

Science Knowledge, Skills and Progression Document

Working scientifically					
	Nursery	Reception	KS1	LKS2	UKS2
Development Matters and the National Curriculum	Understanding the world involves guiding children to make sense of their physical world and their community. The frequency and range of children's personal experiences increases their knowledge and sense of the world around them – from visiting parks, libraries and museums to meeting important members of society such as police officers, nurses and firefighters. In addition, listening to a broad selection of stories, non-fiction, rhymes and poems will foster their understanding of our culturally, socially, technologically and ecologically diverse world. As well as building important knowledge, this extends their familiarity with words that support understanding across domains. Enriching and widening children's vocabulary will support later reading comprehension.	Understanding the world involves guiding children to make sense of their physical world and their community. The frequency and range of children's personal experiences increases their knowledge and sense of the world around them – from visiting parks, libraries and museums to meeting important members of society such as police officers, nurses and firefighters. In addition, listening to a broad selection of stories, non-fiction, rhymes and poems will foster their understanding of our culturally, socially, technologically and ecologically diverse world. As well as building important knowledge, this extends their familiarity with words that support understanding across domains. Enriching and widening children's vocabulary will support later reading comprehension.	During years 1 and 2, pupils should be taught to use the following practical scientific methods, processes and skills through the teaching of the programme of study content: • Asking simple questions and recognising that they can be answered in different ways • Observing closely, using simple equipment • Performing simple tests • Identifying and classifying • Using their observations and ideas to suggest answers to questions • Gathering and recording data to help in answering questions	During years 3 and 4, pupils should be taught to use the following practical scientific methods, processes and skills through the teaching of the programme of study content: • Asking relevant questions and using different types of scientific enquiries to answer them • Setting up simple practical enquiries, comparative and fair tests • Making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers • Gathering, recording, classifying and presenting data in a variety of ways to help in answering questions • Recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables • Reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions • Using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions • Identifying differences, similarities or changes related to simple scientific ideas and processes • Using straightforward scientific evidence to answer questions or to support their finding	During years 5 and 6, pupils should be taught to use the following practical scientific methods, processes and skills through the teaching of the programme of study content: • Planning different types of scientific enquiries to answer questions, including recognising and controlling • Variables where necessary • Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate • Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs • Using test results to make predictions to set up further comparative and fair tests reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and a degree of trust in results, in oral and written forms such as displays and other presentations • Identifying scientific evidence that has been used to support or refute ideas or arguments
	<u>3 and 4 year olds will be learning to:</u> • Use all their senses in hands-on exploration of natural materials. • Explore collections of materials with similar and/or different properties. • 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 a plant and an animal. • Begin to understand the need to respect and care for the natural environment and all living things. • Explore and talk about different forces they can feel. • Talk about the differences between materials and changes they notice	<u>Children in reception will be learning to:</u> • Explore the natural world around them. • Describe what they see, hear and feel whilst outside. • Recognise some environments that are different from the one in which they live. • Understand the effect of changing seasons on the natural world around them. <u>Early Learning Goals</u> • Explore the natural world around them, making observations and drawing pictures of animals and plants. • Know some similarities and differences between the natural world around them and contrasting environments, drawing on their			

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	•Explore the natural world around them.	experiences and what has been read in class. • Understand some important processes and changes in the natural world around them, including the seasons and changing states of matter.			
Enrichment			KS1 will take part in science week	LKS2 will visit Science Oxford annually taking part in science workshops. The focus of these workshops will change each year depending on the focus for science during the term where the visit will take place. LKS2 will take part in science week.	UKS2 will have a Science Oxford show or workshop, in school. The focus of these shows/workshops will change depending on the focus for science during the term where the in-school visit will take place. UKS2 will have an annual Science week
	Living eggs - directly linked to the National Curriculum, all children across the school will observe and take part in a variety of activities linked to the ‘Chick Hatching Programme.’ Space Week takes place bi-annually, as a whole school enrichment week in line with World Space week, usually in October. British Science Week - alternate years to Space Week. The whole school will celebrate British Science Week, taking part in a variety of activities connected to the theme of that year.				

Plants					
	Nursery	Reception	KS1	LKS2	
National Curriculum	<u>3 and 4 year olds will be learning to:</u> • Use all their senses in hands-on exploration of natural materials. • 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 a plant. • Begin to understand the need to respect and care for the natural environment and all living things. •Explore the natural world around them.	<u>Children in reception will be learning to:</u> • Explore the natural world around them. •Describe what they see, hear and feel whilst outside. •Recognise some environments that are different from the one in which they live. •Understand the effect of changing seasons on the natural world around them. <u>Early Learning Goals</u> • Explore the natural world around them, making observations and drawing pictures of animals and plants. • Know some similarities and differences between the natural world around them and contrasting environments, drawing on their experiences and what has been read in class. • Understand some important processes and changes in the natural world around them, including the seasons and changing states of matter.	<u>YEAR 1</u> <u>Plants</u> Pupils should be taught to: · identify and name a variety of common wild and garden plants, including deciduous and evergreen trees · identify and describe the basic structure of a variety of common flowering plants, including trees <u>YEAR 2</u> <u>Plants</u> Pupils should be taught to: · observe and describe how seeds and bulbs grow into mature plants · find out and describe how plants need water, light and a suitable temperature to grow and stay healthy	<u>YEAR 3</u> <u>Plants</u> Pupils should be taught to: · identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers · 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 · investigate the way in which water is transported within plants · explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal	
Knowledge	Key learning	• Planting a range of flower seeds and looking after them.	• Wow Science- Introduction to practical science experiments.	<u>Year 1</u> • Growing locally, there will be a vast array of	• Many plants, but not all, have roots, stems/trunks, leaves and

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(What pupils need to know in order to be secure)			• Growth and life cycles- sunflowers, (chicks, butterflies, bees). • Explore the natural world around them. • Describe what they hear, see and feel. • Recognise and talk about plant and animal life cycles.	plants which all have specific names. These can be identified by looking at the key characteristics of the plant. • Plants have common parts, but they vary between the different types of plants. • Some trees keep their leaves all year while other trees drop their leaves during autumn and grow them again during spring. <u>Year 2</u> • Plants may grow from either seeds or bulbs. These then germinate and grow into seedlings which then continue to grow into mature plants. These mature plants may have flowers which then develop into seeds, berries, fruits etc. • Seeds and bulbs need to be planted outside at particular times of year and they will germinate and grow at different rates. • Some plants are better suited to growing in full sun and some grow better in partial or full shade. Plants also need different amounts of water and space to grow well and stay healthy.	flowers/blossoms. The roots absorb water and nutrients from the soil and anchor the plant in place. The stem transports water and nutrients/minerals around the plant and holds the leaves and flowers up in the air to enhance photosynthesis, pollination and seed dispersal. The leaves use sunlight and water to produce the plant's food. • Some plants produce flowers which enable the plant to reproduce. Pollen, which is produced by the male part of the flower, is transferred to the female part of other flowers (pollination). This forms seeds, sometimes contained in berries or fruits which are then dispersed in different ways. • Different plants require different conditions for germination and growth.
	Vocabulary	• Growing, seed, water, soil, rain, grow	• Growing, seed, water, soil, rain, grow, leaf, flower, stem, root	<u>Year 1</u> Leaf, flower, blossom, petal, fruit, berry, root, seed, trunk, branch, stem, bark, stalk, bud Names of trees in the local area Names of garden and wild flowering plants in the local area <u>Year 2</u> As for Year 1 plus light, shade, sun, warm, cool, water, grow, healthy	Photosynthesis, pollen, insect/wind pollination, seed formation, seed dispersal (wind dispersal, animal dispersal, water dispersal)
	Common misconceptions Some children may think:			<u>Year 1</u> • Plants are flowering plants grown in pots with coloured petals and leaves and a stem. • Trees are not plants. • All leaves are green. • All stems are green. • A trunk is not a stem. • Blossom is not a flower. <u>Year 2</u> • Plants are not alive as they cannot be seen to move. • Seeds are not alive. • All plants start out as seeds. • Seeds and bulbs need sunlight to	• Plants eat food. • Food comes from the soil via the roots. • Flowers are merely decorative rather than a vital part of the life cycle in reproduction. • Plants only need sunlight to keep them warm. • Roots suck in water which is then sucked up the stem.

