the body and the lungs are used for breathing which gets air into your body (Y3 Spr). •Oxygen and carbon dioxide are found in the air (Y3 Spr). •The digestive system is the group of organs that help your body digest food (Y4 Aut). •Food is further broken down (chemical digestion) in the small intestines where most of the nutrients are absorbed (Y4 Aut). •A cell is the smallest building block of living things. All organisms are made of cells (Y5 Spr). •There are lots of different types of cell, which each have different purposes (Y5 Spr).	•Living things **m**ove, **r**eproduce, are **s**ensitive to their **s**urroundings, **g**row, respire, excrete, and need **n**utrition (MRS GREN). •**Respiration** provides the energy needed for organisms to function. **Oxygen** and **glucose** (a sugar) are needed by **cells** for respiration. Carbon dioxide is a waste product of respiration and needs to be **excreted**. •**Blood** carries **oxygen**, **glucose**, **nutrients,** and **carbon dioxide** to and from cells around the body. •The **heart** is a muscle that pumps the blood through the **blood vessels**. •The heart pumps **deoxygenated** blood to the lungs, where oxygen is transferred to it, and it flows back to the heart. The heart pumps **oxygenated** blood to the rest of the body, where the oxygen is transferred to the organs/muscles and carbon dioxide is transferred to the blood. Deoxygenated blood then travels back to the heart to begin the process again. •**Glucose** and **nutrients** are absorbed by the blood along the **small intestine** and transported to cells. •**Arteries** carry blood away from the heart. Arteries have thick walls because they carry blood from the heart which is at a high pressure. Blood is being pumped through very quickly. Arteries mostly carry oxygenated blood. •**Veins** carry blood back to the heart. They mostly carry deoxygenated blood. •Arteries branch into smaller blood vessels called **capillaries**, which are very small and supply our cells with oxygen, glucose and nutrients. Capillaries collect carbon dioxide from cells and merge into veins. •The **heart rate** is how quickly the heart pumps. It is usually measured in beats/min. Muscles need more oxygen when they are being used in exercise, so the heart rate increases. •Being **healthy** means being in a state of **physical**, **mental** and **social** wellbeing and free from disease. •Diet and exercise can have a positive effect on our bodies. Other lifestyle choices impact our health. •A **drug** is a substance that, when taken into the body, has an effect on it. Some drugs (**medicines**) are helpful, and some are only harmful. All drugs are harmful when taken in the wrong quantities. •Tobacco smoke contains nicotine, tar and carbon monoxide. These have a damaging effect on the body.	•The hierarchical organisation of multicellular organisms. Organisms consist of organ systems which are made of organs. Organs are a collection of different tissues and tissues are made of cells. An example being the circulatory system (KS3). •Aerobic respiration occurs in the cells of organisms, it involves the breakdown of organic molecules (sugar) and using oxygen (KS3). •The blood is oxygenated in the lungs and this is transported to the organs (and cells) that require it for aerobic respiration, along with sugar, by the blood vessels in the circulatory system (KS3). •Gas exchange systems in humans are adapted to their function as they have many alveoli which provides a large surface area for diffusion (KS3). •The mechanism of breathing moves air in and out of the lungs (KS3). •The role of diffusion in the movement of materials in and between cells (KS3). •The impact of smoking on the human gas exchange surface (KS3).
Disciplinary	•Mathematics: Calculate/ interpret the mean (Y6). •A&P: Make a prediction based on substantive knowledge (Y2 Aut); A&E: Use scientific understanding to explain their findings (Y3 Sum). •M&O: Taking multiple readings allows you to see if your data is repeatable and helps identify outliers.	***Investigate the effect of exercise on heart rate*** •M&O: Planning to take multiple readings allows anomalous data to be identified and enables a mean to be calculated. Repeats show if our data is repeatable. •A&E: Calculating the mean can be used as a method of analysing data. ***Research effects of smoking on the human body, and how our scientific understanding has changed over time, including in the current day.***	
VCs	•4: All living things need food to give them energy and other things (Y2). •7: A cell is the smallest building block of living things. All organisms are made of cells (Y5). •8: Living things move, reproduce, are sensitive to their surroundings, grow, need oxygen, get rid of their waste, and need nutrition (MRS GOWN) (Y2). •11: Ageing happens naturally, and can be sped up by environmental factors like smoking (Y5).	•4: All organisms respire. •7: Respiration takes place in cells. •8: Living things move, reproduce, are sensitive to their surroundings, grow, respire, excrete, and need nutrition (MRS GREN). •11: Being healthy means we are in a state of physical, mental and social well being and are free from disease. Some drugs can help us and some can harm us (particularly in the wrong quantities).	•4: Biological process of respirations, including reactants and products (KS3). •7: All organisms are made of cells. All the basic functions of life are the results of what happens inside cells. Cells are often aggregated into tissues, tissues into organs, and organs into organ systems (KS3). •11: The biological causes and effects of diseases, exercise, lifestyles and deficiencies on the body (KS3).

Year 6: Summer 2

Chemistry: Physical & Chemical Changes

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	• Digestion in the human body can be chemical and mechanical (Y4 Aut). • Physical properties are properties that we can measure or observe in the classroom. They include electrical conductivity; melting and boiling points; thermal conductivity; being malleable; windproof; hard/soft; and magnetic (Y4 Sum). • Chemical properties are properties that scientists need specialist equipment to measure. They include flammability and toxicity (Y4 Sum). • A mixture is two or more substances, e.g. air, steel (Y5 Aut). • Mixtures can be made of two gases (e.g. air), two solids (e.g. steel), two liquids (e.g. squash and water), or a liquid and a solid (e.g. salt water) (Y5 Aut). • A solvent is a liquid that is used to dissolve other substances (Y5 Aut). • A reversible change is a change that can be undone, where the original substances can be recovered (Y5 Aut). • An irreversible change is a change that cannot be undone, where the original substances cannot be recovered (Y5 Aut). • Carbon dioxide is produced when fossil fuels are burned.(Geo Y5 Sum).	• A mixture is two or more substances that are mixed but not chemically joined together. • Distillation is a separating technique that can separate a solvent from a solution. It relies on evaporation and condensation. • Chromatography is a separation technique in which a mixture is dissolved into a solvent, and the components of the mixture are carried by the solvents at different rates. • A chemical change is a change where a new substance is formed. • A chemical change has usually taken place if: gas bubbles appear; a new solid appears; it changes colour; or changes temperature. • A physical change is where the substance changes its properties, but it does not become a different substance. • Some chemical changes are irreversible, (e.g. cook an egg, rusting iron), but some can be reversed. • Most physical changes are reversible (e.g. water to ice), but some are not (e.g. crack an egg, turn wood into sawdust). • Chemical reactions can be summarised using word equations. • Word equations show the names of the chemicals reacting and the names of the products formed. • A combustion reaction occurs when a fuel is heated and reacts with oxygen. A product of a combustion reaction is carbon dioxide. Combustion is an irreversible chemical reaction. • Rust is an irreversible chemical reaction. It requires iron, water and oxygen.	• In a chemical reaction, mass is conserved (KS3). • In a chemical reaction, there is a rearrangement of atoms (KS3). • Chemical reactions can be represented using formulae and equations (KS3). • Examples of types of chemical reactions include combustion, thermal decomposition, oxidation neutralisation and displacement (KS3). • Reactions of acids with metals produces a salt and hydrogen (KS3). • Reactions of acids with alkalis produces a salt and water (KS3). • Reactions can be endothermic or exothermic (KS3).
Disciplinary	• A&P: Scientists group objects or living things based on their properties (Y1 Spr). • A&P: Make a prediction based on substantive knowledge. • A&P: Scientists identify potential hazards in their experiments and plan ways to reduce them (Y2 Spr). • R&P: Use a Carroll diagram to classify items based on properties (Y1 Spr). • R&P: Present information in a written format.	***Use a Carroll diagram to classify changes as physical/chemical and reversible/irreversible*** ***Carry out changes and identify whether the change created is physical/chemical and reversible/irreversible***	
VCs	• 1: Properties of materials can be physical (such as hardness) or chemical (such as toxicity). (Y4)	• 1: A chemical change is where a new substance – that is made of a different type of particle – is formed.	• The smallest piece of a material is called an atom. All materials, anywhere in the universe, living and non–living, are made of a very large numbers of these basic 'building blocks', of which there are about 100 different kinds (KS3).

Vertical Concepts

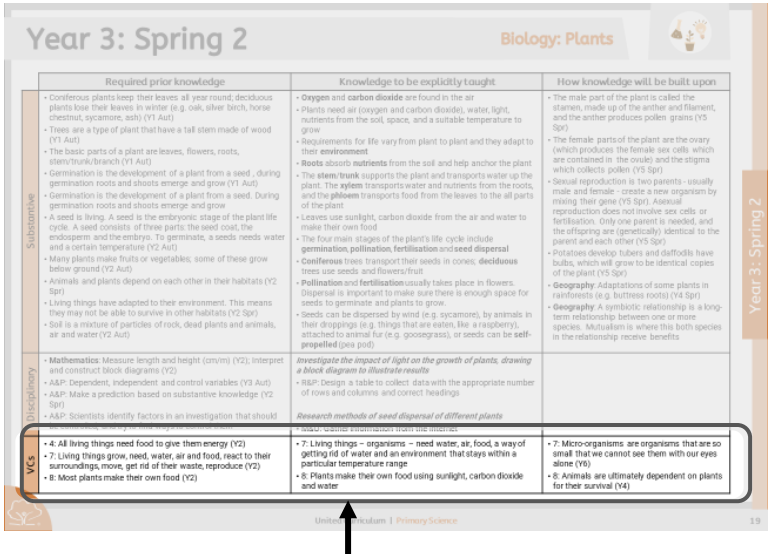
The 'big ideas of science education' were first published by Wynne Harlen and a group of experts in science education in 2010. These ideas set out key concepts that, when understood together, allow pupils to understand the world around them.

The ideas are expressed in the form of narrative descriptions that builds the understanding of key ideas from primary to secondary education. They cannot be understood in single units or lessons; we need to build concepts by attending to them in small steps within the curriculum.

Ten ideas are **ideas of science**, and span the disciplines of chemistry, biology and physics. Four are **ideas about science**, and contribute to pupils' disciplinary understanding of how scientists work today.

