Science Curriculum Content and Progression

National Curriculum Aims: (Highlighted in purple are Fourfields key aims)

The national curriculum for science aims to ensure that all pupils:

- develop scientific knowledge and conceptual understanding through the specific disciplines of biology, chemistry and physics
- develop understanding of the nature, processes and methods of science through different types of science enquiries that help them to answer scientific questions about the world around them
- are equipped with the scientific knowledge required to understand the uses and implications of science, today and for the future

Scientific knowledge and conceptual understanding

- it is important that pupils make progress, it is also vitally important that they develop secure understanding of each key block of knowledge and concepts in order to progress to the next stage.
- Pupils should be able to describe associated processes and key characteristics in common language, but they should also be familiar with, and use, technical terminology accurately and precisely.
- They should build up an extended specialist vocabulary.
- They should also apply their mathematical knowledge to their understanding of science, including collecting, presenting and analysing data.
- The social and economic implications of science are important but, generally, they are taught most appropriately within the wider school curriculum: teachers will wish to use different contexts to maximise their pupils' engagement with and motivation to study science.

The nature, processes and methods of science

- 'Working scientifically' specifies the understanding of the nature, processes and methods of science for each year group. It should not be taught as a separate strand.
- These types of scientific enquiry should include: observing over time; pattern seeking; identifying, classifying and grouping; comparative and fair testing (controlled investigations); and researching using secondary sources.
- Pupils should seek answers to questions through collecting, analysing and presenting data. 'Working scientifically' will be developed further at key stages 3 and 4, once pupils have built up sufficient understanding of science to engage meaningfully in more sophisticated discussion of experimental design and control.

Spoken language

- The national curriculum for science reflects the importance of spoken language in pupils' development across the whole curriculum – cognitively, socially and linguistically.
- The quality and variety of language that pupils hear and speak are key factors in developing their scientific vocabulary and articulating scientific concepts clearly and precisely.
- They must be assisted in making their thinking clear, both to themselves and others, and teachers should ensure that pupils build secure foundations by using discussion to probe and remedy their misconceptions.

Science Disciplines – Key Ideas:

Physics

P1: The universe follows unbreakable rules that are all about forces, matter and energy.
P2: Forces are different kinds of pushes and pulls that act on all the matter that is in the universe. Matter is all the stuff, or mass, in the universe.
P3: Energy, which cannot be created or destroyed, comes in many different forms and tends to move away from objects that have lots of it.

Chemistry
C1: All matter (stuff) in the universe is made up of tiny building blocks.
C2: The arrangement, movement and type of the building blocks of matter and the forces that hold them together or push them apart explain all the properties of matter (e.g. hot/cold, soft/hard, light/heavy, etc).
C3: Matter can change if the arrangement of these building blocks changes.

Biology
B1: Living things are special collections of matter that make copies of themselves, use energy and grow.
B2: Living things on Earth come in a huge variety of different forms that are all related because they all came from the same starting point 4.5 billion years ago.
B3: The different kinds of life, animals, plants and microorganisms, have evolved over millions of generations into different forms in order to survive in the environments in which they live.

Earth science
E1: The Earth is one of eight planets that orbit the sun.
E2: The Earth is tilted and spins on its axis leading to day and night, the seasons and the climate.
E3: The Earth is made up of several layers, including a relatively thin rocky surface which is divided into tectonic plates, and the movement of these plates leads to many geologic events (such as earthquakes and volcanoes) and geographical features (such as mountains.)

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Early Years Foundation Stage	
ELG – Health and Self Care	ELG - Understanding the World
• Learn the importance of good health and physical exercise and a healthy diet – discuss application of a healthy diet, variety of foods, what happens to our bodies when we move	• Knows some of what makes them unique and expresses similarities and difference in relation to friends and family – name parts of body, girls and boys. • Can talk about some of the things they have observed such as plants, animals, natural and found objects. – naming naturally occurring objects (conkers etc) – observational drawings • Talks about why things happen and how things work. • Developing an understanding of growth, decay and changes over time. – Plants of lifecycle of sunflowers/frogs/tadpoles • Shows care and concern for living things and the environment. – take care of plants/mini beasts • Looks closely at similarities, differences, patterns and change- seasonal feaures

Year 1 Working scientifically	
NC objectives	Key knowledge and vocabulary
• Sc1/1.1 asking simple questions and recognising that they can be answered in different ways • Sc1/1.2 observing closely, using simple equipment • Sc1/1.3 performing simple tests • Sc1/1.4 identifying and classifying • Sc1/1.5 using their observations and ideas to suggest answers to questions • Sc1/1.6 gathering and recording data to help in answering questions	<u>New learning and vocabulary</u> **properties,** observe, test, magnifying glass, object, record, equipment Know that we can ask questions about the world and that when we observe the world to answer these questions, this is science Know that we can use magnifying glasses to observe objects closely Know that we can test our questions to see if they are true Know that objects can be identified or sorted into groups based on their observable properties Know that we can write down numbers and words or draw pictures to record what we find

Year 1 - Animals including humans	
NC objectives	Key knowledge and vocabulary
• Sc1/2.2a identify and name a variety of common animals including, fish, amphibians, reptiles, birds and mammals • Sc1/2.2b identify and name a variety of common animals that are carnivores, herbivores and omnivores • Sc1/2.2c describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals including pets) • Sc1/2.2d identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense.	<u>Science Discipline(s):</u> **B2, B3** <u>New learning and vocabulary</u> **energy, growth, habitat**, fish, amphibian, reptile, bird, mammal, offspring, carnivore, herbivore, omnivore, vertebrate, skeleton, organ Know that a trout is an example of fish, a frog is an example of an amphibian; a lizard is an example of a reptile; a robin is an example of a bird; a rabbit and a human are examples of a mammal Know that herbivorous animals eats plants; a carnivorous animal eats other animals; omnivorous animals eat both animals and plants Know that a cat is an example of a carnivore; that a rabbit is an example of a herbivore; know that many humans are examples of omnivores (though not vegetarians) Know that fish, amphibians, reptiles, birds and mammals are similar in that they have internal skeletons and organs; these are known as vertebrates, which means they are animals that have a backbone Know that fish are different in having gills so that they can breathe underwater **and** scaly skin Know that amphibians are different in that they begin their lives with gills but then develop lungs and breath on land Know that reptiles are different in that they breath air **and** have scaly skin Know that birds are different to other animals in that they have feathers and wings Know that mammals are different to other animals in that they have fur/hair **and** they feed milk to their young Know that feet, legs, arms, hands, torso, head, skin, ears, eyes, nose, mouth and tongue are part so the body and identify them Know that eyes are associated with sight, ears with sound, nose with smell, tongue with taste and skin with touch.

Year 1 - Everyday materials	
NC objectives	Key knowledge and vocabulary
• Sc1/3.1a distinguish between an object and the material from which it is made • Sc1/3.1b identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock • Sc1/3.1c describe the simple physical properties of a variety of everyday materials • Sc1/3.1d compare and group together a variety of everyday materials	Science Discipline(s): **C1, C2** New learning and vocabulary **absorption, matter, property,** wood, plastic, glass, metal, water, rock Know from observation how to distinguish between materials made of wood, plastic, glass, metal, water, rock Know that an object is made from/of a material Know that materials can be hard, soft, strong, weak, absorbent, heavy, light, solid and runny, smooth and rough; these descriptions denote the properties of a material Know that matter (stuff) is made from tiny building blocks

Year 1 - Seasonal changes	
NC objectives	Key knowledge and vocabulary
• Sc1/4.1a observe changes across the 4 seasons • Sc1/4.1b observe and describe weather associated with the seasons and how day length varies.	Science Discipline(s): **E2** New learning and vocabulary **energy, freezing, melting, orbit, reflection,** Sun, clouds, wind, snow, ice, spring, summer, autumn, winter Know that days are longer in the summer and shorter in winter Know that weather changes through the year, getting hotter in the summer and colder in the winter Know that the winter is likely to bring ice on the ground when water freezes due to the cold Know that the Earth orbits the Sun with one orbit constituting a year of 365/366 days

Year 1 - Plants	
NC objectives	Key knowledge and vocabulary
• Sc1/2.1a identify and name a variety of common wild and garden plants, including deciduous and evergreen trees • Sc1/2.1b identify and describe the basic structure of a variety of common flowering plants, including trees	Science Discipline(s): **B2** Consolidation **energy, habitat** New learning and vocabulary **component, energy, growth,** deciduous, evergreen, flower, plant, tree, structure, roots, stem, leaf, trunk, flower Know a rose bush, a sunflower and a dandelion by sight Know an oak tree, a birch tree and a horse chestnut tree by sight Know that evergreen trees maintain their leaves throughout the year and deciduous trees shed their leaves Know that a flowering plants consist of roots, stem, leaves and flowers, and that a tree's stem is called a trunk

