

I am a scientist...

I am a scientist. I seek to explain the world around me. I build my theories based on evidence collected, by making observations in the natural and physical world. These theories are supported, modified or replaced as I find new evidence. My search for evidence in science occurs through an inquiry process that blends my curiosity, imagination, logic and serendipity. I am strongly influenced by the ideas which people currently hold. I understand that scientific knowledge is provisional: Although reliable and durable, scientific knowledge is subject to change as scientists learn more about phenomena. I learn about the theories and models that are used to describe the natural and physical world. These simplified theories or models help to describe the way the natural and physical world works. I use these models or theories to make predictions, test these predictions through experimentation and observation and use my results to revise and improve the models.



Key Concepts for Scientists

	Key Concepts		Contexts
What is Physics? <i>About 13.5 billion years ago, matter, energy, time and space came into being in what is known as the Big Bang. The story of these fundamental features of our universe is called Physics.</i>	The universe is made of matter and energy At the smallest level, matter is made of elementary particles which have mass and charge. On a large scale, matter ranges from everyday objects to vast galaxy super-clusters. Energy has many different forms.	Y2 The Earth and its place in the solar system	Y5 Astronomy
	The universe evolves by means of interactions All interactions involve matter and energy and take place through forces, fields, and energy transformations.		Y6 Chemistry: Matter & Change
	Some quantities are conserved Underlying these interactions and transformations are laws of conservation – energy and charge cannot be created or destroyed. This means that overall they remain unchanged by an interaction or transformation.		Y4 Materials Y5 Chemistry
	There are four fundamental forces All interactions originate in four fundamental forces of nature. The force of gravity acts between all bodies and depends on their masses. The electromagnetic force acts between charged particles or between magnetic poles and is responsible for electric and magnetic fields and electric currents. The strong and weak nuclear forces operate between protons and neutrons in the nuclei of atoms, holding them together and sometimes resulting in radioactive decay.	Y1 Magnetism Y2 Electricity	Y3 Forces & Magnets Y4 Electricity
	Waves carry energy Energy propagates through materials and space by means of various types of waves, for example, sound waves in air, seismic waves through the earth, electromagnetic waves, including light that may travel through materials or empty space.		Y4 Sound; Light
What is Chemistry? <i>300, 000 years after their appearance matter and energy started to coalesce into complex structures called atoms, which then combined into molecules (13.2 billion years ago). The story of atoms, molecules and their interactions is called Chemistry.</i>	All matter is made of particles The fundamental particle from which all matter is made is the atom. There are approximately 115 different atoms which form the building blocks of the molecular and ionic structures that make up all the known substances.	Y2 Matter & Properties & Measurements	Y5 Chemistry Y6 Chemistry: Matter & Change
	The properties of materials derive from the identity and arrangement of particles Atoms come together to form bonds during chemical reactions. The properties of the resulting materials depend on which atoms are combined and the way they are arranged.	Y1 Everyday materials; Magnetism Y2 Matter & Properties & Measurements; Electricity	Y4 Electricity Y5 Chemistry Y6 Chemistry: Matter & Change
	Energy plays a key role in determining the changes that matter can undergo Energy changes occur during physical and chemical transformations as the bonds between atoms or molecules are broken and new bonds are formed. Since energy can be neither created nor destroyed, energy will determine the changes that matter can undergo.		Y4 Materials Y6 Chemistry: Matter & Change
	Chemistry is everywhere Chemical transformations maintain the world around us. Most natural processes are based on chemistry and can be understood at a molecular level. For example, the chemical reactions occurring in cells will determine their structure and function and ultimately the nature of the organism to which it belongs.		Y5 Chemistry Y6 Chemistry: Matter & Change