Ideas of science

1. All material in the Universe is made of very small particles.
2. Objects can affect each other at a distance.
3. Changing the movement of an object requires a net force acting on it.
4. The total amount of energy in the Universe is always the same but energy can be transferred when things change or are made to happen.
5. The composition of Earth and its atmosphere and the processes occurring within them shape the Earth's surface and its climate.
6. The solar system is a very small part of one of millions of galaxies in the Universe.
7. Organisms are organised on a cellular basis.
8. Organisms require a supply of energy and materials for which they are often dependent on or in competition with other organisms.
9. Genetic information is passed down from one generation of organisms to another.
10. The diversity of organisms, living and extinct, is the result of evolution.
11. Organisms are healthy when physically, mentally and socially well and free from disease. [This is additional to the original ten ideas and included as we felt it important].



Most units attend to at least one of these big ideas. The unit overview outlines the relevant building blocks that pupils will learn in each unit, and how the idea is developed in previous and subsequent units or at KS3-4.

Progression in Vertical Concepts

Chemistry

1.

All material in the universe is made of very small particles.

Objects have a purpose and are made of different **materials**.

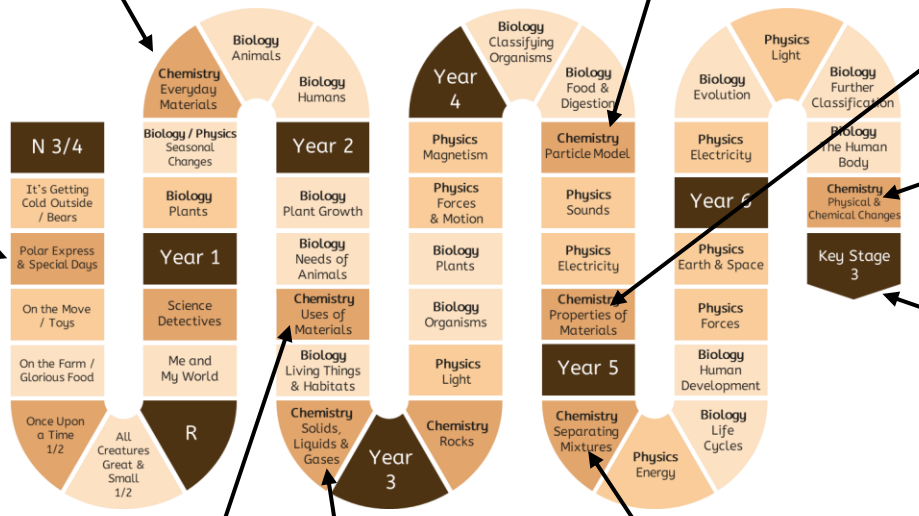
If a material could be divided into smaller and smaller pieces, it would be found to be made of **particles**, which smaller than can be seen even with a microscope. These particles are not *in* a material; they *are* the material.

The particles of a substance are arranged differently when it is solid, liquid or gas.

Properties of materials can be physical (such as hardness) or chemical (such as toxicity).

The same thing (water) can look different when it is hot or cold (ice).

A **chemical change** is where a new substance – that is made of a different type of particle – is formed.



The smallest piece of a material is called an **atom**. All materials, anywhere in the universe, living and non-living, are made of a very large numbers of these basic 'building blocks', of which there are about 100 different kinds.

All the 'stuff' encountered in everyday life, including air, water and different kinds of solid substances, is called **matter**.

Different materials are recognisable by their **properties**.

Materials have different properties, which make them suitable for specific purposes.

Matter can exist in three different **states**: as **solids**, **liquids** and **gases**.

The amount and type of **substance** does not change when the matter changes state.

A **pure substance** is one that contains only one type of particle.

A **mixture** is created when two or more substances are mixed. The two types of particle are mixed together, but the particles themselves stay the same.

Progression in Vertical Concepts

Physics

2.

Objects can affect each other at a distance.

3.

Changing the movement of an object requires a net force to be acting on it.

3. Forces act in pairs. Forces acting against each other are **opposing**.

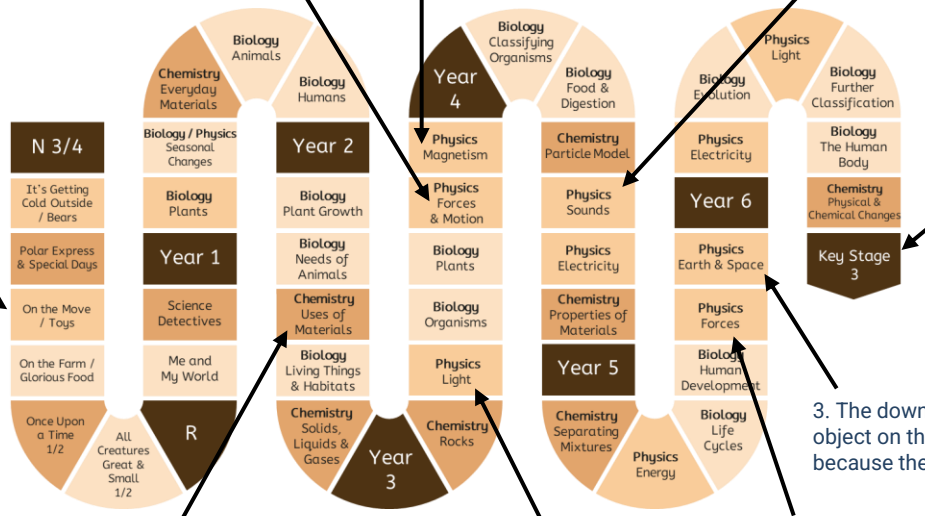
If opposing forces equal, they are **balanced,** and the object's motion will stay the same; this includes staying stationary. If opposing forces are unequal, they are **unbalanced** will change an object's speed, direction or shape.

Friction is a force that will slow an object down.

2. The **non-contact** force of magnetism mean magnets can attract or repel other magnets and attract objects made of magnetic materials.

3. Friction is an example of a **contact** force.

2. Sound comes from objects that **vibrate** and can be detected at a distance from the source, because the air or other material around is made to vibrate. Sounds are heard when the vibrations in the air reach our ears.



2. **Magnets** can **attract** or **repel** other magnets.

Magnets attract **magnetic** objects.

3. We can **push** and **pull** objects to make them move.

2. There is attraction and repulsion between objects that are electrically charged. Visible light and other forms of radiation can travel through any empty space.

3. How quickly an object's motion is changed depends on the force acting and the object's mass. The greater the mass of the object, the longer it takes to speed it up or slow it down (inertia).

3. The downward force of gravity on an object on the Moon is less than that on Earth because the Moon has less mass on Earth.

3. We can move or change the shape of objects by pushing and pulling: by squashing, bending, twisting or stretching the materials.

2. Objects can affect other objects even when they are not in contact with them. Light reaches our eyes, even though the light source may be far away.

2. The non-contact force of **gravity** pulls objects towards the centre of the Earth.

3. There is **gravitational** force between all objects, but it is only felt when one or more of the objects has a very large mass. The greater the mass, the greater the gravitational force.

Objects on Earth are pulled to the centre of the Earth because the Earth's mass and therefore gravitational force is much larger than that of the objects.

Progression in Vertical Concepts

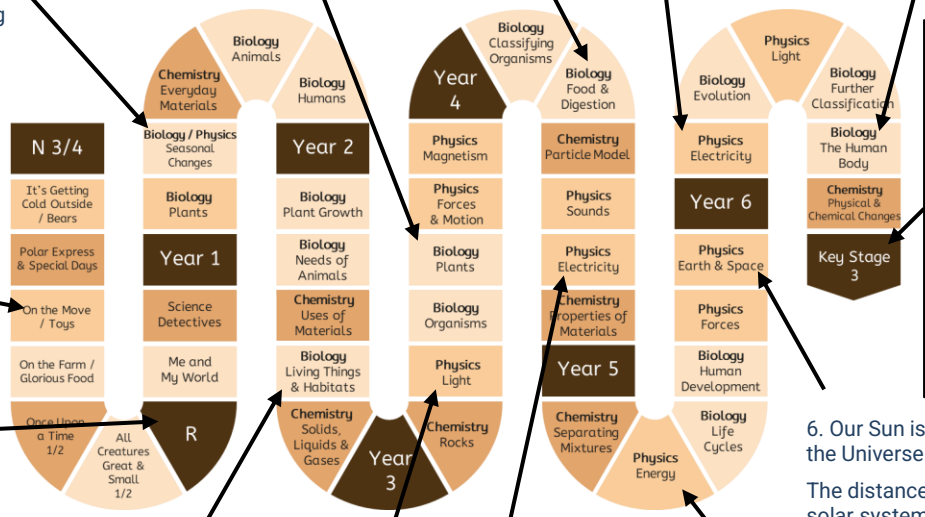
Physics

4.

The total amount of energy in the Universe is always the same, but energy can be transformed when things change or are made to happen.

6.

Our solar system is a very small part of one of millions of galaxies in our universe.



4. In most plants, sunlight, carbon dioxide and water are used to make food in the leaves.

4. The arrows in a **food web** show where energy is being transferred from and to.

4. Energy resources can be **renewable** (such as wind, solar, geothermal and hydrological) or **non-renewable** (such as fossil fuels).

4. All organisms **respire**.

6. Daytime is when the Earth is facing the Sun; nighttime is when the Earth is facing away from the Sun.

4. We have to push or pull objects to make them move; they do not move on their own.

6. Naming the Sun, Earth and Moon.

4. Objects have energy because of their chemical composition, their movement, their temperature, their position in a gravitational or other field, or because of compression or distortion of an elastic material.

6. The tilt of the Earth's axis gives rise to seasons.

The movements of galaxies suggest that the Universe is expanding from a past state called the 'big bang', towards a future that is still unclear.

6. Our Sun is one of many stars that make up the Universe.

The distances between us and the bodies in solar system is huge, and even bigger in the Universe.

4. All living things need **food** to give them energy (and other things).

All **food chains** start with a **producer** (a living thing that makes its own food).

The arrows in a food chain show where **energy** is being transferred from and to.

6. The Sun emits light, some of which reaches Earth. The Moon reflects light from the Sun.

4. A cell in a complete circuit can make a bulb light or buzzer sound. This will not happen without a cell.

4. Many processes and phenomena are explained in terms of energy exchanges.

Energy cannot be created or destroyed. When energy is **transferred** from one object to others, the total amount of energy in the universe remains the same; the amount that one object loses is the same as the other objects gain.

Two examples of **energy stores** are **thermal** stores and **chemical** stores of energy.

Energy resources – but not energy – can be depleted.