Year 2 - Working scientifically	
NC objectives	Key knowledge and vocabulary
• Sc2/1.1 asking questions and recognising they can be answered in different ways • Sc2/1.2 observing closely, using simple equipment • Sc2/1.3 performing simple tests • Sc2/1.4 identifying and classifying • Sc2/1.5 using their observations and ideas to suggest answers to questions • Sc2/1.6 gathering and recording data to help in answering questions	Learning and vocabulary – continuing from year 1 **properties,** observe, test, magnifying glass, object, record, equipment Know that we can ask questions about the world and that when we observe the world to answer these questions, this is science Know that we can use magnifying glasses to observe objects closely Know that we can test our questions to see if they are true Know that objects can be identified or sorted into groups based on their observable properties Know that we can write down numbers and words or draw pictures to record what we find

Year 2 - Uses of everyday materials	
NC objectives	Key knowledge and vocabulary
• Sc2/3.1a identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for different uses • Sc2/3.1b compare how things move on different surfaces. • Sc2/3.1c find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching	Science Discipline(s): **C1, C2** Consolidation **absorption, matter, property** Objects are made from materials such as wood, plastic, glass, metal, water, rock Materials have properties such as being hard, soft, strong, weak, absorbent, heavy, light, solid, runny, smooth and rough; these descriptions denote the properties of a material Matter (stuff) is made from tiny building blocks New learning and vocabulary **conductor**, brick, paper, cardboard, friction, movement, suitability, surface, stretch, twist, waterproof, deformation, flexible, rigid Know that materials can have useful properties for a given job (including being waterproof, strong, hard, soft, flexible, rigid, light or heavy.) Know that many types of plastic are waterproof, that steel (a type of metal) is strong, that rock is hard, that cotton wool is soft, that rubber is flexible, that rock is rigid, that polystyrene (a type of plastic) is light and that iron (a type of metal) is heavy, Know that when objects move across a surface there is friction when they rub against each other and that sometimes this friction is larger or smaller Know that applying forces to objects can change their shape

Year 2 - Living things and life cycles	
NC objectives	Key knowledge and vocabulary
• Sc2/2.1a explore and compare the differences between things that are living, dead, and things that have never been alive • Sc2/2.1b 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 • Sc2/2.1c identify and name a variety of plants and animals in their habitats, including microhabitats • Sc2/2.1d 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.	Science Discipline(s): **B1, B3** Consolidation **habitat**, **growth, absorption**, deciduous, evergreen, flower, plant, tree, structure, roots, stem, leaf, trunk, flower, herbivore, carnivore, omnivore Dandelions, rose bushes, grass, ash trees, birch trees and conifers trees are examples of plants. Trees can be deciduous or evergreen. A trout is an example of fish, a frog is an example of an amphibian; a lizard is an example of a reptile; a robin is an example of a bird; a rabbit and a human are examples of a mammal Herbivorous animals eats plants; a carnivorous animal eats other animals; omnivorous animals eat both animals and plants New learning and vocabulary **birth, decay, energy,** microhabitat, dead, life cycle, food chain, source, nutrients, reproduction, consumption, environment Know that living things move, grow, consume nutrients and reproduce; that dead things used to do these things, but no longer do; and that things that never lived have never done these things. Know that polar bears are an example of an animal adapted to its environment – thick fur for warmth and oily paw pads to ensure that they don't freeze to the ice. Know that sharks are another example – smooth skin and streamlined shape for quick swimming; and gills for breathing underwater Know that cacti are an example of a plant adapted to its environment – thick skin keeps a store of water safe; sharp spikes keep animals from stealing the water Know that pine trees have thick bark and pine cones to protect against cold winters Know that woodlice live under logs – an example of a microhabitat - as they need somewhere dark and damp so that they do not dry out Know that frogs can live in ponds – an example of a microhabitat - as they water in which to lay their eggs (frogspawn) Know that plants absorb energy from the Sun; that this energy is consumed by herbivorous animals; and that carnivorous animals eat other animals. Know that the arrows on a food chain show the direction that the energy travels.

Year 2 - Plants and Animals including humans	
NC objectives	Key knowledge and vocabulary
• Sc2/2.2a observe and describe how seeds and bulbs grow into mature plants • Sc2/2.2b find out and describe how plants need water, light and a suitable temperature to grow and stay healthy. • Sc2/2.3a notice that animals, including humans, have offspring which grow into adults • Sc2/2.3b find out about and describe the basic needs of animals, including humans, for survival (water, food and air) • Sc2/2.3c describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene.	Science Discipline(s): **B1** Consolidation **growth, habitat,** nutrients, consumption Living things move, grow, consume nutrients and reproduce; that dead things used to do these things, but no longer do; and that things that never lived have never done these things. New learning and vocabulary **reproduction,** offspring, adult, bulb, seed, survival, temperature, hygiene, exercise Know that seeds and bulbs need to be buried underground in soil and that they will grow into adult plants under the right conditions (water, warmth) Know that plants that are deprived of light, food or air will not grow and will die. Know that plants and animals produced offspring that grow into adults. Know that animals, including humans, need food, water and air to survive Know the basic food groups: fruit and vegetables, carbohydrates, protein, dairy, fat and sugary foods Know that more than half of our diet should be made up of carbohydrates, fruit and vegetables Know that fats and sugary foods should be eaten rarely and in small amounts Know that people need to exercise often to help their body stay strong and fit Know that keeping clean, including washing and brushing teeth, is an important part of staying healthy

Year 3 – Working scientifically	
NC objectives	Key knowledge and vocabulary
• Sc4/1.1 asking relevant questions and using different types of scientific enquiries to answer them • Sc4/1.2 setting up simple practical enquiries, comparative and fair tests • Sc4/1.3 making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers • Sc4/1.4 gathering, recording, classifying and presenting data in a variety of ways to help in answering questions • Sc4/1.5 recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables • Sc4/1.6 reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions • Sc4/1.7 using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions • Sc4/1.8 identifying differences, similarities or changes related to simple scientific ideas and processes • Sc4/1.9 using straightforward scientific evidence to answer questions or to support their findings.	<u>Consolidation</u> **properties,** observe, test, magnifying glass, object, record, equipment Know that we can ask questions about the world and that when we observe the world to answer these questions, this is science Know that we can use magnifying glasses to observe objects closely Know that we can test our questions to see if they are true Know that objects can be identified or sorted into groups based on their observable properties Know that we can write down numbers and words or draw pictures to record what we find <u>New learning and vocabulary</u> prediction, measurement, enquiry, dependent variable, independent variable, fair test, similar, theory, hypothesis Know that we can ask questions and answer them by setting up scientific enquiries Know how to make relevant predictions that will be tested in a scientific enquiry Know that in a fair test one thing is altered (independent variable) and one thing that may change as a result is measured (dependent variable) while all other conditions are kept the same Know how to use a range of equipment to measure accurately, including thermometers, data loggers, rulers and stopwatches Know how to draw bar charts; how to label a diagram using lines to connect information to the diagram; how to use a coloured key how to draw a neat table; how to draw a classification key; how to show the relationship between an independent variable in a two-way table; and how to label specific results in a two-way table Know – with structured guidance - how to write a simple scientific enquiry write-up including an introduction, a list of equipment, a numbered method, a detailing of results and a conclusion Know how to precis a scientific enquiry write-up into a brief oral discussion of what was found in a scientific enquiry Know that scientific enquiries can suggest relationships, but that they do <u>not</u> prove whether a prediction is true Know that scientific enquiries are limited by the accuracy of the measurements (and measuring equipment) and by the extent to which conditions can vary even, and that repeating enquiries, measurements and taking measures to keep conditions as consistent as possible can improve an enquiry Know that the conclusions of scientific enquiries can lead to further questions, where results can be clarified or extended to different contexts (e.g. effect of changing sunlight on a plant – does this work with other plants / different types of light / etc) Know that they can draw conclusions from the findings of other scientists Know that a theory is an explanation of observations that has been tested to some extent and that a hypothesis is an explanation that has not yet been tested, but that can be tested through a scientific enquiry

