Progression of skills and knowledge in Science

These progressions are to outline the expectations of the National Curriculum, but also to provide clarity on the knowledge and skills taught in Biology, Chemistry and Physics across the primary school. For Early Years, see knowledge and skills organisers. *Note: vocabulary is core and will be added to.*

Scientific Enquiry (to be embedded into all Science topics)

Year group	Scientific Enquiry
1	• Explore the world around them and raise their own simple questions. • Experience different types of science enquiries, including experiments. • Begin to recognise ways in which to answer scientific questions. • Carry out simple tests. • Use simple features to compare objects, minerals, materials and living things. With help, decide how to sort and group. • Ask people questions and use simple secondary resources. • Observe closely using simple equipment to help, with help, observe changes over time. • With guidance, begin to notice patterns and relationships. • Use simple measurements and equipment to gather data. • Record simple data. • Use their observations and ideas to suggest answers to questions. Talk about what they found out and how they found it out. • With help, record and communicate their findings in a range of ways and begin to use scientific language.
2	• Explore the world around them and raise their own simple questions, share their ideas with others. • Experience different types of science enquiries, including practical activities. • Begin to recognise different ways in which to answer scientific questions. • Carry out simple tests using some basic equipment. • Use simple features to compare objects, minerals, materials and living things. With help, decide how to sort and group them. • Ask people questions and use simple secondary resources, select their own, reliable secondary sources. • Observe closely using simple equipment to help. Observe changes over time. • With guidance, begin to notice patterns and relationships. • Use simple measurements and equipment (e.g. hand lenses, egg timers) to gather data. • Record simple data using at least two different methods. • Use their observations and ideas to suggest answers to questions. Talk about what they found out and how they found it out and offer their own opinions. • With help, record and communicate their findings in a range of ways and begin to use scientific language.

3	• Raise their own relevant questions about the world around them. • Be given a range of scientific experiences including different types of scientific enquiry. • Start to make their own decisions about the most appropriate type of scientific enquiry they might use to answer questions. • Set up simple practical enquiries, comparative and fair tests. Recognise when a simple fair test is necessary and help decide how to set it up, with help. • Talk about criteria for grouping, sorting and classifying; use simple keys, with some help. • Recognise when and how secondary sources might help them to answer questions that cannot be answered through practical investigations. • Make systematic and careful observations. Help to make decisions about what observations to make, how long to make them for and the type of simple equipment that might be used. • Begin to look for naturally occurring patterns and relationships; begin to decide what data to collect to identify them. • With help, take accurate measurements using standard units, learn how to use a range of equipment, such as data loggers and thermometers, appropriately. • Collect and record data from their own observations and measurements in a variety of ways: notes, bar charts, tables. Use standard units, drawings, labelled diagrams, keys and help to make decisions about how to analyse the data. • With help, pupils should look for changes, patterns, similarities and differences in their data in order to draw simple conclusions and answer questions. • Use relevant scientific language to discuss their ideas and communicate their findings, in ways that are appropriate for different audiences, including oral and written explanations, displays or presentations of results and conclusions. • With support, they should identify new questions arising from their data, making predictions for new values within or beyond the data they have already collected and finding ways of improving what they have already done.
4	• Raise their own relevant questions about the world around them and begin to look for answers. • Be given a range of scientific experiences including different types of scientific enquiry to answer questions. • Start to make their own decisions about the most appropriate type of scientific enquiry they might use to answer questions and give justifications. • Set up simple practical enquiries, comparative and fair tests. Recognise when a simple fair test is necessary and help decide how to set it up. • Talk about criteria for grouping, sorting and classifying; use simple keys and explain how they should be used. • Recognise when and how secondary sources might help them to answer questions that cannot be answered through practical investigations. Use a selection of resources. • Make systematic and careful observations. Make decisions about what observations to make, how long to make them for and the type of simple equipment that might be used. • Look for naturally occurring patterns and relationships; decide what data to collect to identify them. • Take accurate measurements using standard units, learn how to use a range of equipment, such as data loggers and thermometers, appropriately. • Collect and record data from their own observations and measurements in a variety of ways: notes, bar charts, tables. Select and use the most appropriate standard units, drawings, labelled diagrams, keys and help to make decisions about how to analyse the data. • With help, pupils should look for changes, patterns, similarities and differences in their data in order to draw accurate conclusions and answer further questions. • Confidently use relevant scientific language to discuss their ideas and communicate their findings, in ways that are appropriate for different audiences, including oral and written explanations, displays or presentations of results and conclusions.

	• Children should identify new questions arising from their data, making predictions for new values within or beyond the data they have already collected and finding ways of improving what they have already done.
5	• Use their science experience to explore ideas and raise questions about the world. • Talk about how different scientific ideas have developed over time. • Select and plan, with help, the most appropriate type of scientific enquiry they might use to answer questions and give justifications. • Recognise when and how to set up comparative and fair tests. Explain, with help, which variables need to be controlled and why. • Use and develop keys and other information records to identify, classify and describe living things and materials. • Identify patterns that might be found in natural environments. • Recognise which secondary sources will be most useful to research their ideas and begin to separate opinion from fact. • With help, make decisions about what observations to make, what measurements to use and how long to make them for • With support, for causal relationships in their data and identify evidence that refutes or supports their ideas. • Choose the most appropriate equipment to make measurements with increasing precision and explain how to use it accurately. Take repeat measurements where appropriate. • Decide how to record data and results of increasing complexity from a choice of familiar approaches: scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs. • Identify scientific evidence that has been used to support of refute ideas or arguments. • With help, use relevant scientific language and illustrations to discuss, communicate and justify their scientific ideas, use oral and written forms (such as displays and other presentations) to report conclusions, causal relationships and explanations of degree of trust in results. • Use their results to make predictions and identify when further observations, comparative and fair tests might be needed.
6	• Use their science experience to explore ideas and raise relevant questions of different kinds. • Talk about how different scientific ideas have developed over time giving specific examples. • Select and plan the most appropriate type of scientific enquiry they might use to answer questions and give justifications. • Recognise when and how to set up comparative and fair tests. Explain which variables need to be controlled and why. • Use and develop more complex keys and other information records to identify, classify and describe living things and materials. • Identify patterns that might be found in natural environments. • Recognise which secondary sources will be most useful to research their ideas; separate opinion from fact and give justifications for their reasoning. • Make their own decisions about what observations to make, what measurements to use and how long to make them for. • Look for causal relationships in their data and identify evidence that refutes or supports their ideas. • Choose the most appropriate equipment to make measurements with increasing precision and explain how to use it accurately. Take repeat measurements where appropriate and give justifications for their choice. • Decide how to record data and results of increasing complexity from a choice of familiar approaches: scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs, use multiple methods where appropriate. • Identify scientific evidence that has been used to support of refute ideas or arguments, begin to form opinions about validity of these. • Use relevant scientific language and illustrations to discuss, communicate and justify their scientific ideas, use oral and written forms (such as displays and other presentations) to report conclusions, causal relationships and explanations of degree of trust in results. • Use their results to make predictions and identify when further observations, comparative and fair tests might be needed, carry these out where appropriate.