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				germinate.	
Skills (Applying the knowledge in related contexts)				<u>Year 1</u> • Make close observations of leaves, seeds, flowers outside. • Compare two leaves, seeds, flowers etc. • Classify leaves, seeds, flowers etc. using a range of characteristics. • Identify plants by matching them to named images. • Make observations of how plants change over a period of time. • When further afield, spot plants that are the same as those in the local area studied regularly, describing the key features that helped them. <u>Year 2</u> • Make close observations of seeds and bulbs. • Classify seeds and bulbs. • Research and plan when and how to plant a range of seeds and bulbs. • Look after the plants as they grow – weeding, thinning, watering etc. • Make close observations and measurements of their plants growing from seeds and bulbs. • Make comparisons between plants as they grow.	• Observe what happens to plants over time when the leaves or roots are removed. • Observe the effect of putting cut white carnations or celery in coloured water. • Investigate what happens to plants when they are put in different conditions e.g. in darkness, in the cold, deprived of air, different types of soil, different fertilisers, varying amounts of space. • Spot flowers, seeds, berries and fruits outside throughout the year. • Observe flowers carefully to identify the pollen. • Observe flowers being visited by pollinators e.g. bees and butterflies in the summer. • Observe seeds being blown from the trees e.g. sycamore seeds. • Research different types of seed dispersal. • Classify seeds in a range of ways, including by how they are dispersed. • Create a new species of flowering plant.

Animals, including humans					
	Nursery	Reception	KS1	LKS2	UKS2
National Curriculum	<u>3 and 4 year olds will be learning to:</u> • 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.	<u>Early Learning Goals</u> • Explore the natural world around them, making observations and drawing pictures of animals and plants.	<u>YEAR 1</u> Pupils should be taught to: · identify and name a variety of common animals including fish, amphibians, reptiles, birds and mammals · identify and name a variety of common animals that are carnivores, herbivores and omnivores · describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals including pets) · identify, name, draw and label the basic parts of the human body and	<u>YEAR 3</u> Pupils should be taught to: · identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat · identify that humans and some other animals have skeletons and muscles for support, protection and movement <u>YEAR 4</u> Pupils should be taught to:	<u>YEAR 5</u> Pupils should be taught to: · describe the changes as humans develop to old age <u>YEAR 5</u> Pupils should be taught to: · identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood · recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function

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				say which part of the body is associated with each sense <u>YEAR 2</u> Pupils should be taught to: · notice that animals, including humans, have offspring which grow into adults · find out about and describe the basic needs of animals, including humans, for survival (water, food and air) · describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene	· describe the simple functions of the basic parts of the digestive system in humans · identify the different types of teeth in humans and their simple functions · construct and interpret a variety of food chains, identifying producers, predators and prey	· describe the ways in which nutrients and water are transported within animals, including humans
Knowledge (What pupils need to know in order to be secure)	Key learning	All about me - naming parts of the body, family. When I was a baby – how have I changed? Describing myself. Naming body parts. Farms and farmyard babies. Living eggs.	Me and My Family. Me as a Baby. Being me - We are all different (Elmer). Wow Science- Introduction to practical science experiments. Minibeasts - worms, bees, ladybirds. Explore the natural world around them. Describe what they hear, see and feel. Living eggs.	<u>Year 1</u> Animals vary in many ways having different structures e.g. wings, tails, ears etc. They also have different skin coverings e.g. scales, feathers, hair. These key features can be used to identify them. Animals eat certain things - some eat other animals, some eat plants, some eat both plants and animals. Humans have key parts in common, but these vary from person to person. Humans (and other animals) find out about the world using their senses. Humans have five senses – sight, touch, taste, hearing and smelling. These senses are linked to particular parts of the body. <u>Year 2</u> All objects are either living, dead or have never been alive. Living things are plants (including seeds) and animals. Dead things include dead animals and plants and parts of plants and animals that are no longer attached e.g. leaves and twigs, shells, fur, hair and feathers (This is a simplification, but appropriate for Year 2 children.) An object made of wood is classed as dead. Objects made of rock,	<u>Year 3</u> Animals, unlike plants which can make their own food, need to eat in order to get the nutrients they need. Food contains a range of different nutrients – carbohydrates (including sugars), protein, vitamins, minerals, fats, sugars, water – and fibre that are needed by the body to stay healthy. A piece of food will often provide a range of nutrients. Humans, and some other animals, have skeletons and muscles which help them move and provide protection and support. <u>Year 4</u> Food enters the body through the mouth. Digestion starts when the teeth start to break the food down. Saliva is added and the tongue rolls the food into a ball. The food is swallowed and passes down the oesophagus to the stomach. Here the food is broken down further by being churned around and other chemicals are added. The food passes into the small intestine. Here nutrients are removed from the food and leave the digestive system to be used elsewhere in the body. The rest of the food then passes into the large	<u>Year 5</u> When babies are young, they grow rapidly. They are very dependent on their parents. As they develop, they learn many skills. At puberty, a child’s body changes and develops primary and secondary sexual characteristics. This enables the adult to reproduce. This needs to be taught alongside PSHE. The new statutory requirements for relationships and health education can be found below: • statutory guidance on Physical health and mental wellbeing (primary and secondary). Other useful guidance includes: • Joint briefing on teaching about puberty in KS2 from PSHE Association and Association for Science Education • Briefing on human development and reproduction in the Primary Curriculum from PSHE Association and Association for Science Education. <u>Year 6</u> The heart pumps blood in the blood vessels around to the lungs. Oxygen goes into the blood and