Year 3 – Light

NC objectives	Key knowledge and vocabulary
• Sc3/4.1a recognise that they need light in order to see things and that dark is the absence of light • Sc3/4.1b notice that light is reflected from surfaces • Sc3/4.1c recognise that light from the Sun can be dangerous and that there are ways to protect their eyes • Sc3/4.1d recognise that shadows are formed when the light from a light source is blocked by a solid object • Sc3/4.1e find patterns in the way that the size of shadows change.	Science Discipline(s): **P1, P3** Consolidation **absorption, energy, property, reflection** New learning and vocabulary **wave,** mirror, incident ray, image, beam, photons, solid, opaque, transparent, object, source, data logger Know that light is a form of energy Know that energy comes in different forms and can be neither created nor destroyed, only changed from one form to another Know that we need light to see things and that darkness is the absence of light Know that light travels in straight lines Know that light is reflected when it travels from a light source and then 'bounces' off an object Know that everything that we can see is either a light source or something that is reflecting light from a light source into our eyes Know that the Sun is a light source, but that the Moon is not and is merely reflecting light from the Sun Know that many light sources give off light and heat Know that the Sun gives off light and heat when hydrogen turns into helium Know that filaments in traditional bulbs heat up until they glow, giving off light and heat Know that fluorescent bulbs glow when electricity adds energy to a gas within the bulb Know that sunglasses can protect eyes from sunlight **but looking at the Sun directly – even with sunglasses – can damage the eyes** Know that opaque objects block light creating shadows and that light passes through transparent objects Know that opacity/transparency and reflectiveness are properties of a material Know that as objects move towards a light source, the size of the shadow increases Know how to show the changing of shadow size by drawing a diagram with straight lines representing light **Know that a data logger can keep track of light levels and that this can be plotted on a graph to show how this changes over the course of a day** (NB: the Sun and the Moon are capitalized when being discussed in an astronomical context.)

Year 3 – Rocks and Fossils	
NC objectives	Key knowledge and vocabulary
• Sc3/3.1a compare and group together different kinds of rocks on the basis of their appearance and simple physical properties • Sc3/3.1b describe in simple terms how fossils are formed when things that have lived are trapped within rock • Sc3/3.1c recognise that soils are made from rocks and organic matter.	Science Discipline(s): **C1, C2, C3, E3** Consolidation **decay, matter**, **melting**, material, Rock is a type of solid material. New learning and vocabulary **extinction,** igneous, metamorphic, sedimentary, paleontologist, weathering, molten rock, crust, tectonic plates, scavengers, fossil Know that there are three kinds of rocks: igneous, sedimentary and metamorphic Know that the Earth has a solid crust made up of tectonic plates with molten rock beneath Know that granite and basalt are types of igneous rock and that igneous rocks form from molten rock below the Earth's crust Know that limestone and sandstone are types of sedimentary rock which form when small, weathered fragments of rock or shell settle and stick together, often in layers Know that marble and slate are types of metamorphic rock which form when rocks in Earth's crust get squashed and heated in processes such as when tectonic plates press against each other Know that fossils form when a plant or animal dies and is quickly covered with silt or mud so that it cannot be rotted by microbes or eaten by scavenging animals; in time layers of sediment build, squashing the mud and turning it to stone around the dead plant or animal; the materials in the body are replaced by minerals that flow in water through the rock, leaving a rock in the shape of the animal or plant that was once there Know that soil is made from tiny particles of rock broken down by the action of weather (weathering)

Year 3 – Forces and Magnets

NC objectives	Key knowledge and vocabulary
• Sc3/4.2a compare how things move on different surfaces • Sc3/4.2b notice that some forces need contact between 2 objects, but magnetic forces can act at a distance • Sc3/4.2c observe how magnets attract or repel each other and attract some materials and not others • Sc3/4.2d 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 • Sc3/4.2e describe magnets as having 2 poles • Sc3/4.2f predict whether 2 magnets will attract or repel each other, depending on which poles are facing.	Science Discipline(s): **P2** Consolidation **energy, matter, property, wave,** metal, material, surface, friction, force, stretch, squash, rough, smooth Metal is a material from which objects can be made. As objects move across a surface there is friction when they rub against each other and that sometimes this friction is larger or smaller. Applying forces to objects can change their shape. Know that the roughness of a material is an example of a property New learning and vocabulary magnetic, non-magnetic, pole, north, south, sliding friction, static friction, elastic, resist, attraction, repulsion Know that a force can be thought of as a push or a pull Know that there are three types of contact force: impact forces (when two surfaces collide), frictional forces (when two surfaces are already in contact) and strain forces (when an elastic material is stretched or squashed). Know that objects move differently on rough and smooth surfaces; objects resist movement more on rough surfaces because there is higher friction as the object moves Know that there are also non-contact forces that can act between objects without them touching and that magnetism is an example of a non-contact force Know that magnets have two poles called north and south Know that like poles (south-south and north-north) of two magnets repel each other and that opposite poles of two magnets (north-south) attract each other Know that there is a magnetic field around a magnet which is strongest at each pole Know that some materials are magnetic, meaning that they are attracted to a magnet, while other materials are non-magnetic

Year 3 - Plants and Animals

NC objectives	Key knowledge and vocabulary
• Sc3/2.1a identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers • Sc3/2.1b 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 • Sc3/2.1c investigate the way in which water is transported within plants • Sc3/2.1d explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal. • Sc3/2.2a 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 • Sc3/2.2b identify that humans and some other animals have skeletons and muscles for support, protection and movement	Science Discipline(s): **B1, B2, B3** Consolidation **component, energy, growth, habitat, reproduction, decay,** offspring, adult, bulb, seed, survival, temperature nutrients, consumption, deciduous, evergreen, flower, plant, tree, structure, roots, stem, leaf, trunk, flower, vertebrate, skeleton New learning and vocabulary **extinction,** fruit, nectar, anther, ovary, ovule, petal, pollen, stigma, style, stamen, function, exchange, dispersal, fertilization, vitamin, balanced diet, cartilage, invertebrate, contract, loosen, ribcage, insect Know that different parts of plants have one or more functions (jobs) Know that the roots collect water and minerals from the soil, and hold the plant firmly in the ground Know that the stem holds up the leaves so that they can gather light to make food and holds up the flowers so that they can receive pollen and disperse their fruits; know that the stem also transports water and minerals from the roots to the other parts of the plant Know that the leaves make food by trapping light and using its energy to turn carbon dioxide and water into carbohydrates Know that the function of a flower is reproduction, where flowers of the same kind exchange pollen – made by an anther – in a process called fertilisation, and a structure in the flower's ovary called an ovule becomes a seed; the ovary then becomes a fruit which helps the seed leave the plant in a process called dispersal Know that proteins are good for growth, carbohydrates for energy and fruit and vegetables provide vitamins and minerals which help keep us healthy (e.g. calcium for healthy bones and teeth) Know that getting the right amount of each food group (including over half of the diet made up of fruit, vegetables and carbohydrates) is called a balanced diet Know that lack of a nutrient can cause ill health; for example, a lack of vitamin D leads to a disease called rickets Know that excess of a food group can cause ill health, such as tooth decay due to excess sugar **NB – some food groups are difficult to afford for some families so sensitivity is required in teaching this area** Know that excess fat from fatty foods such as butter and cheese - and created in the body from excess calories – builds up in the body and can cause obesity Know that excess body fat can lead to heart disease and increases the strain on joints and growing bones Know that animals, including humans, have a skeleton made up of solid objects. Know that some animals (such as insects) have an exoskeleton – a solid covering on the outside of their body Know that many invertebrates (such as earthworms and slugs) have water held inside by muscles which act like a skeleton Know that skeletons provide support for muscles and protect the body; for example, the ribcage protects the vital organs in the human body Know that human skeletons are made up of bones and cartilage Know that muscles can only contract, so they must be arranged in pairs in the body so that as one contracts the other loosens