Biology

Year group	Topic	Scientist/ inspirational figure/ stimulus (where appropriate)	National Curriculum objectives	Core Knowledge	Additional Knowledge	Key Vocabulary
1	**My body is amazing...and so are animals'!**	**Ourselves!**	**Animals including humans** 1. identify and name a variety of common animals including fish, amphibians, reptiles, birds and mammals 2. identify and name a variety of common animals that are carnivores, herbivores and omnivores 3. describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals, including pets) 4. identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense	**I can name the 5 types of vertebrate animal groups.** **I can name and locate external body parts.** **I can describe what a carnivore, an omnivore and a herbivore is.**	I can describe the features of each of these groups. I can identify from pictures what group animals belong to. I can name some invertebrates. I can name the five senses. I can describe how we can keep our bodies healthy. I know what humans need to survive. I know what animals are carnivores. I know what animals are herbivores. I know what animals are omnivores.	*Senses, touch, see, smell, taste, hear, fingers (skin), eyes, nose, ear and tongue, head, neck, arms, elbows, legs, knees, face, ears, eyes, hair, mouth, teeth, penis, testicles, vulva. Carnivores, herbivores, omnivores, food chains, vertebrates, invertebrates*
	How can I look after my garden?		**Plants** 1. identify and name a variety of common wild and garden plants, including deciduous and evergreen trees 2. identify and describe the basic structure of a variety	**I can name some trees and plants from around Urmston.** **I can label the different parts of a plant.**	I can recognise the leaves of different trees. I know what deciduous and evergreen means. I know what a plant needs to grow, i.e sunlight, water, soil. I know that the roots absorb water and minerals from the soils.	*Leaf, flower, blossom, petal, fruit, berry, root, seed, trunk, branch, stem, bark, stalk, bud, Names of trees in the local area, Names of garden*

			of common flowering plants, including trees **Seasonal changes:** 1. observe changes across the four seasons 2. observe and describe weather associated with the seasons and how day length varies	**I can name the different seasons of the year**	I know that the stem takes water and minerals to the other parts of the plant. I know that the leaves make food for the plant from sunlight and carbon dioxide.	*and wild flowering plants in the local area*
2	**Do plants need resilience too?**		**Plants** 1. observe and describe how seeds and bulbs grow into mature plants. 2. find out and describe how plants need water, light and a suitable temperature to grow and stay healthy.	**I know that plants need water, light and a suitable temperature to grow and stay healthy.** **I can describe how, over time, seeds and bulbs grow into mature plants through seed – sprout – seedling – adult.** **I can explain the differences between the weather and tropical climate in Malawi and the temperate climate in the UK. I know that this means different plants can grow.**	I know that plants get their food from light and without it they can't grow. I know that water helps to move nutrients from the soil to the plants. I know that a seed will not produce a plant if it is too cold. I know that germination is when a seed sprouts to form a seedling. I know that a plant is an adult when it is ready to produce fruit or flowers. I know that reproduction means to create more and that adult plants have special ways to do this like birds, insects and wind carrying the seeds. I know that maize grows in Malawi and that people make nsima from it which most Malawians eat as (but only if there is a good rainy season!). I know that soil must be fertile for plants and crops to grow and there needs to be lots of rain. I know that drought can stop plants from growing. I know that some plants can grow with very little water and are super resilient!	*As for year 1 plus – light, shade, sun, warm, cool, water, grow, healthy*
	Happy and Larry: a world	**World Wildlife Fund – school sponsored**	**Animals including humans** 1. notice that animals, including humans, have	**I know the difference between things that are living, dead and things**	I can describe how animals including humans have offspring which grow	***Animals, including humans:*** *Offspring, reproduction,*

	of animals and the WWF	**leopards – Happy and Larry**	offspring which grow into adults 2. find out about and describe the basic needs of animals, including humans, for survival (water, food and air) 3. describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene **Living things and their habitat** 1. explore and compare the differences between things that are living, dead, and things that have never been alive 2. identify that most living things live in habitats to which they are suited and describe how different habitats provide for the basic needs of different kinds of animals and plants, and how they depend on each other 3. identify and name a variety of plants and animals in their habitats, including micro-habitats 4. describe how animals obtain their food from plants and other animals, using the idea of a simple food chain, and identify and name different sources of food	**that have never been alive and can find them outside.** **I know what I should do to stay healthy.** **I know that to survive, animals and humans need air, food, shelter and water.**	into adults, using the appropriate names for the stages. I know that some mammals lay eggs and some do not – and I can name them. I can explain the life cycle of an animal. I know that I need a balanced diet including five fruit or vegetable portions a day but I also need some fats, proteins and carbohydrates. I know what some of these things do for my body. I know how important it is that I exercise and I can that exercising helps my heart and lungs become stronger. I know what I must do to stay hygienic and why this is so important. I can talk about how the some features of animals and plants make them suitable to the habitat they live in, that different habitats provide for the basic needs of different kinds of animals and plants, and how they depend on each other. I can name a range of animals and plants that live in a habitat and micro-habitats that I have studied. I can construct a food chain that starts with a plant and has the arrows pointing in the correct direction.	*growth, child, young/old stages (examples - chick/hen, baby/child/adult, caterpillar/butterfly), exercise, heartbeat, breathing, hygiene, germs, disease, food types (examples – meat, fish, vegetables, bread, rice, pasta)* ***Living things and their habitats:*** *Living, dead, never been alive, suited, suitable, basic needs, food, food chain, shelter, move, feed, names of local habitats e.g. pond, woodland etc., names of micro-habitats e.g. under logs, in bushes etc.*
3	**Janaki Ammal: pioneering R**	**Janaki Ammal**	**Plants** 1. identify and describe the functions of different parts of flowering plants:	**1) I can describe the function of the different parts of a flowering plant.**	I know that the roots anchor the plant in the ground and absorb water/nutrients from the soil. I know that the stem/trunk holds the plant up and transports the water/nutrients to the leaves.	*photosynthesis, pollen, insect/wind pollination,*

	and R for the environment		roots, stem/trunk, leaves and flowers 2. explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow) and how they vary from plant to plant 3. investigate the way in which water is transported within plants 4. explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal	**2) I Know the requirements needed for a plant to live and grow.** **3) I can investigate the way in which water is transported within plants.** **4) I know that the flower has an important part to play in the life cycle of a plant.** **5) I know that Janaki Ammal was a famous botanist.**	I know that the leaves make food for the plant using sunlight and carbon dioxide. I know that flowers are brightly coloured to attract insects and birds. I know that plants need air, light, water, nutrients from the soil, and room to grow in order to live and grow. I can set up an investigation that shows the requirements needed for a plant to live and grow. I can make systematic and careful observations about the plant. I know that the requirements for life and growth vary from plant to plant. I can make systematic and careful observations over time when placing celery/carnation into coloured food dye. I know that water works against gravity up the stem to the leaves. I can explain the lifecycle of an apple tree – from seed germination, to seedling, to sapling, to tree, to blossom, to apple! I can explain that pollination is where insects carry pollen from one flower to another. The transfer of pollen makes a new seed. I know that seed dispersal can occur in a variety of ways: wind, water, bursting, shaking, animal droppings, travelling on animal fur, drop and roll. I know that Janaki Ammal was born in India in 1897. I know that a botanist is a scientist that studies plants. Janaki's work developing sugar cane was important because the sugar cane that grew in India wasn't as sweet as ones from other countries. Janaki helped to develop a sweet sugarcane that would grow in India so that they wouldn't need to buy it from other countries.	*seed formation, seed dispersal – wind dispersal, animal dispersal, water dispersal, germination, seedling, sapling, blossom, Janaki Ammal, botanist*