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				metal and plastic have never been alive (again ignoring that plastics are made of fossil fuels). Animals and plants live in a habitat to which they are suited, which means that animals have suitable features that help them move and find food and plants have suitable features that help them to grow well. The habitat provides the basic needs of the animals and plants – shelter, food and water. Within a habitat there are different microhabitats e.g. in a woodland – in the leaf litter, on the bark of trees, on the leaves. These micro-habitats have different conditions e.g. light or dark, damp or dry. These conditions affect which plants and animals live there. The plants and animals in a habitat depend on each other for food and shelter etc. The way that animals obtain their food from plants and other animals can be shown in a food chain.	intestine. Here the water is removed for use elsewhere in the body. What is left is then stored in the rectum until it leaves the body through the anus when you go to the toilet. Humans have four types of teeth: incisors for cutting; canines for tearing; and molars and premolars for grinding (chewing). Living things can be classified as producers, predators and prey according to their place in the food chain.	carbon dioxide is removed. The blood goes back to the heart and is then pumped around the body. Nutrients, water and oxygen are transported in the blood to the muscles and other parts of the body where they are needed. As they are used, they produce carbon dioxide and other waste products. Carbon dioxide is carried by the blood back to the heart and then the cycle starts again as it is transported back to the lungs to be removed from the body. This is the human circulatory system. Diet, exercise, drugs and lifestyle have an impact on the way our bodies function. They can affect how well our heart and lungs work, how likely we are to suffer from conditions such as diabetes, how clearly we think, and generally how fit and well we feel. Some conditions are caused by deficiencies in our diet e.g. lack of vitamins. This content is also included in PSHE. The new statutory requirements for relationships and health education can be found below: • statutory guidance on Physical health and mental wellbeing (primary and secondary).
	Vocabulary	• Face, nose, hand, leg, foot, neck, ear, nose, eye, tongue, hair. • Names of farm animals – cow, pig, sheep, chicken, hen, horse, duck. • Words when describing farm animals – feathers, hair, fur, wings, beak. • Growing/grow, change, taller, shorter, bigger, older. • Eggs, chicken, hatch, grow, change, feathers, peck, beak, wing.	• Hair colours, eye colours. • Names of minibeasts. • Eggs, chicken, hatch, grow, change, feathers, peck, beak, wing.	<u>Year 1</u> • Head, body, eyes, ears, mouth, teeth, leg, tail, wing, claw, fin, scales, feathers, fur, beak, paws, hooves. • Names of animals experienced first-hand from each vertebrate group. • Parts of the body including those linked to PSHE teaching (see joint document produced by the ASE and PSHE Association) • Senses – touch, see, smell, taste, hear, fingers (skin), eyes, nose, ear and tongue <u>Year 2</u> • Living, dead, never been alive,	<u>Year 3</u> Nutrition, nutrients, carbohydrates, sugars, protein, vitamins, minerals, fibre, fat, water, skeleton, bones, muscles, joints, support, protect, move, skull, ribs, spine. <u>Year 4</u> Digestive system, digestion, mouth, teeth, saliva, oesophagus, stomach, small intestine, nutrients, large intestine, rectum, anus, teeth, incisor, canine, molar, premolars, herbivore, carnivore, omnivore, producer, predator, prey, food chain.	<u>Year 5</u> Puberty – the vocabulary to describe sexual characteristics <u>Year 6</u> Heart, pulse, rate, pumps, blood, blood vessels, transported, lungs, oxygen, carbon dioxide, nutrients, water, muscles, cycle, circulatory system, diet, exercise, drugs, lifestyle

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				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.		
	Common misconceptions Some children may think:			• Only four-legged mammals, such as pets, are animals • Humans are not animals • Insects are not animals • All ‘bugs’ or ‘creepy crawlies’, such as spiders, are part of the insect group • Amphibians and reptiles are the same. • An animal’s habitat is like its ‘home’. • Plants and seeds are not alive as they cannot be seen to move • Fire is living • Arrows in a food chain mean ‘eats’.	• Certain whole food groups like fats are ‘bad’ for you • Certain specific foods, like cheese are also ‘bad’ for you • Diet and fruit drinks are ‘good’ for you • Snakes are similar to worms, so they must also be invertebrates • Invertebrates have no form of skeleton. • Arrows in a food chains mean ‘eats’ • The death of one of the parts of a food chain or web has no, or limited, consequences on the rest of the chain • There is always plenty of food for wild animals • Your stomach is where your belly button is • Food is digested only in the stomach • When you have a meal, your food goes down one tube and your drink down another • The food you eat becomes “poo” ; the drink becomes “wee”.	• A baby grows in a mother’s tummy • A baby is “made”. • Your heart is on the left side of your chest • The heart makes blood • The blood travels in one loop from the heart to the lungs and around the body • When we exercise, our heart beats faster to work the muscles more • Some blood in our bodies is blue and some blood is red • We just eat food for energy • All fat is bad for you • All dairy is good for you • Protein is good for you, so you can eat as much as you want • Foods only contain fat if you can see it • All drugs are bad for you.
Skills (Applying the knowledge in related contexts)		• Observations. Saying what they see.	• Observations. Talking about what they observe.	<u>Year 1</u> • Make first-hand, close observations of animals from each of the groups. • Compare two animals from the same or different groups. • Classify animals using a range of features. • Identify animals by matching them to named images. • Classify animals according to what they eat. • Make first-hand close observations of parts of the body	<u>Year 3</u> • Classify food in a range of ways. • Use food labels to explore the nutritional content of a range of food items. • Use secondary sources to find out the types of food that contain the different nutrients. • Use food labels to answer enquiry questions e.g. How much fat do different types of pizza contain? How much sugar is in soft drinks? • Plan a daily diet to contain a good balance of nutrients.	<u>Year 5</u> • This unit is likely to be taught through PSHE following the Jigsaw unit due to its sensitive nature. <u>Year 6</u> • Create a role play model for the circulatory system. • Carry out a range of pulse rate investigations: ▪ fair test – effect of different activities on my pulse rate ▪ pattern seeking – exploring which groups of people may have

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			e.g. hands, eyes. • Compare two people. • Take measurements of parts of their body. • Compare parts of their own body. • Look for patterns between people e.g. Do people with big hands have big feet? • Classify people according to their features. • Investigate human senses e.g. Which part of my body is good for feeling, which is not? Which food/flavours can I identify by taste? Which smells can I match? <u>Year 2</u> • Explore the outside environment regularly to find objects that are living, dead and have never lived. • Classify objects found in the local environment. • Observe animals and plants carefully, drawing and labelling diagrams. • Create simple food chains for a familiar local habitat from first-hand observation and research. • Create simple food chains from information given e.g. in picture books (Gruffalo etc.).	• Explore the nutrients contained in fast food. • Use secondary sources to research the parts and functions of the skeleton. • Investigate patterns asking questions such as: ▪ Can people with longer legs run faster? ▪ Can people with bigger hands catch a ball better? • Compare, contrast and classify skeletons of different animals. <u>Year 4</u> • Research the function of the parts of the digestive system. • Create a model of the digestive system using household objects. • Explore eating different types of food to identify which teeth are being used for cutting, tearing and grinding (chewing). • Classify animals as herbivores, carnivores or omnivores according to the type of teeth they have in their skulls. • Use food chains to identify producers, predators and prey within a habitat. • Use secondary sources to identify animals in a habitat and find out what they eat.	or lower resting pulse rates ▪ observation over time - how long does it take my pulse rate to return to my resting pulse rate (recovery rate) ▪ pattern seeking – exploring recovery rate for different groups of people. • Research the negative effects of drugs (e.g. tobacco) and the benefits of a healthy diet and regular exercise by asking an expert or using carefully selected secondary sources.
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Living things and their habitat					
	Nursery	Reception	KS1	LKS2	UKS2
National Curriculum	<u>3 and 4 year olds will be learning to:</u> • 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.	<u>Children in reception will be learning to:</u> • Explore the natural world around them. • Describe what they see, hear and feel whilst outside. • Recognise some environments that are different from the one in which they live.	<u>YEAR 2</u> Pupils should be taught to: · explore and compare the differences between things that are living, dead, and things that have never been alive · identify that most living things live in habitats to which they are suited and describe how different habitats provide for the basic needs of	<u>YEAR 4</u> Pupils should be taught to: · recognise that living things can be grouped in a variety of ways · explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment · recognise that environments can change and that this can	<u>YEAR 5</u> Pupils should be taught to: · describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird · describe the life process of reproduction in some plants and animals <u>YEAR 6</u>