Progression in Vertical Concepts

Earth Science & Geology

5 (A)

The composition of the Earth and its atmosphere and the processes occurring within them shape the Earth's surface and its climate.

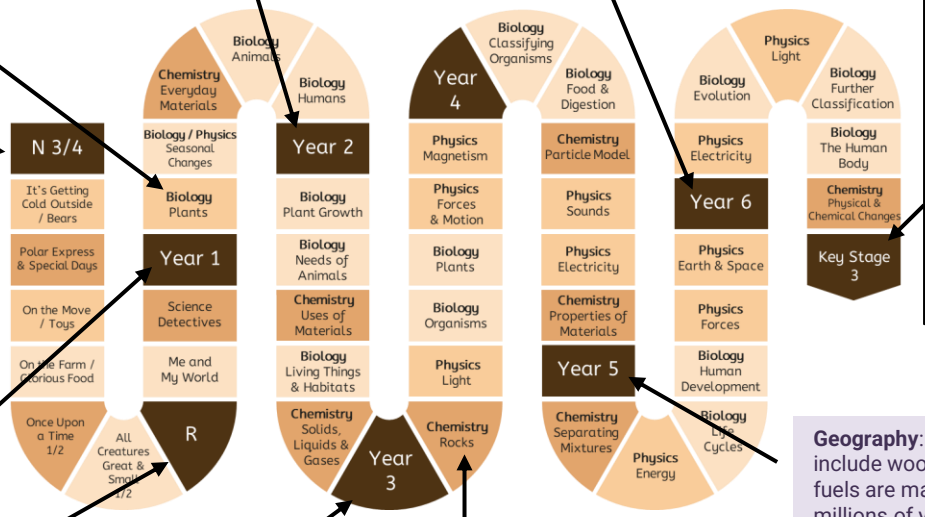
Geography: Features of hot deserts include rocks, sand dunes and oases. Features of cold deserts include mountains and ice sheets.

Rivers travel from highland areas to lowland areas. Physical features around rivers include valleys, mountains, hills and vegetation.

Geography: Use of fossil fuels to create plastics, and the effects this can have on the Earth.

Some plants grow in soil.

Describing the natural things in our local area.



Geography: Formation of volcanoes and mountains at different types of plate boundaries. Movement of tectonic plates as caused by convection currents.

Radioactive decay of material inside the Earth since it was formed is its internal source of energy. Understanding the use of Earth's energy resources in terms of energy stores and transfers.

Geography: We live on the Earth. Physical features occur in nature and include river, forest, soil and hill.

Coastal areas are areas of land that are near the sea. Features in coastal areas include beach, cliff, sea and ocean.

Geographical features include beach, hill, forest, sea and river.

Geography: There are several mountain ranges in the UK.

The Earth has four layers. Its upper layer of tectonic plates move.

Shield and composite volcanoes can form at plate boundaries, which produce lava, pyroclastic flows and lahars.

Soil is rich with nutrients around volcanoes.

Rocks are formed when placed under pressure.

Much of the solid surface of the Earth is covered in soil, which is a mixture of pieces of rock of various sizes and the remains of organisms. Some soil also contains air, water and some nutrients.

There are three main kinds of rock: igneous, sedimentary and metamorphic, which each have different composition and properties.

Geography: Examples of natural resources include wood, food, water and fossil fuels. Fossil fuels are materials made from fossils over millions of years, like coal and oil. Humans use these to run cars and electrical items.

Natural resources are unevenly distributed across the world and can be renewable or non-renewable (finite).

The upper course of a river is in high, mountains ground and the river is narrow and fast flowing. The lower course of a river is in low, flat ground and the river is wide and slow flowing. The middle course is between the two. Rivers erode, transport and deposit to form waterfalls, meanders and floodplains.

Progression in Vertical Concepts

Environmental Science

5 (B)

The composition of the Earth and its atmosphere and the processes occurring within them shape the Earth's surface and its climate.

Geography: The weather is short-term. Climate is long-term summary of the weather conditions.

Precipitation is the fall of water as rain, sleet, snow or hail.

Deserts are places where there is very little precipitation.

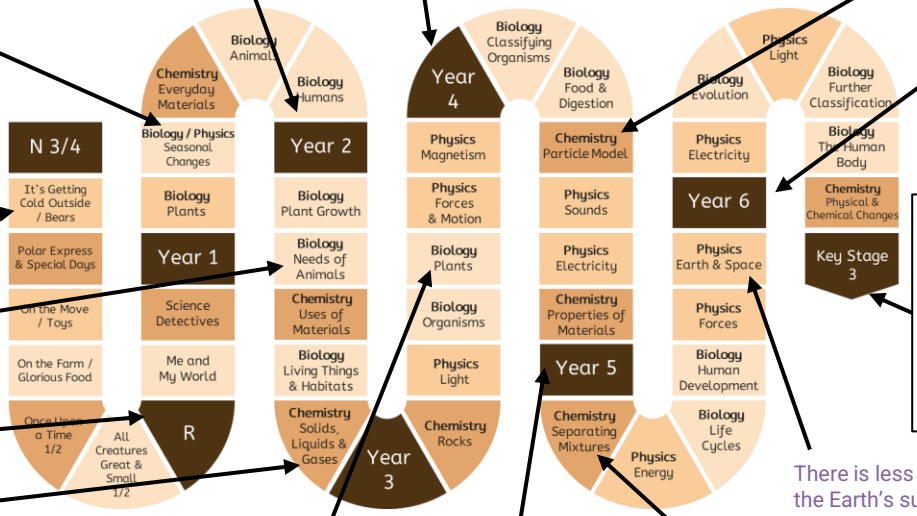
Geography: The layer of air around the Earth is called the atmosphere.

Atmospheric circulation causes some areas on Earth to have higher levels of precipitation than others.

Tropical rainforests are places where there is lots of precipitation.

The water cycle involves evaporation of water from oceans and condensation of water, which falls as precipitation.

The weather can change rapidly. The four different seasons have different weather patterns.



Geography: Mitigation and adaptation are ways that humans can reduce and live with the effects of climate change.

Geography: Weather is determined by conditions of the air. The pressure, temperature, direction and speed of the movement and the amount of water vapour in the air combine to create weather.

Understanding convection currents in terms of pressure and particles.

Types of weather include sunny, rainy, windy, and snowy.

The air is all around us on Earth. Air has oxygen in it.

We experience different types of weather in different seasons (focus on spring and winter).

Global warming describes the increase in Earth's average temperatures.

Air has carbon dioxide in it.

There is less and less air further away from the Earth's surface; space is a vacuum.

Air is a mixture of lots of different gases, including oxygen and carbon dioxide.

Geography: The amount of water on Earth is constant. Most is saltwater stored in oceans, and most freshwater is stored as ice or underground.

Water cycle: Evaporation from the air and transpiration from plants means that water vapour rises in the air. It condenses to form clouds and precipitation occurs when the clouds get heavy. Surface runoff is the flow of water overground; throughflow is the flow of water underground.

Climate zones share long-term weather patterns. There are six main climate zones: polar, temperate, arid, tropical, Mediterranean and mountains.

Biomes are areas of the world that, because of similar climates, have similar landscapes, flora and fauna. The major biomes of the world are tundra, tropical rainforests, coral reefs, temperate forests and hot deserts.

The natural greenhouse effect, the enhanced greenhouse effect, global warming and resulting climate change.

The increase in frequency of extreme weather events like heatwaves and drought as a result of climate change.

Progression in Vertical Concepts

Biology

7.

Organisms are organised on a cellular basis.

8.

Organisms require a supply of energy and materials for which they are often dependent or in competition with other organisms.

7. Plants are organised with roots, stem, leaves and flowers.

8. Living things, including humans, react to their surroundings with their senses.

8. Plants make their own food using sunlight, carbon dioxide and water.

8. The feeding relationships between organisms can be represented as food chains and food webs. They show where the energy is being transferred from and to.

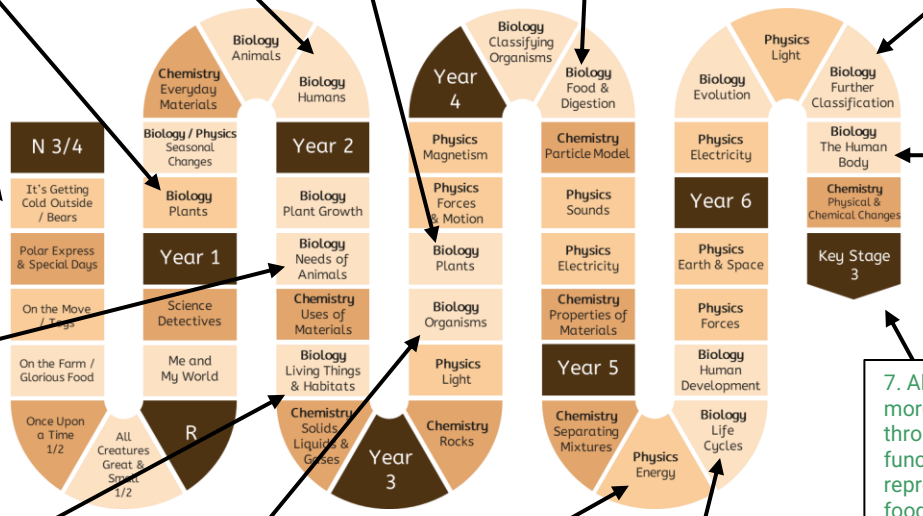
8. There is a wide variety of living things on Earth, including plants and animals.

7. Micro-organisms are organisms that are so small that we cannot see them with our eyes alone.

7. Respiration takes places in cells.

8. Living things move, reproduce, are sensitive to their surroundings, grow, respire, excrete, and need nutrition (MRS GREN).

8. All living things need food, oxygen, water and certain temperature conditions.



7. All organisms are made of one or more cells, which can only be seen through a microscope. All the basic functions of life – growth, reproduction, extracting energy from food – are the results of what happens inside cells. Cells are often aggregated into tissues, tissues into organs, and organs into organ systems.

8. Decomposers are essential (alongside producers and consumers) for a stable ecosystem.

8. Most plants make their own food. Animals' food comes from eating plants (herbivores) or by eating animals (carnivores), which have eaten plants or other animals. These relationships can be represented in a food chain.

Plants and animals are often dependent on each other.

Organisms are adapted to their environment. If conditions in a habitat change, organisms may not be able to survive.

Organisms move, reproduce, are sensitive to their surroundings, grow, need oxygen, get rid of their waste, and need nutrition (MRS GOWN).