What is Earth and Space Science? <i>4.5 billion years ago a cloud of space dust coalesced to form a star surrounded by a group of planets and other material. The story of this is Earth and Space Science. The study of the Earth itself is Geography.</i>	The Earth is a single system with four dynamically interconnected 'spheres' These are the geosphere (rock of the crust, mantle, and core), the hydrosphere (solid, liquid, and gaseous water), the atmosphere (gases of the air) and the biosphere (living organisms).		Y3 What is inside the Earth? – Rocks Y5 Meteorology
	The Earth works in cycles The tectonic, rock and water cycles constantly reshape the surface of the Earth. Bio-geochemical cycles move the elements essential for life. These cycles also balance and regulate the Earth's climate.	Y1 Seasonal Changes;	Y3 What is inside the Earth? – Rocks; The Water Cycle Y5 Life cycles & Seasonal cycles; Meteorology
	All parts of the Earth system are constantly changing Earth systems interact with themselves, and with the Sun, Moon and the rest of the solar system and universe. Critical thresholds can be reached through natural variations in cycles and by human activity.		Y5 Meteorology
	Earth is dynamically part of the solar system and beyond The solar system comprises of objects that are gravitationally bound to the Sun. The solar system and all other planetary systems are formed during the life cycle of stars which have been born, lived and died in giant cycles since the Big Bang.	Y2 The Earth and its place in the solar system	Y5 Life cycles & Seasonal cycles; Astronomy
	Distance/time scales in Earth and space systems vary greatly In all Earth and space system processes and cycles, time scales can range from micro-seconds to billions of years, and distance scales range from microns to thousands of light years.	Y2 The Earth and its place in the solar system	Y5 Astronomy
Biology <i>About 3.8 years ago, on a planet called Earth, certain molecules combined to form particularly large and intricate structures called organisms. The story of organisms is called biology.</i>	All organisms are classified based on how closely related they are on the tree of life There are seven major levels of classification: Kingdom, Phylum, Class, Order, Family, Genus, and Species. The two main kingdoms we think about are plants and animals. Scientists also list four other kingdoms including bacteria, archaeobacteria, fungi, and protozoa.	Year 1 Animals, Plants Y2 Living things and their habitats environment	Y3 Insects Y4 Classification of animals Y6 Plant Structures & Processes; Classifying Living Things
	All organisms share a common set of essential life processes Because of their shared evolutionary history, all organisms share a common set of essential life processes (movement, respiration, sensitivity, growth, reproduction, excretion, and nutrition) and use the same genetic system to maintain continuity. Many of these life processes are cyclical, e.g. growth, reproduction, excretion.	Y1 Animals; Humans; Plants; Y2 The Human Body & systems	Y3 Insects; Plants Y5 Life cycles & Seasonal cycles Y6 Plant Structures & Processes; Classifying Living Things Y6 Human Body: Hormones & Reproduction
	Organisms interact with each other and with their environment Living systems are organised and regulate themselves at the cell, organism, and ecosystem levels. Each of these dynamic systems maintains stability in response to a changing environment and their responses impact in turn upon the environment.	Y2 Living things and their habitats environment; The Human Body & systems	Y3 The human body: Cells, systems, and health Y4 Muscular & Skeletal system Y5 Circulatory and Respiratory System Y6 Plant Structures & Processes; Classifying Living Things; Human Body: Hormones & Reproduction
	Species arise, change, and become extinct over time Evolution results in diverse adaptations to ensure survival. This diversity allows organisms to occupy different niches within an ecosystem.		Y6 Evolution and Inheritance
	Genetics maintain continuity plus allow for change The inherited sequence of DNA underlies an organism's phenotype such as shape or blood type. Heritable mutations allow evolution or genetic change over time.		Y6 Evolution and Inheritance