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		•Explore the natural world around them.	•Understand the effect of changing seasons on the natural world around them. <u>Early Learning Goals</u> • Explore the natural world around them, making observations and drawing pictures of animals and plants. • Know some similarities and differences between the natural world around them and contrasting environments, drawing on their experiences and what has been read in class.	different kinds of animals and plants, and how they depend on each other · identify and name a variety of plants and animals in their habitats, including microhabitats · 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	sometimes pose dangers to living things	Pupils should be taught to: · describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including microorganisms, plants and animals · give reasons for classifying plants and animals based on specific characteristics
Knowledge (What pupils need to know in order to be secure)	Key learning	Farms and farmyard babies. Living eggs. Focus on the lifecycle of a caterpillar. Planting a range of flower seeds and looking after them.	My Home, Where do I live? Who lives with me? Wow Science- Introduction to practical science experiments. Recognise and talk about plant and animal life cycles - sunflowers, chicks, butterflies' bees. Minibeasts- worms, bees, ladybirds. Explore the natural world around them. Describe what they hear, see and feel. Living eggs. Habitats – Ocean, Savannah, Antarctica, Rainforest, Desert.	All objects are either living, dead or have never been alive. Living things are plants (including seeds) and animals. Dead things include dead animals and plants and parts of plants and animals that are no longer attached e.g. leaves and twigs, shells, fur, hair and feathers (This is a simplification, but appropriate for Year 2 children.) An object made of wood is classed as dead. Objects made of rock, metal and plastic have never been alive (again ignoring that plastics are made of fossil fuels). Animals and plants live in a habitat to which they are suited, which means that animals have suitable features that help them move and find food and plants have suitable features that help them to grow well. The habitat provides the basic needs of the animals and plants – shelter, food and water. Within a habitat there are different microhabitats e.g. in a woodland – in the leaf litter, on the bark of trees, on the leaves. These micro-habitats have different conditions e.g. light or dark, damp or dry. These conditions affect which plants and animals live there. The plants and animals in a habitat	Living things can be grouped (classified) in different ways according to their features. Classification keys can be used to identify and name living things. Living things live in a habitat which provides an environment to which they are suited (Year 2 learning). These environments may change naturally e.g. through flooding, fire, earthquakes etc. Humans also cause the environment to change. This can be in a good way (i.e. positive human impact, such as setting up nature reserves) or in a bad way (i.e. negative human impact, such as littering). These environments also change with the seasons; different living things can be found in a habitat at different times of the year.	<u>Year 5</u> As part of their life cycle, plants and animals reproduce. Most animals reproduce sexually. This involves two parents where the sperm from the male fertilises the female egg. Animals, including humans, have offspring which grow into adults. In humans and some animals, these offspring will be born live, such as babies or kittens, and then grow into adults. In other animals, such as chickens or snakes, there may be eggs laid that hatch to young which then grow to adults. Some young undergo a further change before becoming adults e.g. caterpillars to butterflies. This is called a metamorphosis. Plants reproduce both sexually and asexually. Bulbs, tubers, runners and plantlets are examples of asexual plant reproduction which involves only one parent. Gardeners may force plants to reproduce asexually by taking cuttings. Sexual reproduction occurs through pollination, usually involving wind or insects. <u>Year 6</u> Living things can be formally grouped according to characteristics. Plants and animals

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				depend on each other for food and shelter etc. The way that animals obtain their food from plants and other animals can be shown in a food chain.		are two main groups but there are other living things that do not fit into these groups e.g. micro-organisms such as bacteria and yeast, and toadstools and mushrooms. Plants can make their own food whereas animals cannot. Animals can be divided into two main groups: those that have backbones (vertebrates); and those that do not (invertebrates). Vertebrates can be divided into five small groups: fish; amphibians; reptiles; birds; and mammals. Each group has common characteristics. Invertebrates can be divided into a number of groups, including insects, spiders, snails and worms. Plants can be divided broadly into two main groups: flowering plants; and non-flowering plants.
	Vocabulary	• Egg, caterpillar, chrysalis, butterfly. • Chick, chicken, egg, warm. • Seed, flower, stem, soil, leaf.	• Adult and baby animal names. • Egg, caterpillar, chrysalis, butterfly. • Frogspawn, tadpole, frog. • Chick, chicken. • Seed, stem, leaf, petals. • Minibeasts- worms, bees, ladybirds, legs, body, eyes, sting. • Sea, desert, sand, ocean, habitat, rainforest, tree, soil, river, ice, cold, hot.	• 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.	• Classification, classification keys, environment, habitat, human impact, positive, negative, migrate, hibernate.	Life cycle, reproduce, sexual, sperm, fertilises, egg, live young, metamorphosis, asexual, plantlets, runners, bulbs, cuttings Vertebrates, fish, amphibians, reptiles, birds, mammals, invertebrates, insects, spiders, snails, worms, flowering, non-flowering
	Common misconceptions Some children may think:			• An animal's habitat is like its 'home'. • Plants and seeds are not alive as they cannot be seen to move. • Fire is living. • Arrows in a food chain mean 'eats'.	• Certain whole food groups like fats are 'bad' for you. • Certain specific foods, like cheese are also 'bad' for you. • Diet and fruit drinks are 'good' for you. • Snakes are similar to worms, so they must also be invertebrates. • Invertebrates have no form of skeleton. • The death of one of the parts of a food chain or web has no or limited consequences on the rest of the chain. • There is always plenty of food for	• All plants start out as seeds • All plants have flowers • Plants that grow from bulbs do not have seeds • Only birds lay eggs. • All microorganisms are harmful • Mushrooms are plants.

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					wild animals. • animals are only land-living creatures. • Animals and plants can adapt to their habitats, however they change. • All changes to habitats are negative.	
Skills (Applying the knowledge in related contexts)		• To make simple observations and begin to recognise similarities and differences.	• To talk about animal life styles and recognise what eggs / young animals look like and what they will turn into. • To care for plants and animal life to ensure growth. • To recognise what plants / animals need to grow and develop. • To recognise there are different places to live.	• Explore the outside environment regularly to find objects that are living, dead and have never lived. • Classify objects found in the local environment. • Observe animals and plants carefully, drawing and labelling diagrams. • Create simple food chains for a familiar local habitat from first-hand observation and research. • Create simple food chains from information given e.g. in picture books (Gruffalo etc).	• Observe plants and animals in different habitats throughout the year. • Compare and contrast the living things observed. • Use classification keys to name unknown living things. • Classify living things found in different habitats based on their features. • Create a simple identification key based on observable features. • Use fieldwork to explore human impact on the local environment e.g. litter, tree planting. • Use secondary sources to find out about how environments may naturally change. • Use secondary sources to find out about human impact, both positive and negative, on environments.	<u>Year 5</u> • Use secondary sources and, where possible, first-hand observations to find out about the life cycle of a range of animals. • Compare the gestation times for mammals and look for patterns e.g. in relation to size of animal or length of dependency after birth. • Look for patterns between the size of an animal and its expected life span. • Grow and observe plants that reproduce asexually e.g. strawberries, spider plants, potatoes. • Take cuttings from a range of plants e.g. African violet, mint. • Plant bulbs and then harvest to see how they multiply. • Use secondary sources to find out about pollination. <u>Year 6</u> • Use secondary sources to learn about the formal classification system devised by Carl Linnaeus and why it is important. • Use first-hand observation to identify characteristics shared by the animals in a group. • Use secondary sources to research the characteristics of animals that belong to a group. • Use information about the characteristics of an unknown animal or plant to assign it to a group. • Classify plants and animals, presenting this in a range of ways e.g. Venn diagrams, Carroll diagrams and