7. Humans are organised with organs like hearts and lungs, which do particular jobs. The skeleton and muscles allow the body to move.

8. Energy is transferred to the Earth by light. When making their own food, plants transfer some of this energy to their chemical store. As other organisms eat these producers, some energy in this chemical energy store is transferred.

7. A cell is the smallest building block of living things. All organisms are made of cells.

There are lots of different types of cell (e.g. sex cells), which each have different purposes.

Progression in Vertical Concepts

Biology

9.

Genetic information is passed down from one generation of organisms to another.

10.

Diversity of organisms, living and extinct, is the result of evolution.

10. To help scientists make sense of the diversity of organisms, they are classified into different groups. Each group has similar features.

9. When a plant reproduces, it goes through stages of **pollination**, **fertilisation** and **seed dispersal**. The seed will then germinate and grow into a plant.

9. A **species** is a group of one type of organism. Individuals in this group can breed with each other to produce offspring that can go on to reproduce.

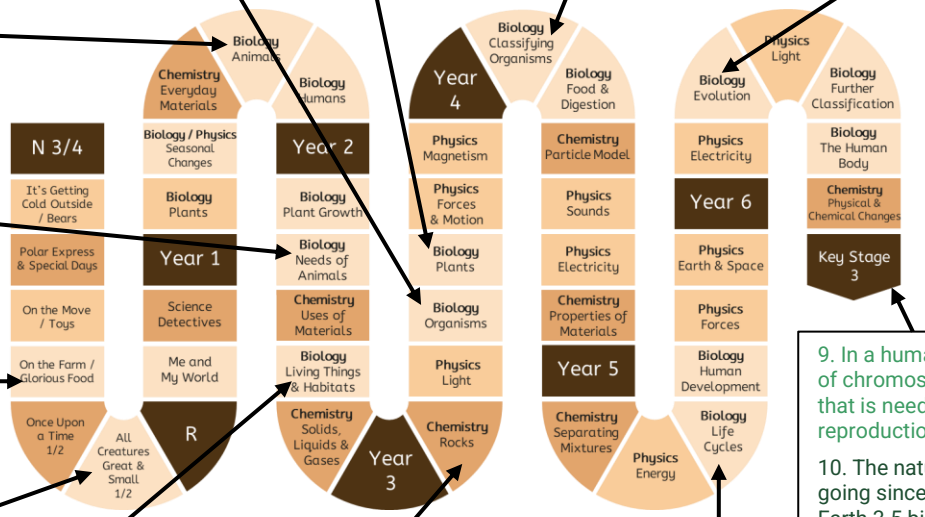
10. Variation exists within species, caused by genetic and environmental factors.

Living things are found in certain environments because they have the features that enable them to survive there. This adaptation to their environment has come about because of the small differences that occur during reproduction, resulting in some individuals being better suited to the environment than others. In the competition for materials and food, those that are better adapted will survive and are more likely to pass on their adapted feature to their offspring. Fossils are evidence of evolution.

10. There are lots of types of animal, and some types can be grouped as amphibians, birds, fish, mammals and reptiles.

9. Plants and animals **reproduce** (have **offspring**).

9. Young animals grow into adult animals. The young look similar, but not the same, as the adults.



9. In a human body, most cells contain 23 pairs of chromosomes. These provide information that is needed to make more cells in growth and reproduction.

10. The natural selection of organisms has been going since the first form of life appeared on Earth 3.5 billion years ago. Multi-cellular organisms evolved around 2 billion years ago.

10. There are many different kinds of plants and animals in the world today.

9. A **species** is a group of living things of the same type.

10. **Biodiversity** describes all the different living things in an area.

Living things are adapted to their environments. If the environment changes, the organisms may no longer be adapted and may struggle to survive.

9. When there are no living individuals of a species to reproduce, the species is **extinct**.

10. We know about extinct and dead species from **fossils**. These are the preserved remains (or traces) of organisms that lived many years ago.

9. An organism's **genome** is the information that controls how that individual organism will develop.

In **sexual reproduction**, two parents contribute to the formation of offspring. They each pass down half their genome through specialised cells called **sex cells**. The two halves are combined during **fertilisation**. While it inherits genetic information from both parents, the offspring's genome is distinct, which means the offspring is not identical to a parent.

Asexual reproduction involves only one parent. In this process, the offspring's genome is an exact copy of the parent's genome. The offspring is identical to the parent.

Progression in Vertical Concepts

Biology

11.

Organisms are healthy when physically, mentally and socially well and free from disease.

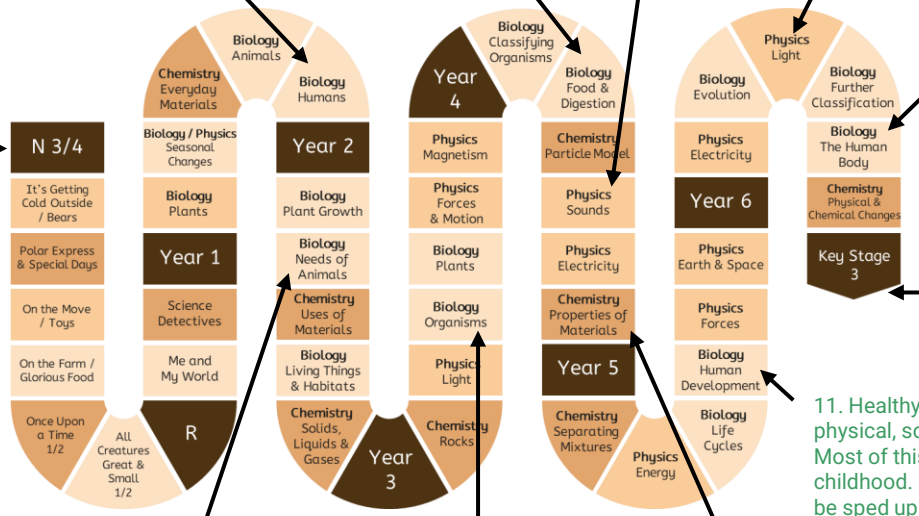
11. Humans need to practise good hygiene, like brushing teeth and washing hands.

11. Humans have five senses. Some people have impairments, like visual and hearing impairments.

11. Bacteria are tiny living things. Some are useful for humans, and some can cause diseases. Bacteria can cause tooth decay.

11. Humans with hearing loss may use closed captions, hearing aids and/or sign language.

11. Visual impairments include long and short sightedness, colour vision deficiency, and blindness. Some of these can be corrected, and some people with visual impairments will use Braille, magnifying devices, canes and/or guide dogs.



11. Being healthy means we are in a state of physical, mental and social well being and are free from disease. Some drugs can help us and some can harm us (particularly in the wrong quantities).

11. The biological causes and effects of diseases (e.g. coeliac disease and emphysema), exercise, lifestyles (e.g. vaping) and deficiencies on the body. Pathogens, their transmission and how transmission can be prevented.

11. Healthy development includes cognitive, physical, social and emotional development. Most of this happens during infancy and childhood. Ageing happens naturally, and can be sped up by environmental factors like smoking.

Some adults are unable to become pregnant. IVF and other treatments can be used.

11. Humans need to exercise, practise good hygiene and eat a healthy and balanced diet to stay healthy. Their diet should be high in fruits and vegetables and low in fats, sugar and salt.

11. A balanced diet includes the right proportions of the main food groups of carbohydrates (starch and sugars), proteins, fats, fibre, vitamins and minerals.

Animals, including humans, may get diseases (like scurvy) if they are deficient in vitamins and minerals.

11. Some substances are toxic; this means they can be poisonous. Humans and other organisms need to avoid these to stay healthy.

Vertical Concepts

	1. All material in the universe is made of very small particles.	2. Objects can affect each other at a distance.
EYFS	• The same thing (water) can look different when it is hot or cold (ice).	• Magnets can attract or repel other magnets. • Magnets attract objects made of magnetic materials.
Y1	• Objects have a purpose and are made of different materials.	
Y2	• All the 'stuff' encountered in everyday life, including air, water and different kinds of solid substances, is called matter. • Different materials are recognisable by their properties. • Materials have different properties, which make them suitable for specific purposes. • Matter can exist in three different states: as solids, liquids and gases. • The amount and type of substance does not change when the matter changes state.	
Y3		• Objects can affect other objects even when they are not in contact with them. Light reaches our eyes, even though the light source may be far away. • The non-contact force of magnetism mean magnets can attract or repel other magnets and attract objects made of magnetic materials.
Y4	• If a material could be divided into smaller and smaller pieces, it would be found to be made of particles, which smaller than can be seen even with a microscope. These particles are not in a material; they are the material. • The particles of a substance are arranged differently when it is solid, liquid or gas. • Properties of materials can be physical (such as hardness) or chemical (such as toxicity).	• Sound comes from objects that vibrate and can be detected at a distance from the source, because the air or other material around is made to vibrate. Sounds are heard when the vibrations in the air reach our ears.
Y5	• A pure substance is one that contains only one type of particle. • A mixture is created when two or more substances are mixed. The two types of particle are mixed together, but the particles themselves stay the same.	• The non-contact force of gravity pulls objects towards the centre of the Earth.
Y6	• A chemical change is where a new substance – that is made of a different type of particle – is formed.	
KS3	• The smallest piece of a material is called an atom. All materials, anywhere in the universe, living and non--living, are made of a very large numbers of these basic 'building blocks', of which there are about 100 different kinds.	• There is attraction and repulsion between objects that are electrically charged. • Visible light and other forms of radiation can travel through any empty space.