Year 4 - Working scientifically	
NC objectives	Key knowledge and vocabulary
• Sc4/1.1 asking relevant questions and using different types of scientific enquiries to answer them • Sc4/1.2 setting up simple practical enquiries, comparative and fair tests • Sc4/1.3 making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers • Sc4/1.4 gathering, recording, classifying and presenting data in a variety of ways to help in answering questions • Sc4/1.5 recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables • Sc4/1.6 reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions • Sc4/1.7 using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions • Sc4/1.8 identifying differences, similarities or changes related to simple scientific ideas and processes • Sc4/1.9 using straightforward scientific evidence to answer questions or to support their findings.	<u>Consolidation</u> **properties,** observe, test, magnifying glass, object, record, equipment Know that we can ask questions about the world and that when we observe the world to answer these questions, this is science Know that we can use magnifying glasses to observe objects closely Know that we can test our questions to see if they are true Know that objects can be identified or sorted into groups based on their observable properties Know that we can write down numbers and words or draw pictures to record what we find <u>New learning and vocabulary – ongoing from year 3</u> prediction, measurement, enquiry, dependent variable, independent variable, fair test, similar, theory, hypothesis Know that we can ask questions and answer them by setting up scientific enquiries Know how to make relevant predictions that will be tested in a scientific enquiry Know that in a fair test one thing is altered (independent variable) and one thing that may change as a result is measured (dependent variable) while all other conditions are kept the same Know how to use a range of equipment to measure accurately, including thermometers, data loggers, rulers and stopwatches Know how to draw bar charts; how to label a diagram using lines to connect information to the diagram; how to use a coloured key how to draw a neat table; how to draw a classification key; how to show the relationship between an independent variable in a two-way table; and how to label specific results in a two-way table Know how – with structured guidance - to write a simple scientific enquiry write-up including an introduction, a list of equipment, a numbered method, a detailing of results and a conclusion Know how to precis a scientific enquiry write-up into a brief oral discussion of what was found in a scientific enquiry Know that scientific enquiries can suggest relationships, but that they do <u>not</u> prove whether a prediction is true Know that scientific enquiries are limited by the accuracy of the measurements (and measuring equipment) and by the extent to which conditions can vary even, and that repeating enquiries, measurements and taking measures to keep conditions as consistent as possible can improve an enquiry Know that the conclusions of scientific enquiries can lead to further questions, where results can be clarified or extended to different contexts (e.g. effect of changing sunlight on a plant – does this work with other plants / different types of light / etc) Know that they can draw conclusions from the findings of other scientists Know that a theory is an explanation of observations that has been tested to some extent and that a hypothesis is an explanation that has not yet been tested, but that can be tested through a scientific enquiry

Year 4 – Animals including humans	
NC objectives	Key knowledge and vocabulary
• Sc4/2.2a describe the simple functions of the basic parts of the digestive system in humans • Sc4/2.2b identify the different types of teeth in humans and their simple functions • Sc4/2.2c construct and interpret a variety of food chains, identifying producers, predators and prey.	Science Discipline(s): **B3** Consolidation **absorption, component, dissolving, energy,** nutrients, consumption, hygiene, herbivore, carnivore, organ Proteins are good for growth, carbohydrates for energy and fruit and vegetables provide vitamins and minerals which help keep us healthy (e.g. calcium for healthy bones and teeth) A food group can cause ill health, such as tooth decay due to excess sugar Living things move, grow, consume nutrients and reproduce Plants absorb energy from the Sun; that this energy is consumed by herbivorous animals; and that carnivorous animals eat other animals. New learning and vocabulary digestion, excretion, peristalsis, anus, duodenum, small intestine, large intestine, stomach, rectum, esophagus, tongue, saliva, acid, bile, enzymes, incisors, canines, molars, predator, prey, producer, consumer, primary, secondary, tertiary Know that food passes through the body with the nutrients being extracted and the waste products excreted, and that this process is called digestion Know that the process of digestion involves breaking complex foodstuffs into simpler building blocks that can be absorbed by the body Know that the process of digestion begins with food being chewed in the mouth by the teeth and saliva added Know that a human has three types of teeth – incisors, canines and molars – and that these each perform different functions Know that incisors slice food, canines tear food (especially meat) and that molars grind food Know that children develop an initial set of teeth which are gradually replaced between the ages of 6 and 12 Know that food is squeezed down the esophagus towards the stomach in a wave-like action called peristalsis Know that the stomach releases acid and enzymes to continue breaking down the food; the stomach is an organ; an organ is a part of living thing that is self-contained and has a specific important job Know that further enzymes and bile break down the food further as it moves through the duodenum towards the small intestine Know that the small intestine adds more enzymes and then absorbs the nutrients Know that the large intestine absorbs water from the undigested food Know that undigested food is stored in the rectum before being excreted through a muscle called the anus Know that a food chain traces the path of energy through a habitat Know that all energy for a food chain initially comes from the Sun which is absorbed and turned into energy by plants which are called producers Know that consumers take in energy by eating Know that an animal that is eaten by another is called prey, and that an animal that eats other animals is called a predator Know that the first consumer in a food chain is called a primary consumer, the second is called a secondary consumer and above it is called a tertiary consumer Know that the arrows in a food chain show the direction that energy is travelling through a habitat

Year 4 - Sound

NC objectives	Key knowledge and vocabulary
• Sc4/4.1a identify how sounds are made, associating some of them with something vibrating • Sc4/4.1b recognise that vibrations from sounds travel through a medium to the ear • Sc4/4.1c find patterns between the pitch of a sound and features of the object that produced it • Sc4/4.1d find patterns between the volume of a sound and the strength of the vibrations that produced it. • Sc4/4.1e recognise that sounds get fainter as the distance from the sound source increases	Science Discipline(s): **P1, P3** Consolidation **absorption, conductor, energy, insulator, wave** Energy comes in different forms and can be neither created nor destroyed, only changed from one form to another New learning and vocabulary **particle,** vibration, percussion instrument, wind instrument, string instrument, frequency, volume, pitch, transverse wave, longitudinal wave, medium, vacuum Know that sound is generated when an object vibrates; some of the energy from the vibrating object is transferred to the air, making the air particles move Know that energy comes in different forms and can be neither created nor destroyed, only changed from one form to another Know that sound is a form of energy that transfers in a longitudinal wave - like that seen in a slinky - *not* a transverse wave - like that seen in water ripples Know that sound travels through a medium (e.g. particles in the air) and thus sounds does not travel through a vacuum which has no particles in it at all Know that longitudinal sound waves are detected in the ear by humans and that the brain interprets this as the sounds we hear Know that sound travels at different speeds through different objects; it travels at around 340 metres per second in air, much slower than light travels; this is why we often hear thunder after we see lightning as the light reaches our eye before the sound reaches our ears Know that pitch is how high or low a sound is and that this is determined by how many vibrations per second are being made by the vibrating object; the number of vibrations per second is called frequency Know that volume is how loud or quiet a sound is and that this is determined by the amount of energy in the wave (e.g. from how hard or soft a percussion instrument is hit) Know that the volume of a sound is quieter if the listener is further away from the object

Year 4 - Electricity	
NC objectives	Key knowledge and vocabulary
• Sc4/4.2a identify common appliances that run on electricity • Sc4/4.2b construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers • Sc4/4.2c 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 • Sc4/4.2d recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit • Sc4/4.2e recognise some common conductors and insulators, and associate metals with being good conductors.	Science Discipline(s): **P1, P3, C2** Consolidation **component, conductor, energy, insulator, particle, property,** material An object is made from/of a material Metal is a material from which objects can be made. Matter (stuff) is made from tiny building blocks Energy comes in different forms and can be neither created nor destroyed, only changed from one form to another New learning and vocabulary **circuit,** appliance, charge, electron, battery, cell, bulb, buzzer, switch, wire, current electricity, static electricity, negative terminal, positive terminal, chemical reaction, emit Know that electrical energy is one of many forms of energy Know that static electricity is an imbalance of charged particles on a material; it does not operate by flowing around a complete circuit Know that current electricity is the flow of charged particles called electrons around a circuit Know that electrical current flows well through some materials, called electrical conductors, and poorly through other materials, called electrical insulators Know that conductors have free electrons and that when electrical current flows around a conductor the electrons move Know that electrical conductivity (how well a material conducts electricity) is an example of a property Know that metals are good electrical conductors Know that a chemical reaction inside a cell produces the charged particles that can flow around a circuit Know that more than one cell lined up to work together is called a battery Know that electrical current can flow if there is a complete circuit Know that wires – which contain a conductor inside them, usually made of metal – can allow electrical current to flow around a circuit Know that when electrical current flows through a circuit components within that circuit – such as buzzers which make a noise and bulbs which emit light – begin to work Know that a switch functions by completing or breaking a complete circuit Know how to construct a simple circuit using components Know that exposure to high levels of electrical current can be dangerous