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					keys. • Create an imaginary animal which has features from one or more groups.
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Materials					
	Nursery	Reception	KS1	LKS2	UKS2
National Curriculum	<u>3 and 4 year olds will be learning to:</u> • Use all their senses in hands-on exploration of natural materials. • Explore collections of materials with similar and/or different properties. • Talk about what they see, using a wide vocabulary. • Talk about the differences between materials and changes they notice • Explore the natural world around them.	<u>Early Learning Goals</u> • Understand some important processes and changes in the natural world around them, including the seasons and changing states of matter.	<u>YEAR 1</u> Pupils should be taught to: · distinguish between an object and the material from which it is made · identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock · 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 <u>YEAR 2</u> Pupils should be taught to: · identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses · find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching	<u>YEAR 4</u> Pupils should be taught to: · compare and group materials together, according to whether they are solids, liquids or gases · observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C) · identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature	<u>YEAR 5</u> Pupils should be taught to: · 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 · know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution · use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating · give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic · demonstrate that dissolving, mixing and changes of state are reversible changes · 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
Knowledge (What pupils need to know in order to be secure)	Key learning	• Exploring solids, liquids, gases through cooking and explorer time using materials including ice, cornflour, playdough, flour, porridge, clay, jelly. Changing materials: melting, freezing, cooking.	• Material properties; floating and sinking, temperature, magnets / magnetic, liquids/solids. Changing states of matter, a first look at fossils. Cooking (e.g. making porridge).	<u>Year 1</u> All objects are made of one or more materials. Some objects can be made from different materials e.g. plastic, metal or wooden spoons. Materials can be described by their properties e.g. shiny, stretchy, rough etc. Some materials e.g. plastic can be	• A solid keeps its shape and has a fixed volume. • A liquid has a fixed volume but changes in shape to fit the container. • A liquid can be poured and keeps a level, horizontal surface. • A gas fills all available space; it has
					Materials have different uses depending on their properties and state (liquid, solid, gas). Properties include hardness, transparency, electrical and thermal conductivity and attraction to magnets. Some materials will dissolve in a liquid and form a solution while others are insoluble

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		To make simple observations and begin to recognise similarities and differences.	- Exploring solids, liquids, gases through cooking and explorer time using materials including ice, cornflour, playdough, flour, porridge, clay. - To make simple observations and begin to recognise similarities and differences.	in different forms with very different properties. <u>Year 2</u> All objects are made of one or more 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. When choosing what to make an object from, the properties needed are compared with the properties of the possible materials, identified through simple tests and classifying activities. A material can be suitable for different purposes and an object can be made of different materials. 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. This can be a property of the material or depend on how the material has been processed e.g. thickness.	no fixed shape or volume. - Granular and powdery solids like sand can be confused with liquids because they can be poured, but when poured they form a heap and they do not keep a level surface when tipped. Each individual grain demonstrates the properties of a solid. - Melting is a state change from solid to liquid. - Freezing is a state change from liquid to solid. The freezing point of water is 0oC. - Boiling is a change of state from liquid to gas that happens when a liquid is heated to a specific temperature and bubbles of the gas can be seen in the liquid. Water boils when it is heated to 100oC. - Evaporation is the same state change as boiling (liquid to gas), but it happens slowly at lower temperatures and only at the surface of the liquid. - Evaporation happens more quickly if the temperature is higher, the liquid is spread out or it is windy. - Condensation is the change back from a gas to a liquid caused by cooling. - Water at the surface of seas, rivers etc. evaporates into water vapour (a gas). This rises, cools and condenses back into a liquid forming clouds. When too much water has condensed, the water droplets in the cloud get too heavy and fall back down as rain, snow, sleet etc. and drain back into rivers etc. This is known as precipitation. This is the water cycle.	and form sediment. Mixtures can be separated by filtering, sieving and evaporation. Some changes to materials such as dissolving, mixing and changes of state are reversible, but some changes such as burning wood, rusting and mixing vinegar with bicarbonate of soda result in the formation of new materials and these are not reversible.
	Vocabulary	Hot, cold, melt, heat, cool down, wet, soft, hard.	Hard, soft, rough, hot, cold, wet, dry, melt, heat, warm up, cool down, soft, hard.melt, change.	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,	Solid, liquid, gas, state change, melting, freezing, melting point, boiling point, evaporation, temperature, water cycle.	Thermal/electrical insulator/conductor, change of state, mixture, dissolve, solution, soluble, insoluble, filter, sieve, reversible/non-reversible change, burning, rusting, new material

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				smooth, shiny, dull, see-through, not see-through. Names of materials – wood, metal, plastic, glass, brick, rock, paper, cardboard 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.		
	Common misconceptions Some children may think:			• Only fabrics are materials. • Only building materials are materials. • Only writing materials are materials. • The word ‘rock’ describes an object rather than a material. • ‘Solid’ is another word for hard. • Only fabrics are materials. • Only building materials are materials. • Only writing materials are materials. • The word rock describes an object rather than a material. • Solid is another word for hard.	• ‘Solid’ is another word for hard or opaque. • Solids are hard and cannot break or change shape easily and are often in one piece. • Substances made of very small particles like sugar or sand cannot be solids. • Particles in liquids are further apart than in solids and they take up more space. • When air is pumped into balloons, they become lighter. • Water in different forms – steam, water, ice – are all different substances. • All liquids boil at the same temperature as water (100 deg). • Melting, as a change of state, is the same as dissolving. • Steam is visible water vapour (only the condensing water droplets can be seen) - www.planassessment.com © PLAN 2020 40 • Clouds are made of water vapour or steam. • The substance on windows etc is condensation rather than water. • The changing states of water (illustrated by the water cycle) are irreversible. • Evaporating or boiling water makes it vanish. • Evaporation is when the Sun sucks up the water, or when water is absorbed into a surface/material.	• Lots of misconceptions exist around reversible and irreversible changes, including around the permanence or impermanence of the change. • There is confusion between physical/chemical changes and reversible and irreversible changes. They do not correlate simply. Chemical changes result in a new material being formed. These are mostly irreversible. Physical changes are often reversible but may be permanent. These do not result in new materials e.g. cutting a loaf of bread. It is still bread, but it is no longer a loaf. The shape, but not the material, has been changed. • thermal insulators keep cold in or out • thermal insulators warm things up • solids dissolved in liquids have vanished and so you cannot get them back • lit candles only melt, which is a reversible change.