Vertical Concepts

	3. Changing the movement of an object requires a net force to be acting on it.	4. The total amount of energy in the Universe is always the same, but energy can be transformed when things change or are made to happen.	6. Our solar system is a very small part of one of millions of galaxies in our universe.
EYFS	• We can push and pull objects to make them move. • Magnets can be used to make other magnets and magnetic materials move.	• We have to push or pull objects to make them move; they do not move on their own.	• Naming the Sun, Earth and Moon.
Y1			• Daytime is when the Earth is facing the Sun; nighttime is when the Earth is facing away from the Sun.
Y2	• We can move or change the shape of objects by pushing and pulling: by squashing, bending, twisting or stretching the materials.	• All living things need food to give them energy. • All food chains start with a producer (a living thing that makes its own food). • The arrows in a food chain show where energy is being transferred from and to.	
Y3	• Forces act in pairs. Forces acting against each other are opposing. If opposing forces equal, they are balanced, and the object's motion will stay the same; this includes staying stationary. If opposing forces are unequal, they are unbalanced will change an object's speed, direction or shape. • Friction is a force that will slow an object down. • Friction is an example of a contact force.		• The Sun emits light, some of which reaches Earth. The Moon reflects light from the Sun.
Y4		• The arrows in a food web show where energy is being transferred from and to. • A cell in a complete circuit can make a bulb light or buzzer sound. This will not happen without a cell.	
Y5	• There is gravitational force between all objects, but it is only felt when one or more of the objects has a very large mass. The greater the mass, the greater the gravitational force. • Objects on Earth are pulled to the centre of the Earth because the Earth's mass and therefore gravitational force is much larger than that of the objects. • The downward force of gravity on an object on the Moon is less than that on Earth because the Moon has less mass on Earth.	• Many processes and phenomena are explained in terms of energy exchanges. • Energy cannot be created or destroyed. When energy is transferred from one object to others, the total amount of energy in the universe remains the same; the amount that one object loses is the same as the other objects gain. • Two examples of energy stores are thermal stores and chemical stores of energy. • Energy resources – but not energy – can be depleted.	• Our Sun is one of many stars that make up the Universe. • The distances between us and the bodies in solar system is huge, and even bigger in the Universe.
Y6		• Energy resources can be renewable (such as wind, solar, geothermal and hydrological) or non-renewable (such as fossil fuels). • All organisms respire.	
KS3	• How quickly an object's motion is changed depends on the force acting and the object's mass. The greater the mass of the object, the longer it takes to speed it up or slow it down (inertia).	• Objects have energy because of their chemical composition, their movement, their temperature, their position in a gravitational or other field, or because of compression or distortion of an elastic material.	• The movements of galaxies suggest that the Universe is expanding from a past state called the 'big bang', towards a future that is still unclear.

Vertical Concepts

	5. The composition of the Earth and its atmosphere and the processes occurring within them shape the Earth's surface and its climate.
	A: Earth Science
EYFS	• Describing the natural things in our local area. • Geographical features include **beach**, **hill**, **forest**, **sea** and **river**.
Y1	• Geography: We live on the **Earth**. • Geography: **Physical features** occur in nature and include river, forest, **soil** and hill. • Geography: **Coastal** areas are areas of land that are near the sea. Features in coastal areas include beach, **cliff**, sea and **ocean**. • Science: Some plants grow in soil.
Y2	• Geography: Features of hot deserts include rocks, sand dunes and oases. Features of cold deserts include **mountains** and ice sheets. • Geography: Rivers travel from highland areas to lowland areas. Physical features around rivers include **valleys**, mountains, hills and **vegetation**.
Y3	• Science: **Rocks** are formed when placed under **pressure**. • Science: Much of the solid surface of the Earth is covered in soil, which is a mixture of pieces of rock of various sizes and the remains of organisms. Some soil also contains air, water and some nutrients. • Science: There are three main kinds of rock, **igneous**, **sedimentary** and **metamorphic**, with different composition and properties. • Geography: There are several mountain ranges in the UK. • Geography: The Earth has four layers. Its upper layer of tectonic plates move. • Geography: **Shield** and **composite volcanoes** can form at **plate boundaries**, which produce **lava**, **pyroclastic flows** and **lahars**. • Geography: Soil is rich with nutrients around volcanoes.
Y4	
Y5	• Geography: Examples of natural resources include wood, food, water and **fossil fuels**. Fossil fuels are materials made from fossils over millions of years, like coal and oil. Humans use these to run cars and electrical items. • Geography: Natural resources are unevenly distributed across the world and can be **renewable** or **non-renewable** (finite). • Geography: The **upper course** of a river is in high, mountains ground and the river is narrow and fast flowing. The **lower course** of a river is in low, flat ground and the river is wide and slow flowing. The **middle course** is between the two. • Geography: Rivers **erode**, **transport** and **deposit** to form **waterfalls**, **meanders** and **floodplains**.
Y6	• Geography: Use of fossil fuels to create plastics, and the effects this can have on the Earth.
KS3	• Geography: Formation of volcanoes and mountains at different types of plate boundaries. Movement of tectonic plates as caused by convection currents. • Science: Radioactive decay of material inside the Earth since it was formed is its internal source of energy. Understanding the use of Earth's energy resources in terms of energy stores and transfers.

Vertical Concepts

	5. The composition of the Earth and its atmosphere and the processes occurring within them shape the Earth's surface and its climate.
	B: Environmental Science
EYFS	• We experience different types of weather in different seasons (focus on spring and winter). • Types of weather include sunny, rainy, windy, and snowy.
Y1	• **Science**: The weather can change rapidly. The four different seasons have different weather patterns.
Y2	• **Geography:** The weather is short-term. Climate is long-term summary of the weather conditions. • **Geography:** Precipitation is the fall of water as rain, sleet, snow or hail. • **Geography:** Deserts are places where there is very little precipitation. • **Science**: There is air all around us on Earth. Air has oxygen in it. • **Science**: Global warming describes the increase in average temperatures on Earth.
Y3	• **Science**: Air has carbon dioxide in it.
Y4	• **Science:** The water cycle involves evaporation of water from oceans and condensation of water, which falls as precipitation. • **Geography:** The layer of air around the Earth is called the atmosphere. • **Geography**: Atmospheric circulation causes some areas on Earth to have higher levels of precipitation than others. • **Geography**: Tropical rainforests are places where there is lots of precipitation.
Y5	• **Science**: Air is a mixture of lots of different gases, including oxygen and carbon dioxide. • **Geography:** The amount of water on Earth is constant. Most is saltwater stored in oceans, and most freshwater is stored as ice or underground. • **Geography**: Water cycle: Evaporation from the air and transpiration from trees means that water vapour rises in the air. It condenses to form clouds and precipitation occurs when the clouds get heavy. Surface runoff is the flow of water overground; throughflow is the flow of water underground. • **Geography**: Climate zones share long-term weather patterns. There are six main climate zones: polar, temperate, arid, tropical, Mediterranean and mountains. • **Geography**: Biomes are areas of the world that, because of similar climates, have similar landscapes, flora and fauna. The major biomes of the world are tundra, tropical rainforests, coral reefs, temperate forests and hot deserts. • **Science**: There is less and less air further away from the Earth's surface. • **Geography**: The natural greenhouse effect, the enhanced greenhouse effect, global warming and resulting climate change. • **Geography**: The increase in frequency of extreme weather events like heatwaves and drought as a result of climate change.
Y6	• **Geography:** Mitigation and adaptation are ways that humans can reduce and live with the effects of climate change.
KS3	• **Geography:** Weather is determined by conditions of the air. The pressure, temperature, direction and speed of the movement and the amount of water vapour in the air combine to create weather. • **Science:** Understanding convection currents in terms of pressure and particles.

Vertical Concepts

	7. Organisms are organised on a cellular basis.	8. Organisms require a supply of energy and materials for which they are often dependent on or in competition with other organisms.
EYFS		• There is a wide variety of living things on Earth, including plants and animals.
Y1	• Plants are organised with roots, stem, leaves and flowers.	• Living things, including humans, react to their surroundings with their senses.
Y2		• All living things need food, oxygen, water and certain temperature conditions. • Most plants make their own food. Animals' food comes from eating plants (herbivores) or by eating animals (carnivores), which have eaten plants or other animals. These relationships can be represented in a food chain. • Plants and animals are often dependent on each other. • Organisms are adapted to their environment. If conditions in a habitat change, organisms may not be able to survive. • Organisms move, reproduce, are sensitive to their surroundings, grow, need oxygen, get rid of their waste, and need nutrition (MRS GOWN).
Y3	• Humans are organised with organs like hearts and lungs, which do particular jobs. The skeleton and muscles allow the body to move.	• Plants make their own food using sunlight, carbon dioxide and water.
Y4		• The feeding relationships between organisms can be represented as food chains and food webs. They show where the energy is being transferred from and to.
Y5	• A cell is the smallest building block of living things. All organisms are made of cells. • There are lots of different types of cell (e.g. sex cells), which each have different purposes.	• Energy is transferred to the Earth by light. When making their own food, plants transfer some of this energy to their chemical store. As other organisms eat these producers, some energy in this chemical energy store is transferred.
Y6	• Micro-organisms are organisms that are so small that we cannot see them with our eyes alone. • Respiration takes places in cells.	• Living things move, reproduce, are sensitive to their surroundings, grow, respire, excrete, and need nutrition (MRS GREN).
KS3	• All organisms are made of one or more cells, which can only be seen through a microscope. All the basic functions of life – growth, reproduction, extracting energy from food – are the results of what happens inside cells. Cells are often aggregated into tissues, tissues into organs, and organs into organ systems.	• Decomposers are essential (alongside producers and consumers) for a stable ecosystem.

Vertical Concepts

	9. Genetic information is passed down from one generation of organisms to another.	10. Diversity of organisms, living and extinct, is the result of evolution.
EYFS	• Young animals grow into adult animals. The young look similar, but not the same, as the adults.	• There are many different kinds of plants and animals in the world today.
Y1		• There are lots of types of animal, and some types can be grouped as amphibians, birds, fish, mammals and reptiles.
Y2	• Plants and animals reproduce (have offspring). • A species is a group of living things of the same type.	• Biodiversity describes all the different living things in an area. • Living things are adapted to their environments. If the environment changes, the organisms may no longer be adapted and may struggle to survive.
Y3	• When there are no living individuals of a species to reproduce, the species is extinct. • When a plant reproduces, it goes through stages of pollination, fertilisation and seed dispersal. The seed will then germinate and grow into a plant.	• We know about extinct and dead species from fossils. These are the preserved remains (or traces) of organisms that lived many years ago. • To help scientists make sense of the diversity of organisms, they are classified into different groups. Each group has similar features.
Y4	• A species is a group of one type of organism. Individuals in this group can breed with each other to produce offspring that can go on to reproduce.	• A species is a group of one type of organism. Individuals in this group can breed with each other to produce offspring that can go on to reproduce.
Y5	• An organism's genome is the information that controls how that individual organism will develop. • In sexual reproduction, two parents contribute to the formation of offspring. They each pass down half their genome through specialised cells called sex cells. The two halves are combined during fertilisation. While it inherits genetic information from both parents, the offspring's genome is distinct, which means the offspring is not identical to a parent. • Asexual reproduction involves only one parent. In this process, the offspring's genome is an exact copy of the parent's genome. The offspring is identical to the parent.	• Although organisms of the same species are very similar, there is variation within them.
Y6		• Variation exists within species, caused by genetic and environmental factors. • Living things are found in certain environments because they have the features that enable them to survive there. This adaptation to their environment has come about because of the small differences that occur during reproduction, resulting in some individuals being better suited to the environment than others. In the competition for materials and food, those that are better adapted will survive and are more likely to pass on their adapted feature to their offspring. Fossils are evidence of evolution.
KS3	• In a human body, most cells contain 23 pairs of chromosomes. These provide information that is needed to make more cells in growth and reproduction.	• The natural selection of organisms has been going since the first form of life appeared on Earth 3.5 billion years ago. • Multi-cellular organisms evolved around 2 billion years ago.