Year 4 – Solids, liquids and gases	
NC objectives	Key knowledge and vocabulary
• Sc4/3.1a compare and group materials together, according to whether they are solids, liquids or gases • Sc4/3.1b 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) • Sc4/3.1c identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.	Science Discipline(s): **C1, C2, C2** Consolidation **absorption, dissolving, energy, evaporation, freezing, matter, melting, particle**, temperature, ice, water, solid An object is made from/of a material Materials can be hard, soft, strong, weak, absorbent, heavy, light, solid and runny, smooth and rough; these descriptions denote the properties of a material Know that matter (stuff) is made from tiny building blocks New learning and vocabulary **bond, condensation, evaporation, reversible,** boiling point, melting point, liquid, gas, thermometer, water cycle, continuous precipitation, transpiration, surface run off process, sublimation Know that things are composed of a material in one of three states of matter: solid, liquid or gas Know that things are made of particles (tiny building blocks) and that these are organized differently in different states Know that materials can change state when temperature changes Know that there are bonds between the particles (building blocks) in a solid; as temperature increases, these bonds are somewhat overcome as the particles absorb energy and solids can change into liquids; with a further increase in temperature, the particles become even more energetic and the bonds are overcome entirely so the liquid changes into a gas Know that when solids turn into liquids, this is called melting and that the reverse process is called freezing Know that when liquids turn into gases, this is called evaporation and that the reverse process is called condensation Know that when a solid turns into a gas without passing through the liquid state, this is called sublimation Know that the melting point of water is 0^{o} C and that the boiling point of water is 100^{o} C Know that water flows around our world in a continuous process called the water cycle Know that, along with evaporation, water on the Earth's surface moves to the air in a process called transpiration in which water turns into water vapour (gas) on the surface of leaves on plants Know that rain condenses in clouds and falls to earth as rain, snow or hail in a process called precipitation Know that water flows across the land in rivers and streams in a process called surface run-off and under the ground as groundwater

Year 4 – Living things and their habitats

NC objectives	Key knowledge and vocabulary
• Sc4/2.1a recognise that living things can be grouped in a variety of ways • Sc4/2.1b explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment • Sc4/2.1c recognise that environments can change and that this can sometimes pose dangers to living things.	Science Discipline(s): **B2, B3** Consolidation **decay, energy, habitat**, **freezing** plant, structure, herbivore, carnivore, omnivore, microhabitat, environment, reproduction, vertebrate Living things move, grow, consume nutrients and reproduce; that dead things used to do these things, but no longer do; and that things that never lived have never done these things. Polar bears are an example of an animal adapted to its environment – thick fur for warmth and oily paw pads to ensure that they don't freeze to the ice. A trout is an example of fish, a frog is an example of an amphibian; a lizard is an example of a reptile; a robin is an example of a bird; a rabbit and a human are examples of a mammal Herbivorous animals eats plants; a carnivorous animal eats other animals; omnivorous animals eat both animals and plants A cat is an example of a carnivore; that a rabbit is an example of a herbivore; know that many humans are examples of omnivores (though not vegetarians) Fish, amphibians, reptiles, birds and mammals are similar in that they have internal skeletons and organs; these are known as vertebrates, which means they are animals that have a backbone Fish are different in having gills so that they can breathe underwater **and** have scaly skin Amphibians are different in that they begin their lives with gills but then develop lungs and breath on land Reptiles are different in that they breath air **and** have scaly skin Birds are different to other animals in that they have feathers and wings Mammals are different to other animals in that they have fur/hair **and** they feed milk to their young Know a rose bush, grass, dandelion by sight Know an ash tree, birch tree and conifer tree by sight New learning and vocabulary kingdom, classification key, species, fungi, bacteria, climate change, characteristics, offspring, extinction, pollution Know that animals can be grouped based on their physical characteristics (e.g. vertebrates and invertebrates) and based on their behavior (e.g. herbivores, carnivores and omnivores) Know that living things are divided into kingdoms: the animal kingdom, plants, fungi, bacteria, and single-celled organisms Know that a species is a group of living things have many similarities that can reproduce together produce offspring Know that a classification key uses questions to sort and identify different living things Know how to use a classification key to identify living things Know how to create a classification key to sort plants on the school premises Know that changes to the environment can make it more difficult for animals to survive and reproduce; in extreme cases this leads to extinction, where an entire species dies Know that human activity – such as climate change caused by pollution - can change the environment for many living things, endangering their existence Know that the polar bear is a famous example of climate change endangering the existence of a species; as the climate changes and gets warmer, the sea ice on which polar bears live reduces in amount making it harder for them to survive and reproduce

Year 5 – Working scientifically	
NC objectives	Key knowledge and vocabulary
• Sc5/1.1 planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary • Sc5/1.2 taking measurements, using a range of scientific equipment, with increasing accuracy and precision • Sc5/1.3 recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, and bar and line graphs • Sc5/1.4 using test results to make predictions to set up further comparative and fair tests • Sc5/1.5 reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of results, in oral and written forms such as displays and other presentations • Sc5/1.6 identifying scientific evidence that has been used to support or refute ideas or arguments.	<u>Consolidation</u> prediction, measurement, enquiry, dependent variable, independent variable, fair test, similar, theory, hypothesis Know that we can ask questions and answer them by setting up scientific enquiries Know how to make relevant predictions that will be tested in a scientific enquiry Know that in a fair test one thing is altered (independent variable) and one thing that may change as a result is measured (dependent variable) while all other conditions are kept the same Know how to use a range of equipment to measure accurately, including thermometers, data loggers, rulers and stopwatches Know how to draw bar charts; how to label a diagram using lines to connect information to the diagram; how to use a coloured key how to draw a neat table; how to draw a classification key; how to show the relationship between an independent variable in a two-way table; and how to label specific results in a two-way table Know – with structured guidance - how to write a simple scientific enquiry write-up including an introduction, a list of equipment, a numbered method, a detailing of results and a conclusion Know how to precis a scientific enquiry write-up into a brief oral discussion of what was found in a scientific enquiry Know that scientific enquiries can suggest relationships, but that they do <u>not</u> prove whether a prediction is true Know that scientific enquiries are limited by the accuracy of the measurements (and measuring equipment) and by the extent to which conditions can vary even, and that repeating enquiries, measurements and taking measures to keep conditions as consistent as possible can improve an enquiry Know that the conclusions of scientific enquiries can lead to further questions, where results can be clarified or extended to different contexts (e.g. effect of changing sunlight on a plant – does this work with other plants / different types of light / etc) Know that they can draw conclusions from the findings of other scientists Know that a theory is an explanation of observations that has been tested to some extent and that a hypothesis is an explanation that has not yet been tested, but that can be tested through a scientific enquiry <u>New learning and vocabulary</u> line graph, relationship, outlier Know how to choose appropriate variables to test a hypothesis (e.g. plant height as a dependent variable when measuring effect of light on plant growth) Know how to identify conditions that were imperfectly controlled and can explain how these might affect results Know how to accurately use further measuring devices, including digital and analogue scales, measuring cylinders and beakers, recognizing the relative accuracy of each device Know how and when to repeat measurements, how to find an average of a set of measurements and how to recognize and remove outliers from a set of data, justifying the removal as a potential mis-measurement Know how to independently write a simple scientific enquiry write-up including an introduction, a list of equipment, a numbered method, a detailing of results and a conclusion Know how to present brief oral findings from an enquiry, speaking clearly and with confidence and using notes where necessary Know examples of instances where scientific evidence has been used to support or refute ideas or arguments (e.g. fossil records as evidence of natural selection)

Year 5 - Earth and space	
NC objectives	Key knowledge and vocabulary
• Sc5/4.1a describe the movement of the Earth, and other planets, relative to the Sun in the solar system • Sc5/4.1b describe the movement of the Moon relative to the Earth • Sc5/4.1c describe the Sun, Earth and Moon as approximately spherical bodies • Sc5/4.1d use the idea of the Earth's rotation to explain day and night, and the apparent movement of the Sun across the sky.	Science Discipline(s): **E1, E2** Consolidation **absorption, energy, freezing, melting, orbit, reflection, wave,** Sun, spring, summer, autumn, winter Days are longer in the summer and shorter in winter Weather changes through the year, getting hotter in the summer and colder in the winter Earth orbits the Sun with one orbit constituting a year of 365/366 days Light is a form of energy We need light to see things and that darkness is the absence of light Light travels in straight lines Everything that we can see is either a light source or something that is reflecting light from a light source into our eyes The Sun is a light source, but that the Moon is not and is merely reflecting light from the Sun The Sun gives off light and heat when hydrogen turns into helium (NB: the Sun and the Earth are capitalized when being discussed in an astronomical context.) New learning and vocabulary planet, satellite, sphere, solar system, eclipse, star, universe, constellation, axis, celestial body, Moon, rotating, lunar, solar, telescope, rotation Know that the universe comprises all matter and space in existence Know that a celestial body is a large object in the universe and know that the Sun is a star Know that a star is an exceptionally hot ball of gas, originally made from hydrogen and helium Know that a planet (e.g Earth) is defined as a spherical celestial body that orbits a star and that has cleared the neighbourhood of its orbit of other objects, some of which crash into the planet and others that become moons of that planet Know it was once thought that everything orbited the Earth, but that scientists like Copernicus and Galileo used telescopes and measurement to show that the Earth orbited the Sun Know that there are eight major planets in our solar system: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune Know that the universe is utterly vast and that our solar system makes up a tiny fraction of the universe Know that the Moon orbits the Earth roughly every 28 days Know that as the Moon orbits the Sun, different parts of it are lit up by the Sun, which is why we see a different shape lit up on the Moon as the lunar cycle progresses Know that all the planets in the solar system orbit the Sun and that the further away they are from the Sun, the longer their orbit Know that the Earth spins around an imaginary line through its centre called an axis and that this axis is tilted relative to the Earth's orbit Know that night and day are the result of the Earth rotating on its axis Know that the tilt of the Earth towards and away from the Sun's light as the Earth orbits the Sun leads to the seasons as during winter the light is spread over a wider area Know that a solar eclipse occurs when the Moon is between the Sun and the Earth, casting a shadow on the Earth; a lunar eclipse occurs when the Earth is between the Sun and the Moon, casting a shadow on the Moon