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Skills (Applying the knowledge in related contexts)	To make simple observations and begin to recognise similarities and differences.	- To recognise similarities and differences in common materials - To explore properties of materials in regards to building, construction and making things - Investigate a variety of materials. - Changing states of matter, a first look at fossils. - Explore the natural world around them. - Discover what they see, hear and feel whilst inside and outside - Material properties; floating and sinking, temperature, magnets / magnetic, liquids. - Investigate a variety of materials. - Explore the natural world around them. - Discover what they see, hear and feel whilst inside and outside.	<u>Year 1</u> - Classify objects made of one material in different ways e.g. a group of objects made of metal. - Classify in different ways one type of object made from a range of materials e.g. a collection of spoons made of different materials. - Classify materials based on their properties. - Test the properties of objects e.g. absorbency of cloths, strength of party hats made of different papers, stiffness of paper plates, waterproofness of shelters. <u>Year 2</u> - Classify materials. - Make suggestions about alternative materials for a purpose that are both suitable and unsuitable. - Test the properties of materials for particular uses e.g. compare the stretchiness of fabrics to select the most appropriate for Elastigirl's costume, test materials for waterproofness to select the most appropriate for a rain hat.	<u>Year 4</u> - Observe closely and classify a range of solids. Observe closely and classify a range of liquids. - Explore making gases visible e.g. squeezing sponges underwater to see bubbles, and showing their effect e.g. using straws to blow objects, trees moving in the wind. - Classify materials according to whether they are solids, liquids and gases. - Observe a range of materials melting e.g. ice, chocolate, butter. - Investigate how to melt ice more quickly. - Observe the changes when making rocky road cakes or ice-cream. - Investigate the melting point of different materials e.g. ice, margarine, butter and chocolate. - Explore freezing different liquids e.g. tomato ketchup, oil, shampoo. - Use a thermometer to measure temperatures e.g. icy water (melting), tap water, hot water, boiling water (demonstration). - Observe water evaporating and condensing e.g. on cups of icy water and hot water. - Set up investigations to explore changing the rate of evaporation e.g. washing, puddles, handprints on paper towels, liquids in containers. - Use secondary sources to find out about the water cycle.	<u>Year 5</u> - Investigate the properties of different materials in order to recommend materials for particular functions depending on these properties e.g. test waterproofness and thermal insulation to identify a suitable fabric for a coat. - Explore adding a range of solids to water and other liquids e.g. cooking oil, as appropriate. - Investigate rates of dissolving by carrying out comparative and fair tests. - Can create a chart or table grouping/comparing everyday materials by different properties - Can use test evidence gathered about different properties to suggest an appropriate material for a particular purpose www.planassessment.com © PLAN 2020 53 - Separate mixtures by sieving, filtering and evaporation, choosing the most suitable method and equipment for each mixture. - Explore a range of non-reversible changes e.g. rusting, adding fizzy tablets to water, burning. - Carry out comparative and fair tests involving non-reversible changes e.g. What affects the rate of rusting? What affects the amount of gas produced? - Research new materials produced by chemists e.g. Spencer Silver (glue of sticky notes) and Ruth Benerito (wrinkle free cotton).
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Seasonal changes			
	Nursery	Reception	KS1
National Curriculum	<u>3 and 4 year olds will be learning to:</u> - Talk about what they see, using a wide vocabulary. - Explore the natural world around them.	<u>Children in reception will be learning to:</u> - Describe what they see, hear and feel whilst outside. - Understand the effect of changing seasons on the natural world around them.	<u>YEAR 1</u> Pupils should be taught to: - observe changes across the 4 seasons - observe and describe weather associated with the seasons and how day length varies

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			<u>Early Learning Goals</u> • Understand some important processes and changes in the natural world around them, including the seasons and changing states of matter.	
Knowledge (What pupils need to know in order to be secure)	Key learning	• Naming different types of weather. • Daily weather.	• Explore the natural world around them. • Discover what they see, hear and feel whilst inside and outside. • The Weather - linked with seasons.	• In the UK, the day length is longest at mid-summer (about 16 hours) and gets shorter each day until mid-winter (about 8 hours) before getting longer again. • The weather also changes with the seasons. In the UK, it is usually colder and rainier in winter, and hotter and dryer in the summer. The change in weather causes many other changes. Some examples are: numbers of minibeasts found outside; seed and plant growth; leaves on trees; and type of clothes worn by people.
	Vocabulary		• Season names. • Weather names.	• Weather (sunny, rainy, windy, snowy etc). • Seasons (winter, summer, spring, autumn). • Sun, sunrise, sunset, day length.
	Common misconceptions Some children may think:			• It always snows in winter. • It is always sunny in the summer. • There are only flowers in spring and summer. • It rains most in the winter.
Skills (Applying the knowledge in related contexts)		• To make simple observations and begin to recognise similarities and differences. • To identify signs of seasons changing. • Describe what they see, hear and feel whilst outside. • Explore the natural world around them. • To identify different types of weather.	• To identify signs of seasons changing. • To understand the effect of seasons on the natural world around them. • Describe what they see, hear and feel whilst outside. • Explore the natural world around them. • To identify different types of weather. • To match weather to different seasons. • To say how the weather affects plant and animal life.	• Collect information about the weather regularly throughout the year. • Present this information in tables and charts to compare the weather across the seasons. • Collect information, regularly throughout the year, of features that change with the seasons e.g. plants, animals, humans. • Present this information in different ways to compare the seasons. • Gather data about day length regularly throughout the year and present this to compare the seasons.

Rocks			
		Reception	LKS2
National Curriculum		<u>Children in reception will be learning to:</u> • Explore the natural world around them. • Describe what they see, hear and feel whilst outside. • Recognise some environments that are different from the one in which they live.	<u>YEAR 3</u> Pupils should be taught to: · compare and group together different kinds of rocks on the basis of their appearance and simple physical properties · describe in simple terms how fossils are formed when things that have lived are trapped within rock · recognise that soils are made from rocks and organic matter
Knowledge	Key learning	• Fossils - dinosaurs.	• Rock is a naturally occurring material. There are different types of rock e.g. sandstone, limestone, slate etc. which have different properties.

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(What pupils need to know in order to be secure)			• Rocks can be hard or soft. They have different sizes of grain or crystal. They may absorb water. • Rocks can be different shapes and sizes (stones, pebbles, boulders). • Soils are made up of pieces of ground down rock which may be mixed with plant and animal material (organic matter). • The type of rock, size of rock pieces and the amount of organic matter affect the property of the soil. • Some rocks contain fossils. Fossils were formed millions of years ago. When plants and animals died, they fell to the seabed. They became covered and squashed by other material. Over time the dissolving animal and plant matter is replaced by minerals from the water.
	Vocabulary		• Rock, stone, pebble, boulder, grain, crystals, layers, hard, soft, texture, absorb water, soil, fossil, marble, chalk, granite, sandstone, slate, soil, peat, sandy/chalk/clay soil.
	Common misconceptions Some children may think:		• Rocks are all hard in nature. • Rock-like, man-made substances such as concrete or brick are rocks. • Materials which have been polished or shaped for use, such as a granite worktop, are not rocks as they are no longer 'natural'. • Certain found artefacts, like old bits of pottery or coins, are fossils. • A fossil is an actual piece of the extinct animal or plant. • Soil and compost are the same thing.
Skills (Applying the knowledge in related contexts)			• Observe rocks closely. • Classify rocks in a range of ways, based on their appearance. • Devise a test to investigate the hardness of a range of rocks. • Devise a test to investigate how much water different rocks absorb. • Observe how rocks change over time e.g. gravestones or old buildings. • Research using secondary sources how fossils are formed. • Observe soils closely. • Classify soils in a range of ways based on their appearance. • Devise a test to investigate the water retention of soils. • Observe how soil can be separated through sedimentation. • Research the work of Mary Anning.

Light				
	Preschool	Reception	LKS2	UKS2
National Curriculum	<u>3 and 4 year olds will be learning to:</u> • Talk about what they see, using a wide vocabulary.	<u>Children in reception will be learning to:</u> • Describe what they see, hear and feel whilst outside.	<u>YEAR 3</u> Pupils should be taught to: · recognise that they need light in order to see things and that dark is the absence of light · notice that light is reflected from surfaces · recognise that light from the sun can be dangerous and that there are ways to protect their eyes · recognise that shadows are formed when the light from a light source is blocked by an opaque object	<u>YEAR 6</u> Pupils should be taught to: · recognise that light appears to travel in straight lines · use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye · explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes

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				· find patterns in the way that the size of shadows change	· use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them
Knowledge (What pupils need to know in order to be secure)	Key learning 		• Light and dark – Diwali, fireworks, exploring light sources	• We see objects because our eyes can sense light. • Dark is the absence of light. • We cannot see anything in complete darkness. • Some objects, for example, the sun, light bulbs and candles are sources of light. • Objects are easier to see if there is more light. • Some surfaces reflect light. • Objects are easier to see when there is less light if they are reflective. • The light from the sun can damage our eyes and therefore we should not look directly at the sun and can protect our eyes by wearing sunglasses or sun hats in bright light. • Shadows are formed on a surface when an opaque or translucent object is between a light source and the surface and blocks some of the light. • The size of the shadow depends on the position of the source, object and surface.	• Light appears to travel in straight lines, and we see objects when light from them goes into our eyes. • The light may come directly from light sources, but for other objects some light must be reflected from the object into our eyes for the object to be seen. • Objects that block light (are not fully transparent) will cause shadows. • Because light travels in straight lines the shape of the shadow will be the same as the outline shape of the object.
	Vocabulary 		• Light, dark, shadow. • Candle, flame, fire, fireworks, torch, lamp.	• Light, light source, dark, absence of light, transparent, translucent, opaque, shiny, matt, surface, shadow, reflect, mirror, sunlight, dangerous.	As for Year 3 - • Light, plus straight lines, light rays
	Common misconceptions Some children may think:			• We can still see even where there is an absence of any light. • Our eyes 'get used to' the dark. • The moon and reflective surfaces are light sources. • A transparent object is a light source. • Shadows contain details of the object, such as facial features on their own shadow. • Shadows result from objects giving off darkness.	• We see objects because light travels from our eyes to the object.
Skills (Applying the knowledge in related contexts)			• To make simple observations and begin to recognise similarities and differences.	• Explore how different objects are more or less visible in different levels of lighting. • Explore how objects with different surfaces, e.g. shiny vs matt, are more or less visible. • Explore how shadows vary as the distance between a light source and an object or surface is changed. • Explore shadows which are connected to	• Explore different ways to demonstrate that light travels in straight lines e.g. shining a torch down a bent and straight hose pipe, shining a torch through different shaped holes in the card. • Explore the uses of the behaviour of light, reflection and shadows, such as in periscope design, rear view mirrors and

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			and disconnected from the object e.g. shadows of clouds and children in the playground. • Choose suitable materials to make shadow puppets. • Create artwork using shadows.	puppets.
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Forces					
		Nursery	Reception	LKS2	UKS2
National Curriculum		<u>3 and 4 year olds will be learning to:</u> • Use all their senses in hands-on exploration of natural materials. • Talk about what they see, using a wide vocabulary. • Explore and talk about different forces they can feel. •Explore the natural world around them.	<u>Children in reception will be learning to:</u> • Explore the natural world around them. •Describe what they see, hear and feel whilst outside.	<u>YEAR 5</u> · compare how things move on different surfaces · notice that some forces need contact between 2 objects, but magnetic forces can act at a distance · observe how magnets attract or repel each other and attract some materials and not others · compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials · describe magnets as having 2 poles · predict whether 2 magnets will attract or repel each other, depending on which poles are facing	<u>YEAR 5</u> Pupils should be taught to: · explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object · identify the effects of air resistance, water resistance and friction, that act between moving surfaces · recognise that some mechanisms including levers, pulleys and gears allow a smaller force to have a greater effect
Knowledge (What pupils need to know in order to be secure)	Key learning	• Exploring bikes, cars and other moving toys during explorer time. • Exploring floating and sinking in the water tray during explorer time.	• Exploring bikes, cars and other moving toys during explorer time and to explore and talk about how/why things move faster, slower, smoothly and more. • Exploring floating and sinking in the water tray during explorer time.	• A force is a push or a pull. • When an object moves on a surface, the texture of the surface and the object affect how it moves. • It may help the object to move better or it may hinder its movement e.g. ice skater compared to walking on ice in normal shoes. • A magnet attracts magnetic material. • Iron and nickel and other materials containing these, e.g. stainless steel, are magnetic. • The strongest parts of a magnet are the poles. • Magnets have two poles – a north pole and a south pole. If two like poles, e.g. two north poles, are brought together they will push away from each other – repel. If two unlike poles, e.g. a north and south, are brought together they will pull together – attract.	• A force causes an object to start moving, stop moving, speed up, slow down or change direction. • Gravity is a force that acts at a distance. Everything is pulled to the Earth by gravity. This causes unsupported objects to fall. • Air resistance, water resistance and friction are contact forces that act between moving surfaces. The object may be moving through the air or water, or the air and water may be moving over a stationary object. • A mechanism is a device that allows a small force to be increased to a larger force. The payback is that it requires a greater movement. The small force moves a long distance and the resulting large force moves a small distance, e.g. a crowbar or bottle top remover. • Pulleys, levers and gears are all mechanisms, also known as simple machines.

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	Vocabulary	• Fast, slow. • Float, sink.	• Fast, slow, smooth, bumpy. • Float, sink.	• 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 pole.	• Force, gravity, Earth, air resistance, water resistance, friction, mechanisms, simple machines, levers, pulleys, gears
	Common misconceptions Some children may think:			• The bigger the magnet the stronger it is. • All metals are magnetic.	• The heavier the object the faster it falls, because it has more gravity acting on it. • Forces always act in pairs which are equal and opposite. • Smooth surfaces have no friction. • Objects always travel better on smooth surfaces. • A moving object has a force which is pushing it forwards and it stops when the pushing force wears out. • A non-moving object has no forces acting on it. • Heavy objects sink and light objects float.
Skills (Applying the knowledge in related contexts)		• To make simple observations and begin to recognise similarities and differences.	• To make simple observations and begin to recognise similarities and differences.	• Carry out investigations to explore how objects move on different surfaces e.g. spinning tops/coins, rolling balls/cars, clockwork toys, soles of shoes etc. • Explore what materials are attracted to a magnet. • Classify materials according to whether they are magnetic. • Explore the way that magnets behave in relation to each other. • Use a marked magnet to find the unmarked poles on other types of magnets. • Explore how magnets work at a distance e.g. through the table, in water, jumping paper clips up off the table. • Devise an investigation to test the strength of magnets.	• Investigate the effect of friction in a range of contexts e.g. trainers, bathmats, mats for a helter-skelter. • Investigate the effects of water resistance in a range of contexts e.g. dropping shapes through water and pulling shapes, such as boats, along the surface of water. • Investigate the effects of air resistance in a range of contexts e.g. parachutes, spinners, sails on boats. • Explore how levers, pulleys and gears work. • Make a product that involves a lever, pulley or gear. • Create a timer that uses gravity to move a ball. • Research how the work of scientists such as Galileo Galilei and Isaac Newton helped to develop the theory of gravitation.

Sound	
	LKS2
National Curriculum	<u>YEAR 4</u> Pupils should be taught to: · identify how sounds are made, associating some of them with something vibrating · recognise that vibrations from sounds travel through a medium to the ear · find patterns between the pitch of a sound and features of the object that produced it

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		· find patterns between the volume of a sound and the strength of the vibrations that produced it · recognise that sounds get fainter as the distance from the sound source increases
Knowledge (What pupils need to know in order to be secure)	Key learning	• A sound produces vibrations which travel through a medium from the source to our ears. • Different mediums such as solids, liquids and gases can carry sound, but sound cannot travel through a vacuum (an area empty of matter). • The vibrations cause parts of our body inside our ears to vibrate, allowing us to hear (sense) the sound. • The loudness (volume) of the sound depends on the strength (size) of vibrations which decreases as they travel through the medium. Therefore, sounds decrease in volume as you move away from the source. • A sound insulator is a material which blocks sound effectively. • Pitch is the highness or lowness of a sound and is affected by features of objects producing the sounds. For example, smaller objects usually produce higher pitched sounds.
	Vocabulary	• Sound, source, vibrate, vibration, travel, pitch (high, low), volume, faint, loud, insulation.
	Common misconceptions Some children may think:	Pitch and volume are frequently confused, as both can be described as high or low. Some children may think: • Sound is only heard by the listener. • Sound only travels in one direction from the source. • Sound can't travel through solids and liquids. • High sounds are loud and low sounds are quiet.
Skills (Applying the knowledge in related contexts)		• Classify sound sources. • Explore making sounds with a range of objects, such as musical instruments and other household objects. • Explore how string telephones or ear gongs work. • Explore altering the pitch or volume of objects, such as the length of a guitar string, amount of water in bottles, size of tuning forks. • Measure sounds over different distances. • Measure sounds through different insulation materials.