	Why does Dina Asher-Smith run so fast?	**Dina Asher Smith**	**Animals including humans** 1. identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat 1. identify that humans and some other animals have skeletons and muscles for support, protection and movement	**1) I know the difference between a vertebrate and an invertebrate.** **2) I know the functions of the human skeleton are to support, protect and move.** **3) I can name some of the bones in the human skeleton - e.g. skull, ribs, back bone.** **4) I know that a joint is a point of attachment of 2 bones.** **5) I know that skeletal muscles are attached to the skeleton to enable movement.** **6) I know why it is important to eat a balanced diet to stay healthy.**	I know the vertebrates are animals with a backbone such as humans and dogs. They are known as endoskeletons as their skeletons are on the inside. I know that invertebrates are animals without a backbone. Animals with exoskeletons have their skeletons on the outside of their body - e.g. a crab. I know that animals with a hydrostatic skeleton don't have any bones. Instead, they have a fluid filled body - e.g. worm. These are also invertebrates. I know that the skeleton supports us and keeps us up straight. I know that the skull protects the brain and the ribs protect the heart and lungs. I know that the skeleton uses joints and muscles to allow it to move. I know that a baby has around 300 bones and an adult has 206. I know some of the scientific names for bones in the human skeleton - e.g. femur, tibia, mandible I know that there are 360 joints in the human body. I know the name of the joints and how they work - e.g. pivot, hinge and ball and socket joints. I know that joints are found at the hip, shoulders, elbows, knees, wrists and elbows. I know that muscles are attached to the bones by tendons. I know that there are 600 muscles in the human body. Muscles work in pairs to move a joint. Whilst one muscle contracts, the other relaxes. I know that there are 5 main food groups. These are carbohydrates, dairy, proteins, fats and sugars, fruit and vegetables. I know that humans can't make their own food. They get nutrition from what they eat. I know that alongside a balanced diet, exercise is important to keep us healthy.	*nutrition, nutrients, carbohydrates, sugars, protein, vitamins, minerals, fibre, fat, water, skeleton, bones, muscles, support, protect, move, skull, ribs, spine, muscles, joints*

	Wangari Maathai: Planting, Peace and Park Life	**Wangari Maathai**	**Living things and their habitats** 1. recognise that living things can be grouped in a variety of ways 2. construct and interpret a variety of food chains, identifying producers, predators and prey 3. explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment 2. recognise that environments can change and that this can sometimes pose dangers to living things	**1) I know that a habitat is the natural home or environment of an animal and that different habitats attract different animals and creatures.** **2) I know that the term 'adaptation' means to change in order to improve the chance of survival.** **3) I know that living things can be grouped in a variety of ways using keys and classification charts.** **4) I know that a food chain shows how plants and animals get their energy by showing 'what eats what'.** **5) I know that the environment is the surroundings or conditions a person, animal or plant lives in.**	I can list a range of habitats in the UK (grassland, heathland, woodland, open water, wetland, inland rock, coastal and marine). I know a number of animals and creatures that live in these different habitats. I know geographical terms to describe these habitats and can locate them on an atlas or map. I know that animals have adapted to suit their environment over time. I know examples of how at least three animals have adapted to suit their environment. I know that predators usually have forward or narrow facing eyes and prey have side or wide facing eyes. I know that classification keys help group, identify and name a variety of living things in their local and wider environment. I know that a 'minibeast' is an animal without a backbone (and invertebrate) – like including spiders, ants, termites, butterflies, bees, wasps, flies - and can identify them based on their features. I know that an exoskeleton is a bone structure on the outside of a creature's body. I know how to construct and interpret a variety of food chains. I know that a predator is an animal that naturally 'preys' and hunts other animals. I also know that a herbivore only eats plants and carnivore eats other animals. I know that a food chain always starts with a producer, then primary consumer and ends with a top consumer. I know the arrows in a food chain mean 'is eaten by'. I know that environments can change and that this can sometimes pose dangers to living things. I know who Wangari Maathai is and why she believed in the power of one.	*classification, classification keys, environment, habitat, human impact, environmentalist, conservation, Wangari Maathai, positive, negative, migrate, hibernate, herbivore, carnivore, omnivore, producer, predator, prey, food chain*

					I know that humans are capable of impacting our environment positively and negatively and I can say how.	
4	**What happens to the food we eat?**	**Us!**	**Animals including humans** 1. describe the simple functions of the basic parts of the digestive system in humans 4. identify the different types of teeth in humans and their simple functions	**1) I know that the digestive system is made up of different parts of our body which all help to break down, process and get rid of the food we eat.** **2) I know that there are different types of teeth in my mouth and that they are designed to do specific jobs.** **3) I know that it is important to maintain healthy teeth and understand how to do this.** **4) I know what a healthy, balanced diet is and why it's so important.**	I know where the mouth, oesophagus, Liver, small intestine, large intestine and pancreas are located in the human body. I know the main functions of the mouth (bite, chew and swallow), oesophagus (moves the food down to the stomach), Liver (produces bile and helps get rid of waste), small intestine (breaks down food and absorbs nutrients, large intestine (absorbs water and salts and gets rid of any waste) and pancreas (makes enzymes to break down sugars, fats and starches) and why they are important. I know that saliva glands produce saliva and the enzymes in this help to break down food in the mouth. I know what incisors, canines, pre-molars and molar teeth look like and can locate them in the mouth. I know the specific jobs of the incisors (bite food), canines (sharpest – tear food), pre-molars and molar (grind, tear and crush food) teeth. I know how our teeth differ from those of different animals and can give examples of carnivores, herbivores and omnivores. I know teeth are made up of many layers and that fluoride keeps teeth healthy and strong and prevents cavities and decay. I know what a good hygiene routine is and why this is important. I know that sugary foods are bad for teeth and can explain why using words like acid, cavity and plaque. I know a balanced diet is a combination of carbohydrates, protein, fats and fibre. I know carbohydrates give us energy, protein help repair, fats store energy and fibre helps with digestion. I know that too much of any of these food types is bad for our health.	*digestive system, digestion, mouth, teeth, saliva, oesophagus, stomach, small intestine, nutrients, large intestine, rectum, anus, teeth, incisor, canine, molar, premolars, carbohydrates, protein, fats, fibre*

	Respecting the circle of life	**Us!**	**Living things and their habitats** 1. describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird 2. describe the life process of reproduction in some plants and animals **Animals including humans** 1. describe the changes as humans develop to old age	**1) I know that as part of their life cycle, plants and animals reproduce. I know that reproduction is when organisms produce offspring of the same kind.** **2) I know that animals including humans have offspring which grow into adults.** **3) I can report and present findings on the life cycle of a mammal, an amphibian, an insect and a bird.** **4) I know plants reproduce both sexually and asexually.** **5) I know that when babies are young they grow rapidly.** **6) I can explain the changes that takes place in boys and girls during puberty. *(This will be taught alongside PSHE.)***	I know that most animals reproduce sexually. This involves two parents where the sperm from the male fertilises the female egg. I know that sexual reproduction of plants occurs through pollination, usually involving wind or insects. I can recap on the reproductive system of plants. I know that in humans and some animals these offspring will be born live, such as babies or kittens, and then grow into adults. I know that in other animals, such as chickens or snakes, there may be eggs laid that hatch to young which then grow to adults. I know that some young undergo a further change before becoming adults - e.g. caterpillars to butterflies. This is called a metamorphosis. I can draw the life cycle of a range of animals, identifying similarities and differences between the life cycles. I know that the arrows of a life cycle point towards the next stage (Y4 recap). I can describe the life cycle of humans and as they develop to old age. I can explain the difference between sexual and asexual reproduction and give examples of how plants reproduce in both ways. I know that bulbs, tubers, runners and plantlets are examples of asexual plant reproduction which involves only one parent. I know that gardeners may force plants to reproduce asexually by taking cuttings. I know babies are very dependent on their parents and as they develop they learn many skills. I can explain how a baby changes physically as it grows and also what it is able to do. I know that at puberty, a child's body changes and develops sexual characteristics. This enables the adult to reproduce.	*life cycle, reproduce, reproduction, sexual, sperm, fertilises, egg, live young, metamorphosis , sexual, asexual, plantlets, runners, bulbs, cuttings, mammal, amphibian, insect, bird* *Puberty: the vocabulary to describe sexual characteristics (Y5/6 - see RSE policy)*