Key Concepts, Knowledge, Vocabulary and Skills - Scientists: Year 1

Key Concept	Contexts	Key Knowledge and Vocabulary	Scientific Skills: Enquiry & Application
Chemistry The properties of materials derive from the identity and arrangement of particles.	Everyday materials	<ul style="list-style-type: none">Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular usesExplain why materials are chosen for specific tasks based on their properties. For example, wool for clothing, glass for windows, wood for tables, metal for bridges.Become aware that some materials are natural and some are man-made.Find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching.	<div>1. Asking simple questions and recognising that they can be answered in different ways</div> <div>2. Observing closely, using simple equipment</div> <div>3. Performing simple tests</div> <div>4. Identifying and classifying</div> <div>5. Using their observations & ideas to suggest answers to questions</div> <div>6. Gathering and recording data to help in answering questions</div>
Biology All organisms are classified based on how closely related they are on the tree of life. All organisms share a common set of essential life processes	Animals	<ul style="list-style-type: none">Identify and name a variety of common animals including fish, amphibians, reptiles, birds and mammalsIdentify and name a variety of common animals that are carnivores, herbivores and omnivores.Describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals, including pets).Make the connection that animals, like plants, need food, water and space to live and grow.Recognise that plants make their own food, but animals obtain food from eating plants or other living things.Understand that offspring are very much (but not exactly) like their parents.Understand that most animal babies need to be fed and cared for by their parents; human babies are especially in need of care when young.Recognise that pets have special needs and must be cared for by their owners.	
Earth and Space Science The Earth works in cycles	Seasonal changes	<ul style="list-style-type: none">Identify the four seasons: Autumn, winter, spring, summerBe able to describe characteristic local weather patterns during the different seasons.Recognise the importance of the sun as a source of light and warmth.Understand daily weather changes.Temperature: thermometers are used to measure temperatureClouds: rainfall comes from cloudsRainfall: how the condition of the ground varies with rainfall; rainbowsThunderstorms: lightning, thunder, hail, safety during thunderstormsSnow: snowflakes, blizzards	
Biology All organisms share a common set of essential life processes	Humans	<ul style="list-style-type: none">Identify the five senses and associated body parts:Sight: eyes; hearing: ears; smell: nose; taste: tongue; touch: skinReview the importance of taking care of your body: exercise, cleanliness, healthy foods and rest.	
Biology All organisms are classified based on how closely related they are on the tree of life All organisms share a common set of essential life processes	Plants	<ul style="list-style-type: none">Understand what plants need to grow: sufficient warmth, light and water.Recognise basic parts of plants: seeds, roots, stems, branches and leaves.Understand that plants make their own food.Recognise the importance of flowers and seeds. For example, seeds such as rice, nuts, wheat and corn are food for plants and animals.Know that there are two kinds of plants: deciduous and evergreen.	
Introduction & exploration			
Physics There are four fundamental forces. Chemistry The properties of materials derive from the identity and arrangement of particles.	Magnetism	<ul style="list-style-type: none">Identify familiar, everyday uses of magnets. For example: in toys, in cabinet locks, in refrigerator magnets, etc.Classify materials according to whether they are or are not attracted by a magnet.	