Vertical Concepts

	11: Organisms are healthy when physically, mentally and socially well and free from disease.
EYFS	• Humans need to practise good hygiene, like brushing teeth and washing hands.
Y1	• Humans have five senses. Some people have impairments, like visual and hearing impairments.
Y2	• Humans need to exercise, practise good hygiene and eat a healthy and balanced diet to stay healthy. Their diet should be high in fruits and vegetables and low in fats, sugar and salt.
Y3	• A balanced diet includes the right proportions of the main food groups of carbohydrates (starch and sugars), proteins, fats, fibre, vitamins and minerals. • Animals, including humans, may get diseases (like scurvy) if they are deficient in vitamins and minerals.
Y4	• Bacteria are tiny living things. Some are useful for humans, and some can cause diseases. Bacteria can cause tooth decay. • Humans with hearing loss may use closed captions, hearing aids and/or sign language. • Some substances are toxic; this means they can be poisonous. Humans and other organisms need to avoid these to stay healthy.
Y5	• Healthy development includes cognitive, physical, social and emotional development. Most of this happens during infancy and childhood. Ageing happens naturally, and can be sped up by environmental factors like smoking. • Some adults are unable to become pregnant. IVF and other treatments can be used.
Y6	• Visual impairments include long and short sightedness, colour vision deficiency, and blindness. Some of these can be corrected, and some people with visual impairments will use Braille, magnifying devices, canes and/or guide dogs. • Being healthy means we are in a state of physical, mental and social well being and are free from disease. Some drugs can help us and some can harm us (particularly in the wrong quantities).
KS3	• Considering the biological causes and effects of diseases (e.g. coeliac disease and emphysema), exercise, lifestyles (e.g. vaping) and deficiencies on the body. • Staying healthy during pregnancy. • Pathogens, how they are transmitted and how transmission can be prevented (first line of defence).

Vertical concepts

Ideas about science

Ideas about science relate to disciplinary knowledge and working scientifically. They are best taught with explicit reference in appropriate units. Not all the ideas are relevant to every unit (for example, the idea that 'theories and models fit the facts of the time' is better considered through the topics of classification or the solar system than, for example, magnetism). The most relevant ideas are therefore explicitly referenced at an appropriate level in the unit overviews and lesson slides:

Science assumes that for every effect there is one or more causes

Scientific explanations, theories, and models are those that best fit the facts known at a particular time

The knowledge produced by science is used in some technologies to create products to serve human ends

Applications of science often have ethical, social and economic consequences

Disciplinary knowledge (KS1)

The below tables outlines where disciplinary knowledge – the working scientifically elements – is **first taught** and deliberately practised in KS1 or KS2. The curriculum has been sequenced so that the content is also reviewed in subsequent units (and may also be reviewed in other subject areas like geography and history), but to keep the table readable, we have only set out where it is first taught. The Mathematics Programmes of Study have been considered so that pupils never need to apply mathematical skills (e.g. calculating mean, rounding to an appropriate degree, constructing graphs) until they have first been taught in mathematics lessons.

	Scientific Attitudes & Planning (A&P)	Measuring & Observing (M&O)	Recording & Presenting (R&P)	Analysing & Evaluating (A&E)
EYFS	• Make predictions about what might happen when I try something.	• Measure/observe using senses. • Observe using a magnifying glass safely.	• Use hoops to classify objects based on simple criteria.	• Notice patterns in the world around me.
Y1	• Scientists look for patterns in the world around them. • Scientists group objects or living things based on their properties. • Scientists conduct secondary research to learn from what other scientists have already learned.	• Gather information from text/ books/ images.	• Record numerical or descriptive observations in a table. • Draw a diagram, a simple scientific drawing that explains or informs. • Use a table to classify items based on properties. • Use a Carroll diagram to classify items based on properties. • Use a Venn diagram to classify items into two or three sets based on properties.	• Make simple statements about the results of an enquiry.
Y2	• It is important that we keep as much as we can the same, apart from the one thing we measure and the one thing we change. • Make a prediction based on substantive knowledge. • There are four main stages of enquiry (A&P, M&O, R&P, A&E). • Scientists identify potential hazards in their experiments and plan ways to reduce them.	• Make systematic observations of an object.	• Use a pair of axes to classify items based on the extent it displays two properties.	• Ask further questions that could be explored to extend findings.

Disciplinary knowledge (KS2)

	Scientific Attitudes & Planning (A&P)	Measuring & Observing (M&O)	Recording & Presenting (R&P)	Analysing & Evaluating (A&E)
Y3	• Select most appropriate equipment to measure (the variables) that will give you the best chance of an accurate result. • A dependent variable is what you measure; an independent variable is what you change; controlled variables are things that stay the same. • Scientists identify factors in an investigation that should be controlled, and try to find ways to control them. • Write an appropriate method. • Science is studied as three disciplines: biology (study of organisms), chemistry (study of materials) and physics (study of energy).	• Gather information from the internet. • Anomalous results should be discarded and rerecorded. • Data is repeatable if the same person repeats the investigation and gets the same results; data is reproducible if the investigation is repeated by a different person and the results are the same. • Taking multiple readings allows you to see if your data is repeatable, and helps identify outliers.	• Design a table to collect data with the appropriate number of rows and columns and correct headings.	• Draw conclusions (e.g. 'the greater the… , the greater the…'). • Use scientific understanding to explain their findings. • Suggest ways to improve practical procedures to obtain more accurate measurements. • Use findings of investigation to make further predictions.
Y4	• Set a hypothesis to test. • Draw diagram of the investigation. • Scientists use models to help explain their ideas.	• Gather information using a data logger (e.g. sound meter app; heart rate app).	• Use a classification key to identify an object. • Draw a dichotomous classification key to help others identify an object. • Drawings can be labelled and annotated • Present information orally using a prop or demonstration. • Present information in a written format. • Draw labelled and annotated diagrams.	• Identify scientific evidence that has been used to support or refute ideas.
Y5	• Science is studied as three disciplines: biology (study of organisms), chemistry (study of properties of matter and how it interacts with energy) and physics (study of energy). • Scientists look for patterns in data to try to identify correlations.	• Measure force using a Newtonmeter.	• Scatter graphs can help you decide if there is a relationship between two variables. • (Geography: Interpret and construct climate graph). • Line graphs can be used when data is continuous; bar charts can be used when data is discrete.	• Make judgements on the accuracy of the data • Some people may agree or disagree with the use of some scientific discoveries. • Science is never 'complete' and scientists are always working to make models more accurate or to discover new explanations.
Y6		• Taking multiple readings allows you to see if your data is repeatable, helps identify outliers and allows a mean to be calculated.	• Decide which graph is most appropriate for the enquiry.	• Calculating the mean can be used as a method of analysing data.
KS3	• Evaluate risks.	• Pay attention to objectivity and concern for accuracy, precision, repeatability and reproducibility. • Use a wider range of apparatus and techniques • Apply sampling techniques. • Evaluate data, showing awareness of potential sources of random and systematic error.	• Use a range of graph types to display data, including pie charts, scatter graphs and line graphs.	• The difference between correlation and causation, and suggesting ways to test for both • Understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review.

Alignment to the National Curriculum

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Autumn 1	**BIOLOGY** **Plants** Identifying and naming common plants and describing basic structures	**BIOLOGY** **Plant growth** Plants grow from seeds, and require water, light and a suitable temperature	**CHEMISTRY** **Rocks** Comparisons of types of rocks and how fossils are formed	**BIOLOGY** **Classifying organisms** Introduction to classifying animals and their environment	**CHEMISTRY** **Separating mixtures** Identifying and separating mixtures; difference between reversible and non-reversible changes	**PHYSICS** **Electricity** Investigating variations in series and parallel circuits, and how electricity is generated
Autumn 2	**BIOLOGY / PHYSICS** **Seasonal changes** Observing changes across four seasons and describing associated weather	**BIOLOGY** **Needs of animals** Animals need water, food and air to survive and to have offspring	**PHYSICS** **Light** Relationship between light and how we see; the formation of shadows	**BIOLOGY** **Food & digestion** The human digestive system and simple food chains	**BIOLOGY, CHEMISTRY, PHYSICS** **Energy** Introducing the concept of energy stores and energy transfers, and relating this to prior knowledge	**BIOLOGY** **Evolution** Fossils; introduction to the idea that adaptation may lead to evolution
Spring 1	**CHEMISTRY** **Everyday materials** Distinguishing objects from the material it's made from, and describing simple properties	**CHEMISTRY** **Uses of everyday materials** Comparisons of an object's material with its use; impact of bending, twisting on solid objects	**BIOLOGY** **Organisms** The role of muscles and skeletons; the importance of nutrients	**CHEMISTRY** **Particle model and states of matter** States of matter in relation to particle arrangement	**BIOLOGY** **Life cycles** Life cycles of a mammal, amphibian, insect and bird, and some reproduction processes	**PHYSICS** **Light** How light travels and is reflected and how this allows us to see
Spring 2	**Consolidation and review**	**BIOLOGY** **Living things & their habitats** Basic introduction to habitats and micro-habitats, and simple food chains	**BIOLOGY** **Plants** The key features of flowering plants and what they need to survive	**PHYSICS** **Sounds** Relationship between strength of vibrations and volume of sound	**BIOLOGY** **Human development** Human development to old age	**BIOLOGY** **Further classification** Further classification of organisms based on characteristics
Summer 1	**BIOLOGY** **Animals** Identifying and naming fish, amphibians, reptiles, birds and mammals; carnivores, herbivores and omnivores	**CHEMISTRY** **Solids, liquids and gases** Understanding how the same substances can exist as solids, liquids and gases	**PHYSICS** **Forces & motion** Introducing pushes and pulls, contact forces, and balanced forces	**PHYSICS** **Electricity** Simple series circuits	**PHYSICS** **Forces** Gravity, air and water resistance and friction; introduction to pulleys	**BIOLOGY** **Functions of the human body** Human circulatory system; transport of nutrients within the body
Summer 2	**BIOLOGY** **Humans** Human body parts and senses	**Consolidation and review**	**PHYSICS** **Friction & magnetism** Contact and non-contact forces, including friction and magnetism	**CHEMISTRY** **Properties of materials** Considering physical and chemical properties	**PHYSICS** **Earth and space** Movements of planets and the Moon, and relationship to day and night	**CHEMISTRY** **Physical and chemical changes** Identifying physical and chemical changes

There are opportunities for pupils to consolidate or review knowledge in KS1, to ensure that these early concepts are fully mastered before KS2. They also allow time for pupils to revisit ideas in different seasons (e.g. observing changes in spring from autumn).