					I know the primary sexual characteristics of males and females (body parts linked to reproduction) and the correct scientific vocabulary. I know the secondary sexual characteristics of humans, such as pubic hair, facial hair, breasts. I realise that all animals have secondary sexual characteristics, such as a lion's mane or a peacock's feathers.	
6	**Marie M. Daly, the Circulatory System, and Healthy Lifestyles**	**Marie M. Daly**	**Animals including humans** 1. identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood 2. recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function 3. describe the ways in which nutrients and water are transported within animals, including humans	**1) I can identify and name the main parts of the Human circulatory system** **2) I can describe the functions of the heart, blood vessels and blood.** **3) I know that Scientist Marie M. Daly, the first woman to get a chemistry degree, discovered that high cholesterol is linked to hyper-tension in the heart.** **4) I can describe the ways that nutrients and water are transported in animals** **5) I know that de-oxygenated blood enters the heart, which sends it to the lungs to be oxygenated, goes back to the heart, which then pumps it round the body.**	I can name body part names vs medical terminology: Aorta – main artery leading from the heart; Right Atrium – Left Atrium – Right Ventricle – Left Ventricle are the four chambers in the heart; Arteries carry oxygenated blood; Veins carry de-oxygenated blood. I know that the heart is a muscular pump. I know the difference between veins and arteries. I can draw an annotated diagram of the circulatory system. I know that red blood cells carry oxygen through the body by its haemoglobin, and white blood cells fight disease. I know that venous valves in veins and arteries make blood flow in a one-way cycle. I can describe possible circulatory problems – heart attack – caused by lifestyle (the heart goes into spasm and doesn't beat regularly), Cardiac arrest – electrical problem within the body that stops the heart or causes spasms, sickle cell – not enough red blood cells to carry oxygen and iron, blood poisoning – bacteria or infection in the blood which causes further illness, cholesterol – fatty deposits that block veins and arteries. I know what a good plate of food would look like and know the importance of a balanced diet. I can suggest lifestyle improvements for a healthy body and mind and I recognise the impact that diet, exercise, drugs and lifestyle have on the way our bodies function.	*heart, pulse, rate, pumps, blood, blood vessels, transported, lungs, oxygen, carbon dioxide, cardiovascular, nutrients, water, muscles, cycle, circulatory system, diet, exercise, drugs and lifestyle, Marie M Daly, cholesterol, veins, arteries*

					I know the difference between legal and illegal substances and can name some of these.	
6	**Who on Earth is Mrs GREN?**	**Carl Linneaus, The Hunger Games**	**Living things and their habitats - Variation and Classification** 1. describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals 2. give reasons for classifying plants and animals based on specific characteristics	**1) I know the key characteristics of living things: Mrs Gren Movement, Reproduction, Sensitivity, Growth, Respiration, Excretion, Nutrition** **2) I know that living things can be grouped/classified firstly as either plants or animals, but there are other living things that do not fit – e.g. micro-organisms such as bacteria, yeast/toadstools and mushrooms.** **3) I understand and can follow a branching key to classify a species of plant or animal.** **4) I know that Carl Linnaeus was a botanist from the 1700s.**	I know that plants don't breathe, they respire like humans do. It is the exchange of gasses. I know that plants can make their own food whereas animals can't: I know how Photosynthesis works! I know that nutrition isn't the physicality of eating, it's the absorption of life-sustaining vitamins and minerals. I know the difference between vertebrates and invertebrates. I know the difference between flowering and non-flowering plants. I know the sub-groups, with their characteristics, for animals: fish, amphibians, reptiles, birds and mammals. I know what a branching key is and I can create my own one for a set of animals or plants. I can use information about the characteristics of an unknown animal or plant to assign it to a group. I can present classification in a range of ways: venn diagram, carroll diagrams and keys. I know Carl Linnaeus was a botanist who developed the modern system of taxonomy. I know he published Systema Naturae, which was the first classification of animals and plants which paved the way for other scientists. I know that he was the first person to group apes and humans together. I can explain why he did this.	*vertebrates, fish, amphibians, reptiles, birds, mammals, invertebrates, insects, spiders, snails, worms, flowering and non-flowering, micro-organisms, branching key, classify, Carl Linnaeus, Systema Naturae*
	Darwin, Evolution and Inheritance	**Charles Darwin**	**Evolution and Inheritance** 1. recognise that living things have changed over time and that fossils provide information about living things that inhabited the	**1) I know that all living things reproduce and that their offspring are of the same kind (features inherited from parents).** **2) I know that plants and animals have characteristics suited to their environment.**	I understand offspring are not identical to their parents I can identify and discuss family similarities and differences over time - twins in families, hair colour, face shapes, height (recessive genes). I know that dominant genes can have positive and negative implications on offspring (e.g speed or medical conditions). I can list examples of how specific plants and animals are suited to their environment. I understand when the environment changes, species change with it for survival.	*offspring, sexual reproduction, reproduce, vary, characteristics, suited, adapted/adaptation, environment, evolve, species, inherited/inheritance, species,*

			Earth millions of years ago 2. recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents 3. identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution	**3) I understand the term evolution and that it means species evolve over time to create new species adapted to their current environment.** **4) I know that Fossils give us evidence of animals and plants that lived on Earth millions of years ago.** **5) I know that studies of animals and plants have shown changes, within recent history.** **6) I know that human beings have a massive impact on the planet, our environments and plant and animal species could become extinct if something isn't done about it.**	I understand that over time, inherited characteristics become more dominant within populations. I can design a new plant or animal to live in a particular environment or habitat. I understand fossils give us evidence that different plant and animals lived on our planet. I know that new species can be created by artificial cross-breeding in plants and animals. I know that fossils provide first-hand evidence of the evolution process. I know that Charles Darwin and Alfred Wallace used this evidence to produce theories based on animal and plant evolution. I know that enhancements in DNA testing have enabled further evidence of links between species. I know that Peppered Moths were studied, by RS Edleston, during the Industrial Revolution – a time of huge change towards large factories, burning coal for power and creating thick, black smoke. I know that in 1848 a single sighting of a dark peppered moth was recorded by Edleston in central Manchester. Before that he recorded that they were all light grey. I know that By 1900 (just 50 years later) the dark moth population was as high as 98% in a number of cities. It was found that this genetic change was passed from adults to young, as they were camouflaged in the dark smoke, and lasted longer than the light grey moths. I know that carbon dioxide is released by burning fossil fuels, and by animals used in mass farming. Plants absorb and store carbon dioxide across our planet. Increasing CO2 and cutting down rainforests mean an increase in climate change and the planet is warming over time. I know that changes in average temperature, wind patterns, and ocean currents mean that some parts of the world will get hotter and some will get colder. Many areas will suffer colder lows and hotter highs. I know that changes in climate will affect the habitats where plants and animals live. Many species of plants and animals will not be able to adapt in time and will become extinct.	*fossils, Charles Darwin, 'The Theory of Evolution'*