Year 5 – Forces

• Sc5/4.2a explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object • Sc5/4.2b identify the effects of air resistance, water resistance and friction, that act between moving surfaces • Sc5/4.2c recognise that some mechanisms including levers, pulleys and gears allow a smaller force to have a greater effect	Science Discipline(s): **P1, P2** Consolidation **energy, matter, particle,** surface, friction, force, stretch, squash, rotation, rough, smooth, sliding friction, static friction A force can be thought of as a push or a pull As objects move across a surface there is friction when they rub against each other and that sometimes this friction is larger or smaller. Applying forces to objects can change their shape. Know that the roughness of a material is an example of a property There are three types of contact force: impact forces (when two surfaces collide), frictional forces (when two surfaces are already in contact) and strain forces (when an elastic material is stretched or squashed). New learning and vocabulary acceleration, air resistance, buoyancy, effort, force meter, fulcrum, gravity, load, mass, mesh, Newton, pivot, rigid, streamlined, terminal velocity, unsupported, water resistance, weight Know that a force is measured in a unit called Newtons, named after a British scientist called Sir Isaac Newton who discovered lots about gravity and how planets move Know that pull forces can be measured using a device called a force meter Know that the amount of matter (stuff) in an object is its mass Know that gravity is a force that acts between all objects in the universe, but that it acts much more strongly between objects that have more mass and that are close together Know that unsupported objects are pulled towards the Earth by the force of gravity Know that acceleration is a change in speed and that unbalanced forces acting on an object cause it to accelerate Know that air resistance is a force felt by an object as it moves through the air; it is caused by the object bumping into the gas particles that make up air; the quicker an object moves, the more gas particles it bumps into and the more air resistance it experiences Know that a falling object will accelerate until its air resistance matches the gravitational force pulling it down; at this point, the object will continue to move at this speed (called its terminal velocity) without getting any quicker or slowing down Know that a parachute's shape increases the air resistance that a falling object experiences, giving it a much lower terminal velocity Know that water resistance is a force felt by an object as it moves through water; it is caused by the object bumping into the water particles Know that the shape of an object determines how much air resistance or water resistance it experiences; shapes of object that experience little air resistance or water resistance are described as streamlined Know how to draw a force diagram with arrows representing the different forces acting on an object Know that a lever is a rigid length pivoting around a fulcrum Know that a pulley is a wheel with a fulcrum that supports a moving cable or belt Know that a gear is a rotating wheel with cut teeth that mesh with the teeth of another gear so that turning one gear turns an adjacent gear in the opposite direction Know that gears, levers and pulleys are simple machines that used to allow a smaller force to have a greater effect; they do this by moving a smaller force over a longer distance at one end of the machine, which the machine turns into a larger forcer over a small distance at the other end

Year 5 - Properties and changes of materials

NC objectives	Key knowledge and vocabulary
Sc5/3.1a 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 Sc5/3.1b know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution Sc5/3.1c use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating Sc5/3.1d give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic Sc5/3.1e demonstrate that dissolving, mixing and changes of state are reversible changes Sc5/3.1f 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.	Science Discipline(s): **C2, C3** Consolidation **absorption, bond, condensation, conductor**, **evaporation, matter, melting, particle, property, reversible,** freezing, wood, plastic, glass, metal, water, rock, suitability, surface, waterproof, flexible, rigid, boiling point, melting point, solid, liquid, gas, sublimation, magnetic One can distinguish between materials made of wood, plastic, glass, metal, water, rock An object is made from/of a material Materials can have useful properties for a given job (including being waterproof, strong, weak, hard, soft, flexible, rigid, solid, runny, light, heavy, smooth, rough, flexible or rigid.) Electrical conductivity (how well a material conducts electricity) is an example of a property Metals are good electrical conductors Many types of plastic are waterproof, that steel (a type of metal) is strong, that rock is hard, that cotton wool is soft, that rubber is flexible, that rock is rigid, that polystyrene (a type of plastic) is light and that iron (a type of metal) is heavy, Things are composed of a material in one of three states of matter: solid, liquid or gas Things are made of particles (tiny building blocks) and that these are organized differently in each state Materials can change state when temperature changes New learning and vocabulary **irreversible,** dissolve, soluble, insoluble, solvent, solute, solution, filter, sieve, saturation, crystallization, thermal, chemistry Know that materials can be sorted in a variety to ways based on their properties Know that in some solid materials the bonds between particles break when surrounded by a liquid; this allows the liquid to absorb the solid; when this happens, the solid is called a solute, the liquid is called a solvent and the result is a solution; when a solid does dissolve in a liquid it is described as being soluble in that solvent (e.g. sugar in water); when it cannot it is insoluble (e.g. sand in water) Know that a given amount of solvent can only absorb a certain amount of solid before no more will dissolve; when this happens the liquid is said to be saturated Know that when a solvent is evaporated from a solution, the original solute is left behind; the remaining solid will often form crystals – the slower the solvent evaporates, the larger the crystals that will be formed Know how to dissolve and a solute in a solvent and then how to evaporate the solvent to recover the solute Know that a reversible change is one that can be reversed and that examples of this are mixing, dissolving and changes of state where no chemical reaction takes place Know that an irreversible change is one that cannot be reversed and that examples of this often involve a chemical change where a new material is made, often a gas (e.g. burning, boling an egg, the reaction of bicarbonate of soda and acid) Know that filtering allows solids and liquids to be separated and that sieving allows solids made up of different sizes parts to be separated Know how to separate a mixture of sand, salt and small stones by sieving (to remove the small stones), followed by dissolving in water (so the salt is absorbed), followed by filtering to remove the sand from the mixture, followed finally by evaporation of the water to recover the salt.

Year 5 - Living things & their habitats and Animals including humans

NC objectives	Key knowledge and vocabulary
Sc5/2.1a describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird Sc5/2.1b describe the life process of reproduction in some plants and animals. Sc5/2.2a describe the changes as humans develop to old age. (NB: the changes of adolescence in humans is taught as part of mandatory sex and relationship education; it must be taught with due sensitivity to children's family backgrounds; if in doubt, delay sensitive discussions until the formal teaching of sex and relationship education.)	Science Discipline(s): **B1** Consolidation **decay,** plant, structure, reproduction, nutrients, reproduction, fish, bird, amphibian, reptile, mammal, fruit, nectar, anther, ovary, ovule, petal, pollen, stigma, style, stamen, function, exchange, dispersal, fertilization, insect, vertebrates Living things move, grow, consume nutrients and reproduce; that dead things used to do these things, but no longer do; and that things that never lived have never done these things. Fish, amphibians, reptiles, birds and mammals are similar in that they have internal skeletons and organs; these are known as vertebrates, which means they are animals that have a backbone Fish are different in having gills so that they can breathe underwater **and** have scaly skin Amphibians are different in that they begin their lives with gills but then develop lungs and breath on land Reptiles are different in that they breath air **and** have scaly skin Birds are different to other animals in that they have feathers and wings Mammals are different to other animals in that they have fur/hair **and** they feed milk to their young The stem holds up the leaves so that they can gather light to make food and holds up the flowers so that they can receive pollen and disperse their fruits; The leaves make food by trapping light and using its energy to turn carbon dioxide and water into carbohydrates New learning and vocabulary life cycle, life span, embryo, womb, weaned, adolescence, metamorphosis, pupa, larva, chrysalis, caterpillar, tadpole, hatchling, fledgling, insect Know that the life cycle of a living thing is a series of stages of development starting with a fertilized egg in animals or a seed in many plants Know that in most mammals (e.g. dogs) a fertilized egg develops in the womb into an embryo and is then born and fed on milk before it is weaned onto the food that is adapted to eat; it then develops to maturity in a period called adolescence after which it can reproduce and the cycle can begin again Know that in amphibians (e.g. frogs) a fertilized egg develops into an embryo and then hatches into a tadpole; the tadpole develops adult characteristics, metamorphoses into the adult form after which it can reproduce and the cycle can begin again Know that in many insects (e.g. butterflies) a fertilized egg develops into wingless feeding form called a larva (caterpillar); the larva feeds then later becomes a pupa (chrysalis) with a protective cocoon; inside this cocoon, the pupa metamorphoses into the adult butterfly after which it can reproduce and the cycle can begin again Know that in birds (e.g. robins) a fertilized egg hatches in a nest (a hatchling) and is fed by its parents until it is ready to fly (i.e. becomes a fledgling); it then leaves the nest and grows into an adult after which it can reproduce and the cycle can begin again Know that humans go through stages of development; they begin as fertilized eggs and then develop into embryos before developing into babies; once they are born, these newborn babies become infants (roughly 2 months to 2 years) then into young children (roughly 2-12 years old); children develop into adults during adolescence (roughly 12-16 years old) at which age they become physically capable of reproduction; as adults develop into old age (roughly 55+ years old) they experience changes in their body which require them to move more carefully and rest more frequently