Key Concepts, Knowledge, Vocabulary and Skills - Scientists: Year 2

Key Concept	Contexts	Key Knowledge and Vocabulary	Scientific Skills: Enquiry & Application
Chemistry All matter is made of particles The properties of materials derive from the identity and arrangement of particles	Matter & Properties & Measurements	<ul style="list-style-type: none">Basic concept of atomsNames and common examples of three states of matter: Solid (for example, wood, rocks), Liquid (for example, water) , Gas (for example, steam)Water as an example of changing states of matter of a single substanceUnits of measurement: Length: centimetre, metre; Volume: millilitre, litre ; Temperature: degrees Celsius	1.Asking simple questions and recognising that they can be answered in different ways 2.Observing closely, using simple equipment 3. Performing simple tests 4. Identifying and classifying 5.Using their observations & ideas to suggest answers to questions 6. Gathering and recording data to help in answering questions
Biology All organisms are classified based on how closely related they are on the tree of life Organisms interact with each other and with their environment Species arise, change, and become extinct over time	Living things and their habitats environment	<p>Habitats:</p> <ul style="list-style-type: none">Living things live in environments to which they are particularly suited.Find out about and describe basic needs of animals, including humans, for survival (water, food and air).Specific habitats and what lives there, for example: Forest (for example: oak trees, squirrels, foxes, badgers, snails, mice); Meadow and plains (for example: wildflowers, grasses, prairie dogs); Underground (for example: fungi, moles, worms) o Desert (for example: cacti, lizards, scorpions); Water (for example: fish, oysters, starfish)The food chain: a way of picturing the relationships between living things; Animals: big animals eat little ones, big animals die and are eaten by little ones; Plants: nutrients, water, soil, air, sunlight <p>Environmental change and Habitat destruction:</p> <ul style="list-style-type: none">Environments are constantly changing, and this can sometimes pose dangers to specific habitats, for example: Effects of population and development; Rainforest clearing, pollution, litter <p>Special classification of animals:</p> <ul style="list-style-type: none">Herbivores: plant-eaters (for example, elephants, cows, deer)Carnivores: flesh-eaters (for example, lions, tigers)Omnivores: plant and animal eaters (for example, bears)Extinct animals (for example: dinosaurs)	
Earth & Space Science Earth is dynamically part of the solar system and beyond Distance/time scales in Earth and space systems vary greatly Physics The universe is made of matter and energy	The Earth and its place in the solar system	<ul style="list-style-type: none">Sun: source of energy, light, heatMoon: phases of the moon (full, half, crescent, new)The eight planets (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune) o Note that, in 2006, Pluto was classified as a dwarf planet.Stars o Constellations: the Plough o The sun is a star.Earth and its place in the solar system:<ul style="list-style-type: none">-The Earth moves around the Sun; the sun does not move- The Earth revolves (spins); one revolution takes one day (24 hours)- Sunrise and sunset- When it is day where you are, it is night for people on the opposite side of the Earth <p>Geographical features of the Earth's surface:</p> <ul style="list-style-type: none">The shape of the Earth, the horizonOceans and continentsNorth Pole and South Pole, Equator	
Physics There are four fundamental forces Chemistry The properties of materials derive from the identity and arrangement of particles	Electricity	<ul style="list-style-type: none">Static electricityBasic parts of simple electric circuits (for example, batteries, wire, bulb or buzzer, switch)Conductive and non-conductive materialsSafety rules for electricity (for example, never put your finger or anything metallic in an electrical outlet, never touch a switch or electrical appliance when your hands are wet or when you're in the bathtub, never put your finger in a lamp socket, etc.)	
Biology All organisms share a common set of essential life processes	The Human Body & health	<ul style="list-style-type: none">Describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene. <p>Germs, Diseases and preventing illness:</p> <ul style="list-style-type: none">Taking care of your body: exercise, cleanliness, healthy foods, restVaccinations	
	Introduction & exploration		
Biology Organisms interact with each other and with their environment	The Human Body & systems	<ul style="list-style-type: none">Identify basic parts of the following body systems:<ul style="list-style-type: none">- Skeletal system: skeleton, bones, skull- Muscular system: muscles- Digestive system: mouth, stomach- Circulatory system: heart and blood- Nervous system: brain and nerves	