Chemistry

Year group	Topic	Scientist/ inspirational figure/ stimulus (where appropriate)	National Curriculum objectives	Core Knowledge	Additional Knowledge	Key Vocabulary
1	**Can we build it? Tarmacadam can!**	**John McAdam, Charles MacIntosh**	**Everyday materials** 1. distinguish between an object and the material from which it is made 2. identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock 3. describe the simple physical properties of a variety of everyday materials compare and group together a variety of everyday materials on the basis of their simple physical properties	**I can identify what different objects are made from; wood, plastic, glass, metal, fabric, rubber** **I can describe the properties of materials; i.e, hard, soft, rough, smooth, transparent, opaque, waterproof** **I know that John McAdam invented tarmac and George Macintosh invented the raincoat.**	I can list objects that are made from plastic. I can list objects that are made from metal. I can list objects that are made from glass. I can group objects based on their properties. I know why windows need to be transparent. I know why lots of doors are opaque. I know what objects are waterproof. I know what objects are absorbent. I know why tarmac is used for making roads.	*object, material, wood, plastic, glass, metal, water, rock, brick, paper, fabric, elastic, foil, card/cardboard, rubber, wool, clay, hard, soft, stretchy, stiff, bendy, floppy, waterproof, absorbent, breaks/tears, rough, smooth, shiny, dull, see through, not see through, solid, liquid, gas, temperature, freezing, boiling, John McAdam, tarmac, Charles MacIntosh*
2	**John Boyd Dunlop and**	**John Boyd Dunlop**	**Uses of Everyday Materials**	**I know all objects are made of one or more**	I know why it is important that rope is flexible and why bricks are rigid.	*Names of materials –*

	his stretchy, bendy invention! (Squishy, Squashy, Bendy)		1. identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses 2. find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching	**materials that are chosen specifically because they have suitable properties for the task. For example, a water bottle is made of plastic because it is transparent allowing you to see the drink inside and waterproof so that it holds the water. I also know why (most) clothes are opaque.** **I know that John Boyd Dunlop was an inventor who used his imagination and resilience to create rubber devices.** **I know that to change the shapes of some solid objects I can squash, bend, twist, and stretch. I know that changing shape changes its properties.**	I know why some materials are reflective and some are not reflective. I know a material can be suitable for different purposes and an object can be made of different materials. I know that John Boyd Dunlop invented the pneumatic tyre in 1888. I know that Dunlop invented the pneumatic tyre for his son's tricycle. I know that the tyre works because rubber is so bendy and stretchy and can change shape to fit around a wheel. I know objects made of some materials can be changed in shape by bending, stretching, squashing and twisting. For example, clay can be shaped by squashing, stretching, rolling, pressing etc. I know why it is useful that a sponge can be squashed and change shape. I know when materials might twist and squash and how this can be useful.	*increased range from year 1. Properties of materials - as for year 1 plus opaque, transparent and translucent, reflective, non-reflective, flexible, rigid, shape, push/pushing, pull/pulling, twist/twisting, squash/squashing. Bend/bending, stretch/stretching*
3	**Respecting nature's power: What Makes the Earth Angry? (Geog and Hist link)**	**Mary Anning, British Red Cross (Class charity)**	**Rocks** 1. compare and group together different kinds of rocks on the basis of their appearance and simple physical properties 2. describe in simple terms how fossils are formed when things that have lived are trapped within rock	**1) I know that Earthquakes are a build-up or pressure and when that pressure releases it causes a shaking of the ground.** **2) I know that volcanoes erupt due to the pressure build-up of the tectonic plates.** **3) I know that a Tsunami is a giant**	I know that tectonic plates are constantly moving and that this can cause the friction which causes an earthquake. I know that the epicentre is the middle of the earthquake and the energy ripples out from this point. I know that an earthquake is measured by a seismograph. I know that the liquid in a volcano is called magma and when it is outside of the volcano it is called lava. I know that most of the Earth's volcanic activity can be found in the 'Ring of Fire' (Pacific Ocean)	*minerals, rock types, sedimentary, igneous, metamorphic, rock, stone, pebble, boulder, grain, crystals, layers, hard, soft, texture, absorb water, soil, fossil, marble, chalk, granite, sandstone, slate,*

			3.recognise that soils are made from rocks and organic matter	**wave that can occur through earthquakes or volcanic eruptions.** **4) I know that the earth is made up of 4 layers (Inner core, Outer Core, Mantle and Crust).** **5) I know that rocks can occur naturally or be man-made.** **6) I know that soil is made up of different things (air, mineral, water and organic materials)**	I know that a volcano can be active, extinct or dormant. I know that a Tsunami can travel at speeds of 500mph. I know that Tsunami is a Japanese word meaning harbour wave. I know that before a Tsunami happens the water usually recedes. I know that the crust is the layer of the Earth that we stand on and that this is the thinnest layer. I know the Mantle is the heaviest layer and makes up 85% of the Earth's weight. I know that the temperature of the Inner core is as hot as the sun. I know that the 3 types of naturally occurring rocks are: igneous, metamorphic and sedimentary. I know that metamorphic rocks are made through the process of heat, pressure or both together, sedimentary is layers compacted igneous is through heating and cooling e.g. lava rocks. I know that fossils are made through layers of sediment compacting down on remains and water washing away leaving minerals. I know that there are 4 layers of soil (bedrock, rocky soil, sub soil and top soil). I know that there are 4 processes of soil and that these all happen at the same time, all the time! I know that there are different soil types (Clay, Loamy and Sandy).	*peat, sandy/chalk/clay*
4	**Water: nature's driving force (Geog link)**	**Water Aid (class charity)**	**States of Matter** 1. compare and group materials together, according to whether they are solids, liquids or gases 2. observe that some materials change	**1) I know water is precious and should not be wasted.** **2) I know that the availability of clean water is different throughout the world and I know the factors that influence this.**	I know that a lot of the time, we can take clean water for granted and can list ways that we sometimes waste water - e.g. brushing teeth etc. I know many ways in which water is used on a daily basis in first world countries: washing hands, drinking water, cooking, cleaning ourselves and our homes. I know a number of ways to reduce water usage in our day to day lives e.g. showers not baths, turn	*Solid, liquid, gas, state change, melting, freezing, melting point, boiling point, evaporation, temperature, water cycle*

			state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C) identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature	**3) I know that the three different states of matter are solids, liquids and gases.** **4) I know what the water cycle is.**	water off when brushing teeth, collecting water to water plants etc. I can use an atlas/map to identify continents and countries that do not have much rainfall (near equator), contributing to the lack of available water. I can name some of these countries. I know what children in two other parts of the world, where water is scarce (Africa / India), do in order to obtain and conserve water. I know that *WaterAid* is a charity that helps people all over the world access clean water. I know that all objects are made of molecules that have different properties and react in different ways through heating and cooling and can use a thermometer to measure temperature. I can list the properties of solids, liquids and gases and the behaviour of the molecules in each state. I know that water freezes at 0 degrees Celsius and boils at 100 degrees Celsius. I know that the water we see on Earth today has been around since the beginning of time and is constantly recycled. I can use and understand key terms such as; evaporation, condensation, precipitation and collection. I know what causes evaporation (heat) and the best conditions to make this happen.	
5	**Stephanie Kwolek: Changing state and Kevlar**	**Stephanie Kwolek**	**Solids, Liquids and Gases - Properties and changes of materials** 1. compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets	**1) I know that Stephanie Kwolek was an American Chemist who, in 1965, invented Kevlar.** **2) I know that materials have different uses depending on their**	I know that Kevlar is plastic - synthetic fibres so strong that not even steel bullets can penetrate! I know that it can be used for protective vests and clothing, boats, ropes, cables and planes. I know that Kevlar is so strong because its molecules are naturally arranged in regular, parallel lines and due to the way it's made, through chemistry/chemical reactions, into fibres are knitted tightly together (like pencils in a box). I can explain how these different materials' hardness make them perfect for different purposes – e.g. bricks,	*thermal/electrical insulator/conductor, change of state, mixture, dissolve, solution, soluble, insoluble,*