Year 6 – Working scientifically	
NC objectives	Key knowledge and vocabulary
• Sc5/1.1 planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary • Sc5/1.2 taking measurements, using a range of scientific equipment, with increasing accuracy and precision • Sc5/1.3 recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, and bar and line graphs • Sc5/1.4 using test results to make predictions to set up further comparative and fair tests • Sc5/1.5 reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of results, in oral and written forms such as displays and other presentations • Sc5/1.6 identifying scientific evidence that has been used to support or refute ideas or arguments.	<u>Consolidation</u> prediction, measurement, enquiry, dependent variable, independent variable, fair test, similar, theory, hypothesis Know that we can ask questions and answer them by setting up scientific enquiries Know how to make relevant predictions that will be tested in a scientific enquiry Know that in a fair test one thing is altered (independent variable) and one thing that may change as a result is measured (dependent variable) while all other conditions are kept the same Know how to use a range of equipment to measure accurately, including thermometers, data loggers, rulers and stopwatches Know how to draw bar charts; how to label a diagram using lines to connect information to the diagram; how to use a coloured key how to draw a neat table; how to draw a classification key; how to show the relationship between an independent variable in a two-way table; and how to label specific results in a two-way table Know – with structured guidance - how to write a simple scientific enquiry write-up including an introduction, a list of equipment, a numbered method, a detailing of results and a conclusion Know how to precis a scientific enquiry write-up into a brief oral discussion of what was found in a scientific enquiry Know that scientific enquiries can suggest relationships, but that they do <u>not</u> prove whether a prediction is true Know that scientific enquiries are limited by the accuracy of the measurements (and measuring equipment) and by the extent to which conditions can vary even, and that repeating enquiries, measurements and taking measures to keep conditions as consistent as possible can improve an enquiry Know that the conclusions of scientific enquiries can lead to further questions, where results can be clarified or extended to different contexts (e.g. effect of changing sunlight on a plant – does this work with other plants / different types of light / etc) Know that they can draw conclusions from the findings of other scientists Know that a theory is an explanation of observations that has been tested to some extent and that a hypothesis is an explanation that has not yet been tested, but that can be tested through a scientific enquiry <u>New learning and vocabulary</u> line graph, relationship, outlier Know how to choose appropriate variables to test a hypothesis (e.g. plant height as a dependent variable when measuring effect of light on plant growth) Know how to identify conditions that were imperfectly controlled and can explain how these might affect results Know how to accurately use further measuring devices, including digital and analogue scales, measuring cylinders and beakers, recognizing the relative accuracy of each device Know how and when to repeat measurements, how to find an average of a set of measurements and how to recognize and remove outliers from a set of data, justifying the removal as a potential mis-measurement Know how to independently write a simple scientific enquiry write-up including an introduction, a list of equipment, a numbered method, a detailing of results and a conclusion Know how to present brief oral findings from an enquiry, speaking clearly and with confidence and using notes where necessary Know examples of instances where scientific evidence has been used to support or refute ideas or arguments (e.g. fossil records as evidence of natural selection)

Year 6 - Light

NC objectives	Key knowledge and vocabulary
• Sc6/4.1a recognise that light appears to travel in straight lines • Sc6/4.1b 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 • Sc6/4.1c 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 • Sc6/4.1d use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them	Science Discipline(s): **P1, P3** Consolidation **absorption, energy, property, reflection, wave,** mirror, incident ray, image, beam, photons, solid, opaque, transparent, object, source, Light is a form of energy Energy comes in different forms and can be neither created nor destroyed, only changed from one form to another We need light to see things and that darkness is the absence of light Light travels in straight lines Light is reflected when it travels from a light source and then 'bounces' off an object Everything that we can see is either a light source or something that is reflecting light from a light source into our eyes The Sun is a light source, but that the Moon is not and is merely reflecting light from the Sun Many light sources give off light and heat The Sun gives off light and heat when hydrogen turns into helium Filaments in traditional bulbs heat up until they glow, giving off light and heat Fluorescent bulbs glow when electricity adds energy to a gas within the bulb Sunglasses can protect eyes from sunlight **but looking at the Sun directly – even with sunglasses – can damage the eyes** Opaque objects block light creating shadows and that light passes through transparent objects Opacity/transparency and reflectiveness are properties of a material As objects move towards a light source, the size of the shadow increases The changing of shadow size can be shown by drawing a diagram with straight lines representing light (NB: the Sun and the Moon are capitalized when being discussed in an astronomical context.) New learning and vocabulary angle of incidence, angle of reflection, refraction, spectrum, translucent, medium, periscope Know that translucent objects allow some light to pass through, but some of the light changes direction as it passes through the object; this means that an something seen through a translucent object is not clearly defined Know that when light passes from one medium to another (e.g. from air to water), it changes direction; this is called refraction; this happens because light travels at different speeds in different media. Know that white light comprises all the colours of light Know that white light refracted by two surfaces in a prism will spread out so that all of its constituent colours can be seen; this array of colours is called a spectrum; it happens because the different colours of that constitute white light travel at different speeds. Know how to draw a diagram to show why the shape of a shadow will match the shape of an object Know that when light reflects off an object, the angle of incidence is equal to the angle of reflection Know that a periscope takes advantage of the predictable angles of incidence and reflection to allow an image to be shown to a viewer

Year 6 - Electricity

NC objectives	Key knowledge and vocabulary
• Sc6/4.2a associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit • Sc6/4.2b 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 • Sc6/4.2c use recognised symbols when representing a simple circuit in a diagram.	Science Discipline(s): **P1, P3** Consolidation **circuit, component, conductor, energy, insulator, particle, property,** material, appliance, charge, electron, battery, cell, bulb, buzzer, switch, wire, current electricity, static electricity, negative terminal, positive terminal, voltage, chemical reaction, emit An object is made from/of a material Electrical energy is a form of energy Energy comes in different forms and can be neither created nor destroyed, only changed from one form to another Static electricity is an imbalance of charged particles on a material; it does not operate by flowing around a complete circuit Current electricity is the flow of charged particles called electrons around a circuit Electrical current flows well through some materials, called electrical conductors, and poorly through other materials, called electrical insulators Conductors have free electrons, and when electrical current flows through a conductor, the electrons move like people in a queue Electrical conductivity (how well a material conducts electricity) is an example of a property Metals are good electrical conductors A chemical reaction inside a cell produces the charged particles that can flow around a circuit More than one cell lined up to work together is called a battery Electrical current can flow if there is a complete circuit When electrical current flows through a circuit components within that circuit – such as buzzers which make a noise and bulbs which emit light – begin to work A switch functions by completing or breaking a complete circuit A simple circuit can be constructed using components Exposure to high levels of electrical current can be dangerous New learning and vocabulary series circuit, parallel circuit, resistance, voltage Know that voltage is a measure of the power of a cell to produce electricity; it is a measure of the 'push' of electric current, **not** the size of the electric current Know that as the number and voltage of cells in a circuit increases, the brightness of a bulb or the volume of a buzzer will increase (though too high a voltage may 'blow' the bulb or buzzer) Know how to draw simple circuit diagrams Know the recognized symbols for a battery, bulb, motor, buzzer and wire Know how to predict whether components will function in a given circuit, depending on whether or not the circuit is complete; whether or not a switch is in an on or off position; and whether or not there is a cell to provide electrical current to the circuit Know that two bulbs in a circuit can be wired up to create a series circuit or a parallel circuit; if one bulb blows in a series circuit the other will not shine as the circuit has been broken; in contrast, if one bulb blows in a parallel circuit, there will still be a complete circuit for the other bulb so it will continue to shine; use this knowledge to explain the advantages of using parallel circuits (e.g. in the lighting in homes)