Disciplinary knowledge (working scientifically)

As specified in the National Curriculum, disciplinary knowledge is not taught as a separate strand. Instead, very specific aspects of disciplinary knowledge (for example, recognising and managing risk; or measuring using a Newtonmeter) are explicitly taught as part of the units set out here. They are deliberately practiced in the context of relevant and appropriate experiments, and then reviewed at regularly intervals across the key stages.

Substantive knowledge

The units that are not highlighted in colour align directly to the topics in the Programmes of Study and cover – at a minimum – the statutory content set out.

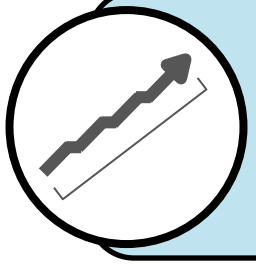
The statutory content in some topics in the Programmes of Study is substantial. Where this is the case, more time has been dedicated to it and the content is split into two complementary units. This allows sufficient time for mastery.

Three additional units purposefully take pupils beyond the Programmes of Study:

- **Year 2: Solids, liquids and gases**. This introduces pupils to the idea that familiar substances (like water or chocolate) can exist as solids, liquids or gases. It will support understanding of states of matter and the particle model in Year 4, and preempts the misconception that substances only ever exist in one state.
- **Year 5: Energy**. This introduces pupils to energy stores and transfers at a very basic level, and has been designed to preempt misconceptions that need to be unpicked at secondary. It also allows pupils to review content from previous topics across biology, chemistry and physics (like food webs, electricity, and states of matter), and consider them through the lens of energy.
- **Year 6: Physical & chemical changes**. This unit gives pupils the opportunity to run more sophisticated practical investigations. It provides a good transition to Year 7.

Using the United Science Curriculum

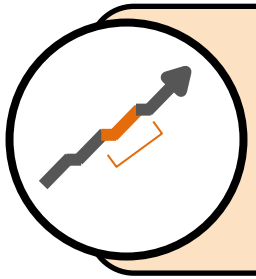
To get the most value from the United Science Curriculum, we recommend adhering to the sequencing and teaching the 'what', but adapting the 'how' and the lesson delivery to meet the needs of your pupils.



Within the Subject

The United Science Curriculum has been very carefully sequenced to ensure coverage and appropriate progression through substantive and disciplinary knowledge.

Implement the longer-term subject plan; avoid swapping units or 'pick and mixing' with other schemes.

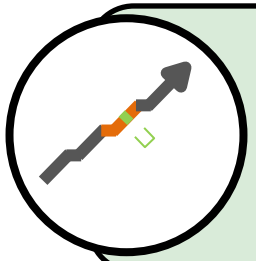


Within the Unit

Each unit clearly sets out the knowledge that should be taught and reviewed in the sequence of lessons.

Each unit is planned to cover six 2-hour lessons; this allows time before and after the unit for you to fill gaps or address misconceptions as required. A sequence of four 2-hour lessons is also provided for each unit; this allows you to teach the core, non-negotiable knowledge for the unit while allowing additional time to fill gaps if required.

Teach the core content in order suggested in the lesson sequence, filling gaps and addressing misconceptions as required.



Within the Lesson

Lesson slides and worksheets follow the principles of the Great Teaching Toolkit; content is broken down into small steps and 'I', 'We', and 'You' sections allow for modelling, guided practice and independent practice.

Lesson slides provide **just one way** to teach the required knowledge. You should adapt these slides as much or as little as is required to meet the needs of your class.

Adapt the lesson slides as much as is required to meet the needs of your class.

Why do we need to include opportunities for writing in science?

"Literacy is foundational for success in school and later life. Students who cannot read, write and communicate effectively are highly unlikely to access the challenging academic curriculum in school and more likely to have poor educational outcomes across all subjects."

Rickets, J., Sperring, R and Nation, K. (2014). Educational attainment in poor comprehenders. Frontiers in Psychology, 5. P. 445

Writing at length in other areas of the curriculum provides opportunities for pupils to:

- **master** their 'target language'
- **apply** and **consolidate** their writing skills and knowledge of text types in new contexts
- write for plenty of **genuine** purposeful reasons
- learn to write as **scholars** of their subject.

It provides opportunities for teachers to:

- **assess** pupils' writing away from the point of teaching
- ensure that pupils' writing is of the same **standard** in all lessons as it is in English lessons.

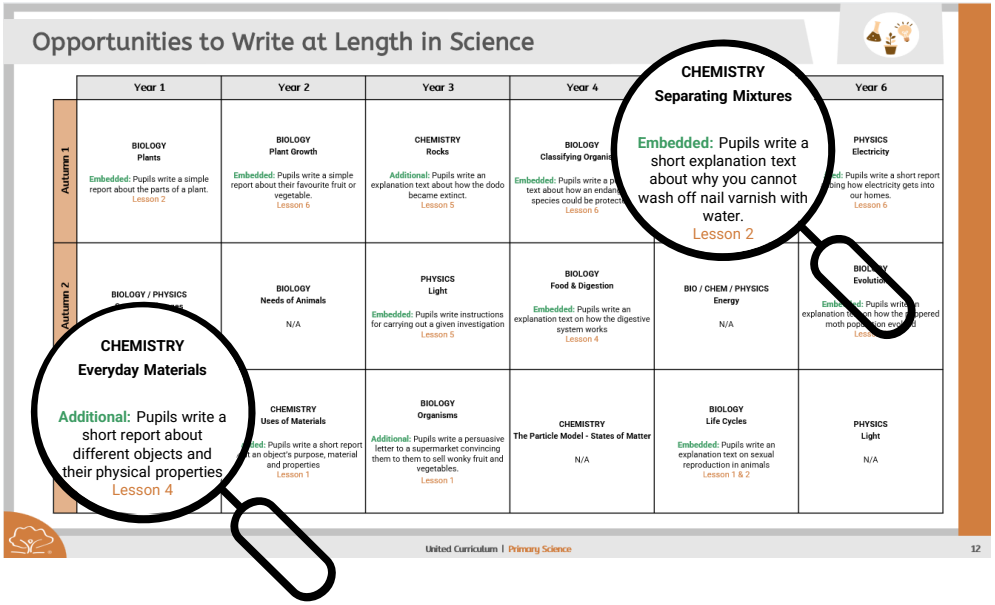
To keep standards of communication high across the curriculum, opportunities for writing at length have been included within science lessons to support pupils in learning to speak and write as scholars.

What do these writing at length opportunities look like?

- Writing at length means having the chance to write **full texts**, as appropriate for the age of pupils *(e.g. for year 1 pupils in autumn term, this might be a sequence of three or more sentences, building up to fully paragraphed, cohesive texts for key stage two pupils).*
- These full texts will usually fall under one of six **text types**.
- They also incorporate the full **writing process**, whereby pupils are given time to plan, draft, revise and edit their work to ensure it is of the highest standard.

Text Types

- Report/ Information Text
- Instruction
- Discussion
- Recount
- Explanation
- Persuasion



- An overview lists every opportunity for writing at length in science for each year group.
- A writing task has been **embedded** into the lesson when it serves a genuine purpose to the subject (i.e. in consolidating or assessing pupil knowledge or understanding of the lesson/ unit).
- Sometimes, the learning in a wider curriculum lesson lays the foundation for a piece of writing at length, but there is not sufficient time for creating this in the subject lesson (or it does not serve a genuine purpose to the subject). In these instances, an **additional** opportunity for writing has been included that can be completed outside of the unit (if the teacher chooses).
- Each writing opportunity listed on the writing overview, details the **task**, **text type** and **lesson number** it appears in.

Opportunities to Write at Length in Science

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Autumn 1	**BIOLOGY** **Plants** **Embedded:** Pupils write a simple report about the parts of a plant. Lesson 2	**BIOLOGY** **Plant Growth** **Embedded:** Pupils write a simple report about their favourite fruit or vegetable. Lesson 6	**CHEMISTRY** **Rocks** **Additional:** Pupils write an explanation text about how the dodo became extinct. Lesson 5	**BIOLOGY** **Classifying Organisms** **Embedded:** Pupils write a persuasive text about how an endangered species could be protected. Lesson 6	**CHEMISTRY** **Separating Mixtures** **Embedded:** Pupils write a short explanation text about why you cannot wash off nail varnish with water. Lesson 2	**PHYSICS** **Electricity** **Embedded:** Pupils write a short report describing how electricity gets into our homes. Lesson 6
Autumn 2	**BIOLOGY / PHYSICS** **Seasonal Changes** N/A	**BIOLOGY** **Needs of Animals** N/A	**PHYSICS** **Light** **Embedded:** Pupils write instructions for carrying out a given investigation Lesson 5	**BIOLOGY** **Food & Digestion** **Additional:** Pupils write an explanation text on how the digestive system works Lesson 4	**BIO / CHEM / PHYSICS** **Energy** N/A	**BIOLOGY** **Evolution** **Embedded:** Pupils write an explanation text on how the peppered moth population evolved Lesson 4
Spring 1	**CHEMISTRY** **Everyday Materials** **Additional:** Pupils write a short report about different objects and their physical properties Lesson 4	**CHEMISTRY** **Uses of Materials** **Embedded:** Pupils write a short report about an object's purpose, material and properties Lesson 1	**BIOLOGY** **Organisms** **Additional:** Pupils write a persuasive letter to a supermarket convincing them to them to sell wonky fruit and vegetables. Lesson 1	**CHEMISTRY** **The Particle Model - States of Matter** N/A	**BIOLOGY** **Life Cycles** **Embedded:** Pupils write an explanation text on sexual reproduction in animals Lesson 1 & 2	**PHYSICS** **Light** N/A