			know that some materials will **dissolve** in liquid to form a solution, and describe how to recover a substance from a solution 2. use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating 3. give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic 4. demonstrate that dissolving, mixing and changes of state are reversible changes 5. explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda	**properties and state (liquid, solid, gas).** **3) I know some materials will dissolve in a liquid and form a solution while others are insoluble and form sediment.** **4) I know that mixtures can be separated by filtering, sieving and evaporation.** **5) I know some changes to materials such as dissolving, mixing and changes of state are reversible, but some changes are irreversible**.	wood, glass and metal being used for buildings (but not cardboard!). I can explain what I found from the Champion Tape experiment and which tape could be used for what purpose. I know that some materials need to be transparent (like glass/windows). I know how materials might be used/not used because they are good thermal and electrical conductors and insulators and can name some of these materials. I know that some materials' properties are developed to be more effective than others...like nappy absorption. I can explain what dissolving means, giving examples – such as salt water and sugar in tea. I know that different solids may take different times to dissolve – and I can explain how I know this. I can say whether the amount of solution or the amount of solid affects the time it takes to dissolve...or whether it dissolves at all! I can name equipment used for filtering and sieving. (WHAT ARE THEY?) I can name some materials that can be separated by evaporation, filtering or sieving. I can use my knowledge of liquids, gases and solids to suggest ***how*** materials can be recovered from solutions or mixtures by evaporation, filtering or sieving. I can name some reversible changes due to melting, boiling, evaporation, freezing, condensation, dissolution and can give some examples of materials that can change state and be reversed back to their original state. I can name some irreversible changes such as burning wood, rusting and mixing vinegar with bicarbonate of soda and these result in the formation of new materials – like the chemical process of making Kevlar!	*evaporation, filter, sieve reversible/non-reversible change, burning, rusting, new material, Stephanie Kwolek, Kevlar, molecules*

Physics

Year group	Topic	Scientist/ inspirational figure/ stimulus (where appropriate)	National Curriculum objectives	Core Knowledge	Additional Knowledge	*Key Vocabulary*
1	**How can I look after my garden?**		**Seasonal Changes** 1. observe changes across the 4 seasons 2. observe and describe weather associated with the seasons and how day length varies	**I can name the different seasons of the year and how each one is different.**	I can describe how the weather changes during the different seasons. I know what happens to deciduous trees during the autumn. I know that the seasons are different in different hemispheres of the world.	*Weather, season, hemisphere, Spring, Summer, Autumn, Winter*
3	**Eratosthenes, light and the absence of light!**	**Eratosthenes**	**Light** 1. recognise that they need light in order to see things and that dark is the absence of light 2. notice that light is reflected from surfaces	**1) I know that Eratosthenes discovered how light and shadow works.** **2) I know that there are different types of light source – natural and man-made.** **3) I know that shadows are formed by objects blocking light.**	I know he did his experiments in Alexandria, Egypt. I know he discovered how shadow worked in 250BC. I know that he found this out by doing an experiment where he put sticks in the ground and measured the angle and length of the shadows. I know that there are natural (sun, lightning, fire flies) and man-made light sources (torch, lamp) I know that light reflects off objects e.g., mirrors and that is how we see them. I know that the moon is not a light source as it reflects the sun's light.	*light, light source, dark, absence of light, transparent, translucent, opaque, shiny, matt, surface, shadow, reflect, mirror,*

			3. recognise that light from the sun can be dangerous and that there are ways to protect their eyes 4. recognise that shadows are formed when the light from a light source is blocked by an opaque object 5. find patterns in the way that the size of shadows change	**4) I know that materials can be translucent, transparent, and opaque and that this can affect shadow.** **5) I know that there is a relationship between the Earth, Sun and the Moon.** **6) I know that reflective materials only work when a source of light reflects off them.**	I know that a shadow changes depending on the position of the light source. E.g., a footballer may have more than one shadow when playing at night. I know that a shadow changes throughout the day according to the position of the sun. I know that the sun travels in straight lines and when an object blocks this light a shadow is formed. I know that translucent objects allow some light particles to pass through (stained glass window, tissue paper). I know an opaque object blocks all light from travelling through (person, table, book). I know that a transparent object allows all light particles to pass through (window, reading glasses, clear bottle). I know the Moon orbits the Earth and that this takes approx. 29 days (a month).I know the Earth orbits the Sun with the Moon and this takes approx. 365 days. I know the Earth rotates (24hrs) as it orbits the sun, and this gives us night and day. I know that some reflective materials have retroreflective properties. I know retroreflective materials reflect the light back towards the source regardless of direction (e.g., high visibility jackets). I know how to investigate if a material is reflective or not.	*sunlight, dangerous, Eratosthenes*
	William Gilbert: the world is a magnet	**William Gilbert**	**Forces and Magnets** 1. compare how things move on different surfaces 2. notice that some forces need contact between two objects, but magnetic forces can act at a distance 3. observe how magnets attract or repel each other and attract some materials and not others 4. compare and group together a variety of	**1) I know that William Gilbert was a physician.** **2) I know what a magnetic field is.** **3) I know that magnets have a relationship with the North Pole.** **4) I know that magnets can attract and repel.** **5) I know that objects can be magnetic or not magnetic**	I know that he discovered that the Earth is one big magnet. I know that he found this out in 1600. I know that he invented the electroscope, which can detect an electric charge. I know that a magnet can be a piece of metal, ore or stone. I know that we use magnets in everyday life (fridge, whiteboard, clasp). I know there are different types of magnets (bar, horseshoe). I know that a magnet has a North and South pole. I know the Earth is a giant magnet and has a magnetic force field. I know magnetic North is different to True North (North Pole). I know that magnets exert a force on other magnets or magnetic materials (push and pull).	*force, push, pull, twist, contact force, non-contact force, magnetic force, magnet, strength, bar magnet, ring magnet, button magnet, horseshoe magnet, attract, repel, magnetic material, metal, iron, steel, poles, north pole, south*

			everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials 5. describe magnets as having two poles 6. predict whether two magnets will attract or repel each other, depending on which poles are facing	**6) I know there are different types of forces acting on an object (push, pull)** **7) I know that friction is a force that acts between two surfaces.**	I know that the two similar ends of a magnet will repel. I know that two different ends of a magnet will attract. I know that not all metals are magnetic. I know other metals such as copper and gold are not magnetic. I know that certain metals such as iron and steel are magnetic. I know magnets exert a force called magnetism, this can be weak or strong. I know a force is a push or pull acting on an object because of the object's interaction with another object (pushing open a door, push and pull on a swing). I know that gravity is a type of force that pulls. I know that different surfaces create different amounts of friction. I know that the amount of friction created by an object moving over the surface depends on the roughness of the surface and the object, and the force between them. Forces change the motion of an object. They make it move, speed it up, slow it down or make it stop.	*pole, William Gilbert, physician*
4	**Ears, brains and da Vinci's sound waves**	**Leonardo da Vinci**	**Sound** 1. identify how sounds are made, associating some of them with something vibrating 2. recognise that vibrations from sounds travel through a medium to the ear 3. find patterns between the pitch of a sound and features of the object that produced it	**1) I know what pitch, volume, tempo, beat and rhythm means and can use these terms to describe different music.** **2) I know that sound is caused by vibrations.** **3) I know that sound vibrations travel in waves.** **4) I can explain what each part of the ear does and can use the correct term: Pinna, outer ear, ear**	I can use technical vocabulary like pitch, volume, tempo, beat and rhythm when talking about different types of music. I understand that there are different genres of music and can describe their properties and how they make me feel. I know how factors like pitch, volume, tempo, beat and rhythm can affect the distance that a sound travels and can test this fairly. I can demonstrate sound is made by vibrations using a drum or my voice box. I know that the volume of a sound depends on the size of the vibrations made. I know that sound enters our ears through vibrations, these vibrations are carried through the outer and inner ear and our brain converts those to recognisable sound. I know that Leonardo da Vinci first discovered that sound travels in waves in 1490 when he inserted a tube into water and was able to detect vessels by ear.	*sound, source, vibrate, vibration, travel, pitch (high, low), volume, faint, loud, insulation, sound waves, frequency, da Vinci (as well as vocabulary related to the ear)*