Year 6 - Living things and their habitats	
NC objectives	**Key knowledge and vocabulary**
• Sc6/2.1a 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 • Sc6/2.1b give reasons for classifying plants and animals based on specific characteristics.	Science Discipline(s): **B2** Consolidation **component, habitat,** plant, structure, fish, bird, amphibian, reptile, mammal, kingdom, classification key, species, fungi, bacteria, characteristics, offspring, vertebrate, invertebrate, insect Animals can be grouped based on their physical characteristics (e.g. vertebrates and invertebrates) and based on their behavior (e.g. herbivores, carnivores and omnivores) Living things are divided into kingdoms: the animal kingdom, plants, fungi, bacteria, and single-celled organisms A species is a group of living things have many similarities that can reproduce together produce offspring A classification key uses questions to sort and identify different living things A classification key can be used to identify living things Living things move, grow, consume nutrients and reproduce; that dead things used to do these things, but no longer do; and that things that never lived have never done these things. A trout is an example of fish, a frog is an example of an amphibian; a lizard is an example of a reptile; a robin is an example of a bird; a rabbit and a human are examples of a mammal Fish, amphibians, reptiles, birds and mammals are similar in that they have internal skeletons and organs; these are known as vertebrates, which means they are animals that have a backbone Fish are different in having gills so that they can breathe underwater **and** have scaly skin Amphibians are different in that they begin their lives with gills but then develop lungs and breath on land Reptiles are different in that they breath air **and** have scaly skin Birds are different to other animals in that they have feathers and wings Mammals are different to other animals in that they have fur/hair **and** they feed milk to their young Different parts of plants have one or more functions (jobs) New learning vocabulary micro-organism, virus, thorax, arthropod, abdomen, arachnid, antenna, jointed limbs Know that there are three types of micro-organism: viruses, fungi and bacteria; of these three, viruses are often not really considered to be alive by many scientists mainly because they don't have the 'machinery' to reproduce inside them Know that germs are disease-causing bacteria Know that an arthoropod is an invertebrate with a hard , external skeleton and jointed limbs Know that insects are a type of arthropod; their bodies consist of six legs, a head, a thorax and an abdomen; most insects also have a pair of antennae and a pair of wings Know that an arachnid (e.g. spider) is a type of arthropod with eight legs and no antennae or wings Know that a crustacean is a type of arthropod with two pairs of antennae (e.g. woodlouse) Know that a myriapod is an arthropod with a flat and long or cylindrical body and many legs (e.g. centipede)

Year 6 - Evolution and adaptation	
NC objectives	Key knowledge and vocabulary
• Sc6/2.3a recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago • Sc6/2.3b recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents • Sc6/2.3c identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.	Science Discipline(s): **B3** Consolidation **birth, decay, energy, habitat**, **irreversible, extinction,** microhabitat, dead, life cycle, food chain, source, nutrients, reproduction, consumption, environment, extinction, species, characteristic, adaptation Living things move, grow, consume nutrients and reproduce; that dead things used to do these things, but no longer do; and that things that never lived have never done these things. Polar bears are an example of an animal adapted to its environment – thick fur for warmth and oily paw pads to ensure that they don't freeze to the ice. Sharks are another example – smooth skin and streamlined shape for quick swimming; and gills for breathing underwater Cacti are an example of a plant adapted to its environment – thick skin keeps a store of water safe; sharp spikes keep animals from stealing the water Pine trees have thick bark and pine cones to protect against cold winters Woodlice live under logs – an example of a microhabitat - as they need somewhere dark and damp so that they do not dry out Frogs can live in ponds – an example of a microhabitat - as they water in which to lay their eggs (frogspawn) A species is a group of living things have many similarities that can reproduce together produce offspring Changes to the environment can make it more difficult for animals to survive and reproduce; in extreme cases this leads to extinction, where an entire species dies Human activity – such as climate change caused by pollution - can change the environment for many living things, endangering their existence The polar bear is a famous example of climate change endangering the existence of a species; as the climate changes and gets warmer, the sea ice on which polar bears live reduces in amount making it harder for them to survive and reproduce Fossils form when a plant or animal dies and is quickly covered with silt or mud so that it cannot be rotted by microbes or eaten by scavenging animals; in time layers of sediment build, squashing the mud and turning it to stone around the dead plant or animal; the materials in the body are replaced by minerals that flow in water through the rock, leaving a rock in the shape of the animal or plant that was once there New learning and vocabulary evolution, natural selection, variation, advantageous Know that all life on Earth began from a single point around 4.5 billion years ago Know that living things changes over time and that this gradual change is called evolution Know that natural selection is the cause of this change; natural selection works as across a species there is natural variation within a species; there is also competition to survive and reproduce and that members of a species with advantageous characteristics survive and reproduce - these characteristics are passed down to their offspring; members of a species with less advantageous characteristics do not survive and reproduce – these characteristics are **not** passed down to offspring Know that offspring are vary and are not identical to their parents Know that Charles Darwin posited this theory of evolution by natural selection Know that the gradual change of species over millions of years can be observed by looking at examples of fossils.

Year 6 - Animals including humans

NC objectives	Key knowledge and vocabulary
• Sc6/2.2a identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood • Sc6/2.2b recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function • Sc6/2.2c describe the ways in which nutrients and water are transported within animals, including humans.	Science Discipline(s): **B1** Consolidation **component, energy, growth,** survival, nutrients, consumption, skeleton, ribcage, protein, carbohydrate, fat, digestion, skeleton, organ Living things move, grow, consume nutrients and reproduce; that dead things used to do these things, but no longer do; and that things that never lived have never done these things. Animals, including humans, need food, water and air to survive People need to exercise often to help their body stay strong and fit Keeping clean, including washing and brushing teeth, is an important part of staying healthy There are food groups: fruit and vegetables, carbohydrates, protein, dairy, fat and sugary foods Proteins are good for growth, carbohydrates for energy and fruit and vegetables provide vitamins and minerals which help keep us healthy (e.g. calcium for healthy bones and teeth) More than half of our diet should be made up of carbohydrates, fruit and vegetables Fats and sugary foods should be eaten rarely and in small amounts Getting the right amount of each food group (including over half of the diet made up of fruit, vegetables and carbohydrates) is called a balanced diet A lack of a nutrient can cause ill health; for example, a lack of vitamin D leads to a disease called rickets Know that excess of a food group can cause ill health, such as tooth decay due to excess sugar **NB – some food groups are difficult to afford for some families so sensitivity is required in teaching this area** Food passes through the body with the nutrients being extracted and the waste products excreted, and that this process is called digestion The process of digestion involves breaking complex foodstuffs into simpler building blocks that can be absorbed by the body New learning and vocabulary artery, aorta, atrium, blood vessels capillary, circulatory system, vein, pulse, ventricle, replenished, resting heart rate, body Know that the heart and lungs are organs protected by the ribcage Know that blood travels around the body transporting nutrients that have been absorbed into the blood stream from digestion; blood also carries oxygen around the body which is used to power the body; this use of oxygen to create energy is called respiration Know that the heart beats, pumping blood around the body and that blood vessels carry the blood; arteries carry blood away from the heart; veins carry blood towards the heart; capillaries are tiny blood vessels that connect arteries and veins Know that the heart is composed of four chambers: two atria and two ventricles; the aorta is the largest artery in the body and most major arteries branch off from it Know that when we exercise, our heart beats more frequently so that the oxygen that is used around the body can be replenished; it returns to a resting heart rate afterwards; fitter people tend to have lower resting heart rates Know that drugs are chemicals that have an impact on the natural chemicals in a person's; know that drugs can be harmful or helpful, depending on what they are and how they are used; know that all drugs can be harmful if overused Know that paracetamol and aspirin are examples of drugs that can be helpful as a painkiller Know that cannabis and cocaine are examples of illegal drugs that can have serious negative effects Know that alcohol and tobacco are examples of drugs that are legal to adults but that can have serious negative effects **NB – note that discussion of drugs needs sensitive teaching due to family circumstances.**