Key Concepts, Knowledge, Vocabulary and Skills - Scientists: Year 3

Key Concept	Contexts	Key Knowledge and Vocabulary	Scientific Skills: Enquiry & Application
Physics There are four fundamental forces. Chemistry The properties of materials derive from the identity and arrangement of particles.	Forces and Magnets	<ul style="list-style-type: none"> Compare how things move on different surfaces Notice that some forces need contact between two objects, but magnetic forces can act at a distance. 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. Magnetism demonstrates that there are forces we cannot see that act upon objects. Most magnets contain iron; Lodestones: naturally occurring magnets Magnetic poles: north-seeking and south-seeking poles Magnetic field (strongest at the poles) Law of magnetic attraction: unlike poles attract, like poles repel. The Earth behaves as if it were a huge magnet: north and south magnetic poles (near, but not the same as, geographic North Pole and South Pole). Orienteering: use of a magnetised needle in a compass, which will always point to the north 	<ol style="list-style-type: none"> Raise their own relevant questions about the world around them Should be given a range of scientific experiences including different types of science enquiries to answer questions Start to make their own decisions about the most appropriate type of scientific enquiry they might use to answer questions Recognise when and how secondary sources might help them to answer questions that cannot be answered through practical investigations Set up simple practical enquiries, comparative and fair tests Recognise when a simple fair test is necessary and help to decide how to set it up Talk about criteria for grouping, sorting and classifying; and use simple keys Make systematic and careful observations Help to make decisions about what observations to make, how long to make them for and the type of simple equipment that might be used Take accurate measurements using standard units learn how to use a range of (new) equipment, such as data loggers/ thermometers appropriately Collect and record data from their own observations and measurements in a variety of ways: notes, bar charts and tables, standard units, drawings, labelled diagrams, keys and help to make decisions about how to analyse this data Begin to look for naturally occurring patterns and relationships and decide what data to collect to identify them With help, pupils should look for changes, patterns, similarities and differences in their data in order to draw simple conclusions and answer questions Use relevant simple scientific language to discuss their ideas and communicate their findings in ways that are appropriate for different audiences, including oral and written explanations, displays or presentations of results and conclusions With support, they should identify new questions arising from the data, making predictions for new values within or beyond the data they have collected and finding ways of improving what they have already done. Use their science experiences to explore ideas and raise different kinds of questions Talk about how scientific ideas have developed over time Select and plan the most appropriate type of scientific enquiry to use to answer scientific questions Recognise which secondary sources will be most useful to research their ideas and begin to separate opinion from fact Recognise when and how to set up comparative and fair tests and explain which variables need to be controlled and why Use and develop keys and other information records to identify, classify and describe living things and materials, and identify patterns that might be found in the natural environment Make their own decisions about what observations to make, what measurements to use and how long to make them for Choose the most appropriate equipment to make measurements with increasing precision and explain how to use it accurately. Take repeat measurements where appropriate. Decide how to record data and results of increasing complexity from a choice of familiar approaches: scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs Look for different causal relationships in their data and identify evidence that refutes or supports their ideas Identify scientific evidence that has been used to support or refute ideas or arguments Use relevant scientific language and illustrations to discuss, communicate and justify their scientific ideas Use oral and written forms such as displays and other presentations to report conclusions, causal relationships and explanations of degree of trust in results Use their results to make predictions and identify when further observations, comparative and fair tests might be needed.
Biology All organisms are classified based on how closely related they are on the tree of life All organisms share a common set of essential life processes	Insects	<ul style="list-style-type: none"> Insects can be helpful and harmful to people: Helpful: pollination; products like honey, beeswax, and silk; eat harmful insects; Harmful: destroy crops, trees, wooden buildings, clothes; carry disease; bite or sting Distinguishing characteristics <ul style="list-style-type: none"> Exoskeleton, chitin Six legs and three body parts: head, thorax and abdomen Most but not all insects have wings Life cycles: metamorphosis o Some insects look like miniature adults when born from eggs, and they moult to grow (for example: grasshopper, cricket) <ul style="list-style-type: none"> Some insects go through distinct stages of egg, larva, pupa, adult (for example: butterflies, ants) Social Insects <ul style="list-style-type: none"> Most insects live solitary lives, but some are social (for example: ants, honeybees, termites, wasps) o Ants: colonies o Honeybees: workers, drones, queen bee 	
Earth and Space Science The Earth is a single system with four dynamically interconnected 'spheres' The Earth works in cycles	What is inside the Earth? - Rocks	<ul style="list-style-type: none"> Inside the Earth: Layers: crust, mantle, core; High temperatures Volcanoes and geysers Rocks and minerals o Formation and characteristics of different kinds of rocks: metamorphic, igneous, sedimentary o Important minerals in the Earth (such as quartz, gold, sulphur, coal, diamond, iron ore) Compare and group together different kinds of rocks on the basis of their appearance and simple physical properties. Describe in simple terms how fossils are formed when things that have lived are trapped within rock. Recognise that soils are made from rocks and organic matter 	
Biology All organisms share a common set of essential life processes	Plants	<ul style="list-style-type: none"> Identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers. Explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow) and how they vary from plant to plant Investigate the way in which water is transported within plants. Explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal 	
Biology Organisms interact with each other and with their environment	The human body: Cells, systems, and health	Cells <ul style="list-style-type: none"> All living things are made up of cells, too small to be seen without a microscope. o Cells make up tissues. o Tissues make up organs. o Organs work in systems. The Digestive System: <ul style="list-style-type: none"> Explore with children what happens to the food we eat by studying body parts and functions involved in taking in food and getting rid of waste. Children should become familiar with the following: Salivary glands, taste buds Teeth: incisors, canines, premolars and molars Oesophagus, stomach, liver, small intestine, large intestine Taking care of your body: A healthy diet <ul style="list-style-type: none"> The 'food pyramid' Vitamins and minerals 	
	Introduction & exploration		
Chemistry Earth and Space Science The Earth works in cycles	The Water Cycle	<ul style="list-style-type: none"> Most of the Earth's surface is covered by water The water cycle o Evaporation and condensation o Water vapour in the air, humidity o Clouds: cirrus, cumulus, stratus o Precipitation, groundwater 	