			4. find patterns between the volume of a sound and the strength of the vibrations that produced it 5. recognise that sounds get fainter as the distance from the sound source increases	**canal, ear drum, ossicles, hammer, stirrup, anvil, cochlea.** **5) I know that the shape of our ears helps to funnel sound waves into our ear canal, therefore helping us to hear better.**	I know that sound travels as waves and is different depending on the pitch (high and low frequency) and volume of the sound – some pitches of sounds are too high or low for us to hear, but other animals, lie dogs, can! I know that sound waves get fainter as the distance from the source increases. I know the ear is made up of the outer, middle and inner ear. I can explain how the parts of the ear work together by transferring vibrations to help us to hear sounds. From the Pinna, outer ear, ear canal, ear drum, ossicles, hammer, stirrup, anvil and cochlea. I know that sometimes our ears don't work the way they should and can be easily damaged. I understand ways in which we can amplify peoples' hearing e.g. hearing aids and cochlea implants. I know the shape of my ear doesn't just funnel sound waves, it amplifies them by funnelling sound waves. I know that our ears are designed to amplify and funnel sounds from the front and from the side, but to reduce sound waves from behind. I know animals have different shaped ears and the Elephants ears are amazing – they are large, therefore help funnel quiet sounds and they are thin to help cool them down in the heat.	
	What would we do without you, Mr Latimer?	**Lewis Latimer**	**Electricity** 1. identify common appliances that run on electricity 2. construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers 3. identify whether or not a lamp will light in a simple series circuit, based on	**1) I can identify common appliances that run on electricity and the dangers of electricity.** **2) I know that there are alternative sources of electricity.** **3) I know that Electricity can be generated using coal, gas,**	I know that electricity is a flow of tiny particles called protons and electrons and they provide energy to effect different things - e.g. light, sound, movement, heat. I know that electrical items in our homes are powered from mains electricity or batteries. I can begin to understand that electrical dangers are associated with materials that are good conductors. I can list a number of safety issues regarding electricity. I know that there are renewable and non-renewable energy sources and can give examples of these. I know the advantages and disadvantages of renewable and non-renewable energy. Renewable resources include timber, wind, and solar while non-renewable resources include coal and natural gas. I can explain how we have become so dependent on electricity over time.	*electricity, electrical appliance/ device, mains, plug, electrical circuit, complete circuit, component, cell, battery, positive, negative, connect/connections, loose connection, short circuit,*

			whether or not the lamp is part of a complete loop with a battery 4. recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit 5. recognise some common conductors and insulators, and associate metals with being good conductors	**nuclear fuels, the wind or sunlight. Electri city is normally generated in big buildings called power st ations** **4) I know what a simple circuit is.** **5) I can recognise circuit symbols.** **6) I know how to construct a simple series electrical circuit.**	I know who Lewis Latimer was and his role in creating the carbon filament in the modern lightbulb. I know the challenges that he faced entering a white male dominated field. I know the role of pylons, transformers, substations in transporting electricity to our homes. I know why voltage needs to be reduced before entering our homes. I know a simple circuit has to have a source of energy, wires, and a device that uses the energy (like a bulb) I know that a circuit has to be complete to work. I know that a circuit breaker (like a switch) turns components on and off and I know how to use one. I can link circuit symbols to the correct component. Using a ruler I can accurately draw circuit symbols. I can draw a range of circuits using a variety of components and explain why they work or don't. I can use crocodile clips to link different components together to make a complete circuit. I can test, classify and record which materials are good conductors and insulators of electricity. I can associate metals with being good conductors. I can names some good conductors (water, metals like copper, silver, etc) and insulators (like rubber, wood, oil) of electricity. I know that a parallel circuit gives electricity different ways to flow – I know how to construct a parallel circuit so that some components work and others don't.	*parallel circuit, crocodile clip, bulb, switch, circuit breaker, buzzer, motor, conductor, insulator, metal, non-metal, symbol, Lewis Latimer, filament, wind, solar, renewable/non-renewable energy, pylon, substation, transformer, voltage* *N.B. Children in year 4 do not need to use standard symbols as this is taught in year 6*
5	**Newton, an apple, and a world of forces!**	**Isaac Newton**	**Forces** 1. explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object	**1) I know that a force is a push, a pull, a bend or a twist that causes an object to start moving, stop moving, speed up, slow down or change direction. I know that this can lead to compression or tension.** **2) I know that Isaac Newton is a famous physician of the 17th and 18th century (but his**	I know that all forces come in pairs and no force works alone – just like I learnt in Y3 with magnets! I know that Isaac Newton said, 'For every action, there is an equal and opposite reaction.' I know that forces can make objects change shape and can give examples (see topic overview). I know that the famous story of an apple falling to the ground from a tree illustrates how Newton's work on gravity was inspired by things he observed in the world around him. I know gravity is an invisible force that acts at a distance, pulling objects toward each other - so, the closer objects are to each other, the stronger their gravitational pull is. Earth's gravity comes from all	*force, bend, twist, push, pull, tension, compression, gravity, Earth, air resistance, lift, drag, thrust, particles, water resistance, friction (high*

			2. identify the effects of air resistance, water resistance and friction, that act between moving surfaces 3. recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect	**mother wanted him to be a farmer!).** **3) I know that friction is a contact force that acts between moving surfaces.** **4) I know that air resistance is a type of friction between the air and another material. The object may be moving through the air or the air may be moving over a stationary object.** **5) I know that water resistance is a type of force. The object may be moving through the water or the water may be moving over a stationary object.** **6) Pulleys, levers and gears are all mechanisms, also known as simple machines.**	its mass. All its mass makes a combined gravitational pull on all the mass in your body I know that everything is pulled to the Earth by gravity. This causes unsupported objects to fall. I can demonstrate the effect of gravity acting on an unsupported object. I can give examples of when it is useful to have high and low friction (like tread on tyres/road); and low friction (ice/snow and skis) I know that friction works in the opposite direction of movement and that the force acting on an object must be greater than friction for it to move. I know some ways in which forces can affect movement. I can give examples of air resistance, like when an aeroplane flies through the air, the air particles hit the aeroplane and make it more difficult to move. I know that things can be made more aerodynamic to decrease air resistance and make it easier to travel through the air, or less aerodynamic to increase air resistance. I know how this can be done! I know that lift, drag, gravity and thrust are some forces that act on an aeroplane. I know that water resistance is a type of force that uses friction to slow things down that are moving through water. It is often called drag. I know that swimming is an example of water resistance when there is friction between our skin and water particles. I know some ways to reduce water resistance/drag (like wearing swimming hats) and realise that certain sea creatures, like sharks, have evolved to be fast in the water. I know that a mechanism is a device that allows a small force to be increased to a larger force. The pay back is that it requires a greater movement. I know an example of this is a crowbar or a bottle opener. I know that a pulley is a rope or wire wrapped around a wheel that changes the direction of force. A basic compound pulley has a rope or wire attached to a stationary point looped around one wheel and then around a second wheel. Pulling on the rope pulls the two wheels closer together.	*and low), mechanisms, simple machines, levers, pulleys, gears, Isaac Newton*