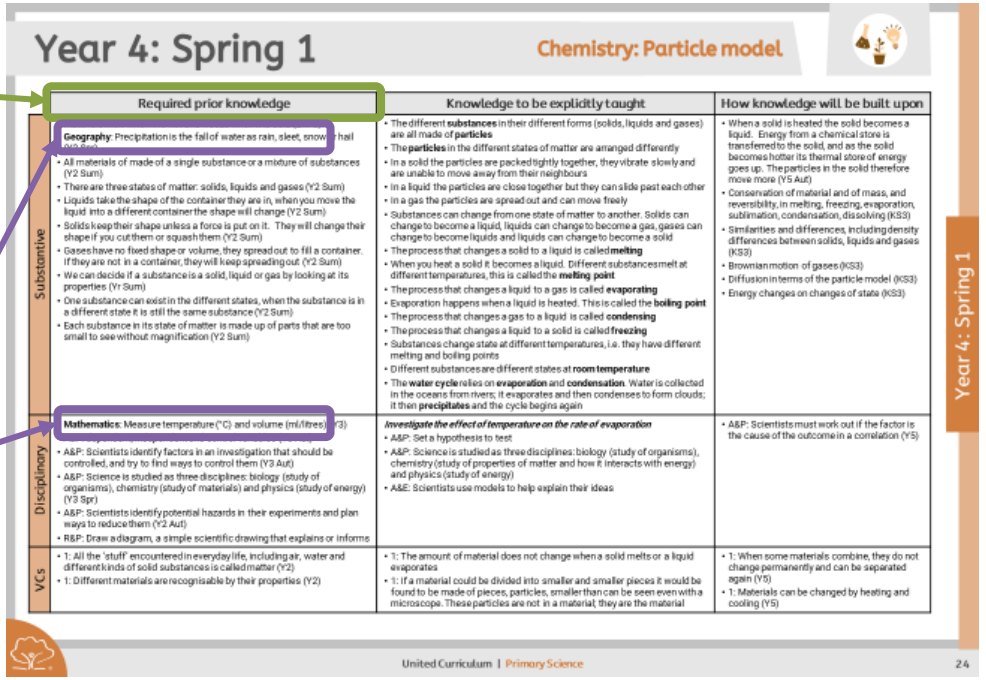
Opportunities to Write at Length in Science (Continued)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Spring 2	**Consolidation and Review** N/A	**BIOLOGY** **Living Things & Their Habitats** N/A	**BIOLOGY** **Plants** **Additional:** Pupils write a report how seeds are dispersed in the form of a poster or fact file. Lesson 5	**PHYSICS** **Sound** **Embedded:** Pupils write a report about hearing loss in the form of an informative poster or leaflet Lesson 6	**BIOLOGY** **Human Development** **Additional:** Pupils write a discussion text in response to the question, 'Should IVF be offered to everyone by the NHS?'. Lesson 4	**BIOLOGY** **Further Classification** **Embedded:** Pupils write an explanation text about the way in which bacteria is not always harmful Lesson 5
Summer 1	**BIOLOGY** **Animals** **Additional:** Pupils write a short report about their favourite animal. Lesson 6	**CHEMISTRY** **Solids, Liquids and Gases** **Additional:** Pupils write a short explanation text about the impact of global warming on polar bears' habitat Lesson 4	**PHYSICS** **Forces & Motion** **Embedded:** Pupils write an explanation text to demonstrate the impact of balanced and unbalanced forces in a game of tug of war. Lesson 4	**PHYSICS** **Electricity** N/A	**PHYSICS** **Forces** **Additional:** Pupils write an explanation of why an ice skate has a rough part and a smooth part. Lesson 3	**BIOLOGY** **Functions of the Human Body** **Additional:** Pupils write an informative and persuasive text about the dangers of smoking Lesson 6
Summer 2	**BIOLOGY** **Humans** **Additional:** Pupils write sentences about the senses. Lesson 6	**Consolidation and Review** N/A	**PHYSICS** **Magnetism** N/A	**CHEMISTRY** **Properties of Materials** **Embedded:** Pupils write a report about a toxic substance in the form of a poster. Lesson 5 & 6	**PHYSICS** **Earth and Space** **Additional:** Pupils write a letter from the perspective of an astronaut on the ISS. Lesson 6	**CHEMISTRY** **Physical and Chemical Changes** **Embedded:** Pupils write an explanation text about why polar bears are endangered. Lesson 6

Transitions

The United Science Curriculum is built upon the National Curriculum, which sets out clearly the statutory content for each year group. This means that any school who had been following the National Curriculum previously can transition to the United Science Curriculum relatively straightforwardly:

- The prerequisite knowledge for each unit is set out clearly in each overview
- A low-stakes pre-learning quiz is provided, which assesses pupils' understanding of the prerequisite knowledge. Teachers should use this, and plan to teach any gaps before or during the unit. (A 4-lesson sequence is also provided in each unit, to allow you time to do this).



Year 4: Spring 1

Chemistry: Particle model

	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	**Geography:** Precipitation is the fall of water as rain, sleet, snow or hail • All materials of made of a single substance or a mixture of substances (Y2 Sum) • There are three states of matter: solids, liquids and gases (Y2 Sum) • Liquids take the shape of the container they are in, when you move the liquid into a different container the shape will change (Y2 Sum) • Solids keep their shape unless a force is put on it. They will change their shape if you cut them or squash them (Y2 Sum) • Gases have no fixed shape or volume, they spread out to fill a container. If they are not in a container, they will keep spreading out (Y2 Sum) • We can decide if a substance is a solid, liquid or gas by looking at its properties (Yr Sum) • One substance can exist in the different states, when the substance is in a different state it is still the same substance (Y2 Sum) • Each substance in its state of matter is made up of parts that are too small to see without magnification (Y2 Sum)	• The different **substances** in their different forms (solids, liquids and gases) are all made of **particles** • The **particles** in the different states of matter are arranged differently • In a solid the particles are packed tightly together, they vibrate slowly and are unable to move away from their neighbours • In a liquid the particles are close together but they can slide past each other • In a gas the particles are spread out and can move freely • Substances can change from one state of matter to another. Solids can change to become a liquid, liquids can change to become a gas, gases can change to become liquids and liquids can change to become a solid • The process that changes a solid to a liquid is called **melting** • When you heat a solid it becomes a liquid. Different substances melt at different temperatures, this is called the **melting point** • The process that changes a liquid to a gas is called **evaporating** • Evaporation happens when a liquid is heated. This is called the **boiling point** • The process that changes a gas to a liquid is called **condensing** • The process that changes a liquid to a solid is called **freezing** • Substances change state at different temperatures, i.e. they have different melting and boiling points • Different substances are different states at **room temperature** • The **water cycle** relies on **evaporation** and **condensation**. Water is collected in the oceans from rivers; it evaporates and then condenses to form clouds; it then **precipitates** and the cycle begins again	• When a solid is heated the solid becomes a liquid. Energy from a chemical store is transferred to the solid, and as the solid becomes hotter its thermal store of energy goes up. The particles in the solid therefore move more (Y5 Aut) • Conservation of material and of mass, and reversibility, in melting, freezing, evaporation, sublimation, condensation, dissolving (KS3) • Similarities and differences, including density differences between solids, liquids and gases (KS3) • Brownian motion of gases (KS3) • Diffusion in terms of the particle model (KS3) • Energy changes on changes of state (KS3)
Disciplinary	**Mathematics:** Measure temperature (°C) and volume (ml/litres) (Y3) • A&P: Scientists identify factors in an investigation that should be controlled, and try to find ways to control them (Y3 Aut) • A&P: Science is studied as three disciplines: biology (study of organisms), chemistry (study of materials) and physics (study of energy) (Y3 Spr) • A&P: Scientists identify potential hazards in their experiments and plan ways to reduce them (Y2 Aut) • R&P: Draw a diagram, a simple scientific drawing that explains or informs	***Investigate the effect of temperature on the rate of evaporation*** • A&P: Set a hypothesis to test • A&P: Science is studied as three disciplines: biology (study of organisms), chemistry (study of properties of matter and how it interacts with energy) and physics (study of energy) • A&E: Scientists use models to help explain their ideas	• A&P: Scientists must work out if the factor is the cause of the outcome in a correlation (Y5)
VCs	• 1: All the 'stuff' encountered in everyday life, including air, water and different kinds of solid substances is called matter (Y2) • 1: Different materials are recognisable by their properties (Y2)	• 1: The amount of material does not change when a solid melts or a liquid evaporates • 1: If a material could be divided into smaller and smaller pieces it would be found to be made of pieces, particles, smaller than can be seen even with a microscope. These particles are not in a material; they are the material	• 1: When some materials combine, they do not change permanently and can be separated again (Y5) • 1: Materials can be changed by heating and cooling (Y5)

Year 4: Spring 1

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There are two areas that require careful consideration:

- **Some of the prerequisite knowledge is taught for the first time in another subject** (particularly geography or mathematics). For subjects in the United Curriculum. For mathematics, no content is required for other subjects until the year after it appears in the Programmes of Study. Teachers should aim to fill gaps where required before or during the unit.
- **The disciplinary knowledge in science has been sequenced in smaller steps than in the National Curriculum**. Teachers therefore need to pay careful attention to these areas, and fill gaps before or during the unit.

Impact

Assessing impact is assessing how well pupils have learned the required knowledge from the implemented curriculum. It is not about lots of tests, or meticulously comparing pupils' outcomes at the start and end of each unit.

If pupils can keep up with a well-sequenced curriculum that has progression built in, they are making progress!

The United Curriculum has this progression built in, and so teachers and subject leads just need to be confident that pupils are keeping up with it.

This can be done through:

- **Formative assessment in lessons**
  There are opportunities for formative assessment in the lesson slides provided, and teachers should continually adapt their lesson delivery to address misconceptions and ensure that pupils are keeping up with the content.

- **Low-stakes summative assessment**
  A post-learning quiz is provided for every unit. These questions usually take the form of multiple-choice questions, and aim to assess whether pupils have learned the core knowledge for that unit. These should also be used formatively, and teachers should plan to fill gaps and address misconceptions before moving on.

- **Books and pupil-conferencing**
  Talking to pupils about their books allows you to assess how much of the curriculum content is secure. These conversations are used most effectively to determine whether pupils have a good understanding of the vertical concepts, and if they can link recently taught content to learning from previous units. (They should not be used to assess whether pupils can recall information, as low-stakes quizzes can gather this information more efficiently).