Electricity		
	LKS2	UKS2
National Curriculum	<u>YEAR 4</u> Pupils should be taught to: · identify common appliances that run on electricity · construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers · identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery · recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit · recognise some common conductors and insulators, and associate metals with being good conductors	<u>YEAR 6</u> Pupils should be taught to: · associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit · 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 · use recognised symbols when representing a simple circuit in a diagram
Knowledge (What pupils need to know in order to be secure)	Key learning • Many household devices and appliances run on electricity. Some plug in to the mains and others run on batteries. • An electrical circuit consists of a cell or battery connected to a component using wires. If there is a break in the circuit, a loose connection or a short circuit, the component will not work. A switch can be added to the circuit to turn the component on and off. • Metals are good conductors so they can be used as wires in a circuit. Non-metallic solids are insulators except for graphite (pencil lead). Water, if not completely pure, also conducts	• Adding more cells to a complete circuit will make a bulb brighter, a motor spin faster or a buzzer to make a louder sound. If you use a battery with a higher voltage, the same thing happens. Adding more bulbs to a circuit will make each bulb less bright. Using more motors or buzzers, each motor will spin more slowly and each buzzer will be quieter. • Turning a switch off (open) breaks a circuit so the circuit is not complete and electricity cannot flow. Any bulbs, motors or buzzers will then turn off as well. • You can use recognised circuit symbols to draw simple circuit diagrams.

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		electricity.	
	Vocabulary	- Electricity, electrical appliance/device, mains, plug, electrical circuit, complete circuit, component, cell, battery, positive, negative, connect/connections, loose connection, short circuit, crocodile clip, bulb, switch, buzzer, motor, conductor, insulator, metal, non-metal, symbol. - N.B. Children in Year 4 do not need to use standard symbols for electrical components, as this is taught in Year 6.	Circuit, complete circuit, circuit diagram, circuit symbol, cell, battery, bulb, buzzer, motor, switch, voltage.
	Common misconceptions Some children may think:	- electricity flows to bulbs, not through them - electricity flows out of both ends of a battery - electricity works by simply coming out of one end of a battery into the component.	- larger-sized batteries make bulbs brighter - a complete circuit uses up electricity - components in a circuit that are closer to the battery get more electricity.
Skills (Applying the knowledge in related contexts)		- Construct a range of circuits. - Explore which materials can be used instead of wires to make a circuit. - Classify the materials that were suitable/not suitable for wires. - Explore how to connect a range of different switches and investigate how they function in different ways. - Choose switches to add to circuits to solve particular problems, such as a pressure switch for a burglar alarm. - Apply their knowledge of conductors and insulators to design and make different types of switch. - Make circuits that can be controlled as part of a DT project. - N.B. Children should be given one component at a time to add to circuits.	- Explain how a circuit operates to achieve particular operations, such as to control the light from a torch with different brightnesses or make a motor go faster or slower. - Make circuits to solve particular problems, such as a quiet and a loud burglar alarm. - Carry out fair tests exploring changes in circuits. - Make circuits that can be controlled as part of a DT project.

Earth and space			
UKS2			
National Curriculum		<u>YEAR 5</u> Pupils should be taught to: - describe the movement of the Earth and other planets relative to the sun in the solar system - describe the movement of the moon relative to the Earth - describe the sun, Earth and moon as approximately spherical bodies - use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky	
Knowledge (What pupils need to know in order to be secure)	Key learning	The Sun is a star. It is at the centre of our solar system. There are 8 planets (can choose to name them, but not essential). These travel around the Sun in fixed orbits. Earth takes 365 1/4 days to complete its orbit around the Sun. The Earth rotates (spins) on its axis every 24 hours. As Earth rotates half faces the Sun (day) and half is facing away from the Sun (night). As the Earth rotates, the Sun appears to move across the sky. The Moon orbits the Earth. It takes about 28 days to complete its orbit. The Sun, Earth and Moon are approximately spherical. - Can create a voice over for a video clip or animation. - Can show, using diagrams, the movement of the Earth and Moon. - Can explain the movement of the Earth and Moon. - Can show using diagrams the rotation of the Earth and how this causes day and night. - Can explain what causes day and night.	
	Vocabulary	Earth, Sun, Moon, (Mercury, Jupiter, Saturn, Venus, Mars, Uranus, Neptune), spherical, solar system, rotates, star, orbit, planets.	
	Common misconceptions	- The Earth is flat. - The Sun is a planet.	

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	Some children may think:	• The Sun rotates around the Earth. • The Sun moves across the sky during the day. • The Sun rises in the morning and sets in the evening. • The Moon appears only at night. • Night is caused by the Moon getting in the way of the Sun or the Sun moving further away from the Earth.
Skills (Applying the knowledge in related contexts)		• Use secondary sources to help create a model e.g. role play or using balls to show the movement of the Earth around the Sun and the Moon around the Earth. • Use secondary sources to help make a model to show why day and night occur. • Make first-hand observations of how shadows caused by the Sun change through the day. • Make a sundial. • Research time zones. • Consider the views of scientists in the past and evidence used to deduce shapes and movements of the Earth, Moon and planets before space travel.

Evolution and inheritance		
UKS2		
National Curriculum		<u>YEAR 6</u> Pupils should be taught to: · recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago · recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents · identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution
Knowledge (What pupils need to know in order to be secure)	Key learning	• All living things have offspring of the same kind, as features in the offspring are inherited from the parents. • Due to sexual reproduction, the offspring are not identical to their parents and vary from each other. • Plants and animals have characteristics that make them suited (adapted) to their environment. If the environment changes rapidly, some variations of a species may not suit the new environment and will die. If the environment changes slowly, animals and plants with variations that are best suited survive in greater numbers to reproduce and pass their characteristics on to their young. Over time, these inherited characteristics become more dominant within the population. Over a very long period of time, these characteristics may be so different to how they were originally that a new species is created. This is evolution. • Fossils give us evidence of what lived on the Earth millions of years ago and provide evidence to support the theory of evolution. More recently, scientists such as Darwin and Wallace observed how living things adapt to different environments to become distinct varieties with their own characteristics.
	Vocabulary	Offspring, sexual reproduction, vary, characteristics, suited, adapted, environment, inherited, species, fossils.
	Common misconceptions Some children may think:	• Adaptation occurs during an animal's lifetime: giraffes' necks stretch during their lifetime to reach higher leaves and animals living in cold environments grow thick fur during their life. • Offspring most resemble their parents of the same sex, so that sons look like fathers. • All characteristics, including those that are due to actions during the parent's life such as dyed hair or footballing skills, can be inherited. • Cavemen and dinosaurs were alive at the same time.
Skills (Applying the knowledge in related contexts)		• Design a new plant or animal to live in a particular habitat. • Use models to demonstrate evolution e.g. 'Darwin's finches' bird beak activity. • Use secondary sources to find out about how the population of peppered moths changed during the industrial revolution. • Make observations of fossils to identify living things that lived on Earth millions of years ago. • Identify features in animals and plants that are passed onto offspring and explore this process by considering the artificial breeding of animals or plants e.g. dogs. • Compare the ideas of Charles Darwin and Alfred Wallace on evolution. • Research the work of Mary Anning and how this provided evidence of evolution.