					I know that a lever works by reducing the amount of force needed to move an object or lift a load. I can give an example – like how a seesaw works! I know that gears wheels with teeth that slot together. When one gear is turned the other one turns as well. If the gears are of different sizes, they can be used to increase the power of a turning force. The smaller wheel turns more quickly but with less force, while the bigger one turns more slowly with more force.	
	Copernicus, Galileo and the Solar system	**Copernicus, Galileo**	**Earth and Space** 1. describe the movement of the Earth, and other planets, relative to the Sun in the solar system 2. describe the movement of the Moon relative to the Earth 3. describe the Sun, Earth and Moon as approximately spherical bodies 4. use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky	**1) I know that Galileo was a scientist/astronomer/ mathematician from the 16th century who developed the telescope.** **2) I know that the sun is a star, like millions of others in the universe, and is the centre of our solar system.** **3) I know that there are eight planets in our solar system and that they travel around the sun in fixed orbits.** **4) I know that the Earth takes 365¼ days to complete its orbit around the Sun.** **5) I can explain how the Moon orbits the Earth - it takes about 28 days to complete its orbit.** **6) I know that our solar system is in one of millions of galaxies in the universe and is called 'The Milky Way'.**	I know that Copernicus first discovered that the sun was the centre of the solar system and the planets rotate around it ('heliocentric') in the 15th century. I know that Galileo was imprisoned for backing up Copernicus' research saying that the sun was the centre of the solar system! I know that Galileo first discovered that the moon had craters and mountains. I know that our sun, like other stars, are burning balls of mostly hydrogen and helium. I know that some stars are over 100 times bigger than our sun...like Arcturus and Rigal. The biggest known star is 1300 times bigger! I know that the next closest star to Earth is Proxima Centauri – 4.24 light years away (40,208,000,000,000 km)!!!!!!! I know that Jupiter is the biggest planet. I know that Mercury is closest to the sun and therefore the hottest planet. I know that Earth is sometimes called the 'Goldilocks planet' as it is just the right distance from the sun and has just the right conditions to sustain life. I know lots about one planet because I've researched and reported on it! I know that the Earth rotates (spins) on its axis every 24 hours. I know that as Earth rotates, half faces the Sun (here it is day) and half is facing away from the Sun (night). I know that as the Earth rotates, the Sun appears to move across the sky. I know that the Sun, Earth and Moon are approximately spherical.	*Earth, Sun, Moon, (Mercury, Jupiter, Saturn, Venus, Mars, Uranus, Neptune) spherical, solar system, galaxy, universe, rotates, star, orbit, planets, gravity, mass, supernova, black hole, Nicolas Copernicus, naked eye, heliocentric, Galileo Galilei, telescope*

					I can show using diagrams the movement of the Earth and Moon and I can explain their movement. I know that the moon was made when a rock smashed into the Earth. I know that in the middle of every galaxy is a supermassive black hole. I can puzzle my brain by trying think about what a black hole is! I can tell you some other amazing facts about our galaxy and the incredible universe!	
6	**Ibn Al-Haytham: the father of optics**	**Ibn Al-Haytham**	**Light** 1. describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals 2. give reasons for classifying plants and animals based on specific characteristics	**1) I know that light travels in straight lines from light sources.** **2) I know that Ibn Al-Haytham discovered that objects are seen because they give out or reflect light, into the eye; we see things because light travels from light sources to objects and then to our eyes.** **3) I can explain why shadows have the same shape as the objects that cast them.** **4) I know that I can explore the behaviours of light and light paths by using mirrors, shadows, reflection, and refraction.** **5) I Understand the eye is made up of different parts.**	I know that the moon is not a light source but just reflects light. I know which are natural sources of light and which are man-made. I know that light travels in all directions from the surface of the light source. I Understand the difference between opaque, transparent, translucent. I can reason about materials and their properties of reflection and absorption of light (why they reflect or absorb). I know that Ibn Al-Haytham is known as the 'father of optics' and studied optics in the eye 1000 years ago in Iraq. I know that colours are seen because certain light colours are absorbed by objects and only certain colours are then reflected back. I know that light travels in straight lines either past, through or is absorbed by objects. I know that black is the absence of light. I know that shadow lengths are affected by the position of a light source. I know that light can be reflected around objects. I can explain how periscopes / Al-Haytham's Camera Obscura works I know that certain objects change the path of the light – e.g. water as demonstrated by the research of Ibn Al-Haytham.	*As for year 3 plus straight lines, light rays. Teachers to use discretion on vocabulary to revisit and new vocabulary to introduce: e.g. - Ibn Al-Haytham, optics, man-made, natural, shadow, absorb, reflect, absence of light, periscope, Camera Obscura (see knowledge)*

					I can label and explain the major parts of the eye (Sclera, Cornea, Iris, Lens, Retina, Anterior & Posterior Chambers, Vitreous Humour) I can explain how each part of the eye helps us see things. I can explain what could make you go blind.	
	Electricity's 'Current War'	**Franklin, Edison, Tesla, Faraday**	**Electricity** 1. associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit 2. compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches 3. use recognised symbols when representing a simple circuit in a diagram	**1) I know four key scientists that helped to discover how electricity worked – Franklin, Faraday, Edison and Tesla.** **1) I can explain how an electrical circuit operates - that electrons flow in one direction around the circuit.** **2) I can recognise circuit symbols and draw simple circuit diagrams.** **3) I know that a cell is 1.5v and a battery is 3v or more.** **4) I know that a break in a circuit will prevent the electrical current from flowing.** **5) I know that complete electrical circuits make something happen such as: light, sound, heat and movement.** **6) I understand the importance of insulators and**	I know that Franklin's kite experiment in 1752 helped him to discover that electricity had a positive and negative charge. I know that both Edison and Tesla were great scientists who invented different electrical currents, Edison became much more famous because he was better at marketing his inventions! I know that cells and batteries have positive and negative terminals and must be placed correctly in order for electricity to flow. I know that all components of a circuit need to be connected for the circuit to be complete. I know what series and parallel circuits are and that parallel circuits have more than one route to follow. I can draw circuit diagrams from verbal prompts. I can draw the corresponding circuit diagram from a physical circuit which I have made. I can say from a circuit diagram whether the circuit will work or not and why. I know that adding more cells or a higher voltage battery will make a bulb brighter, motor spin faster, etc. I know that adding too much power can cause breaks within components, thus affecting the circuit. I know that we use a voltmeter to measure and record the current within a circuit – and I can use one! I know that components can be in any place within a circuit and all still work if connected correctly. I know that breaks in a circuit can be deliberate and useful such as switches, timers, alarms and pressure pads (traffic lights). I can suggest ways of fixing circuits. I can design and make a circuit to solve a particular problem e.g. burglar alarm – and explain how.	*circuit, complete circuit, circuit diagram, circuit symbol, cell, battery, bulb, buzzer, motor, switch, voltage, conductor, insulator, Franklin, Edison, Tesla, Faraday (NB Children do not need to understand what voltage is but will use volts and voltage to describe different batteries. The words cells and batteries are now used interchangeably)*

				conductors to be safe around electricity.	I can explain (following my investigations) how adding or removing components effects a circuit. I know how circuits are used in everyday life. I can list insulators and their properties, making suggestions as to which are appropriate for use in circuits and why. I understand water is a conductor and is extremely dangerous around electricity. I understand the need for safety outside of school e.g. in the home, being around pylons, substations, train and tram lines.	