Key Concepts, Knowledge, Vocabulary and Skills - Scientists: Year 4

Key Concept	Contexts	Key Knowledge and Vocabulary	Scientific Skills: Enquiry & Application
Physics There are four fundamental forces Chemistry The properties of materials derive from the identity and arrangement of particles	Electricity	<ul style="list-style-type: none">Identify common appliances that run on electricityConstruct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzersIdentify 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 batteryRecognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuitRecognise some common conductors and insulators, and associate metals with being good conductorsAssociate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuitCompare and give reasons for variations in how components function, including the brightness of bulbs and the on/off position of switchesUse recognised symbols when representing a simple circuit in a diagram.	<ol style="list-style-type: none">Raise their own relevant questions about the world around themShould be given a range of scientific experiences including different types of science enquiries to answer questionsStart to make their own decisions about the most appropriate type of scientific enquiry they might use to answer questionsRecognise when and how secondary sources might help them to answer questions that cannot be answered through practical investigationsSet up simple practical enquiries, comparative and fair testsRecognise when a simple fair test is necessary and help to decide how to set it upTalk about criteria for grouping, sorting and classifying; and use simple keysMake systematic and careful observationsHelp to make decisions about what observations to make, how long to make them for and the type of simple equipment that might be usedTake accurate measurements using standard units learn how to use a range of (new) equipment, such as data loggers/ thermometers appropriatelyCollect and record data from their own observations and measurements in a variety of ways: notes, bar charts and tables, standard units, drawings, labelled diagrams, keys and help to make decisions about how to analyse this dataBegin to look for naturally occurring patterns and relationships and decide what data to collect to identify themWith help, pupils should look for changes, patterns, similarities and differences in their data in order to draw simple conclusions and answer questionsUse relevant simple scientific language to discuss their ideas and communicate their findings in ways that are appropriate for different audiences, including oral and written explanations, displays or presentations of results and conclusionsWith support, they should identify new questions arising from the data, making predictions for new values within or beyond the data they have collected and finding ways of improving what they have already done.Use their science experiences to explore ideas and raise different kinds of questionsTalk about how scientific ideas have developed over timeSelect and plan the most appropriate type of scientific enquiry to use to answer scientific questionsRecognise which secondary sources will be most useful to research their ideas and begin to separate opinion from factRecognise when and how to set up comparative and fair tests and explain which variables need to be controlled and whyUse and develop keys and other information records to identify, classify and describe living things and materials, and identify patterns that might be found in the natural environmentMake their own decisions about what observations to make, what measurements to use and how long to make them forChoose the most appropriate equipment to make measurements with increasing precision and explain how to use it accurately.Take repeat measurements where appropriate.Decide how to record data and results of increasing complexity from a choice of familiar approaches: scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphsLook for different causal relationships in their data and identify evidence that refutes or supports their ideasIdentify scientific evidence that has been used to support or refute ideas or argumentsUse relevant scientific language and illustrations to discuss, communicate and justify their scientific ideasUse oral and written forms such as displays and other presentations to report conclusions, causal relationships and explanations of degree of trust in resultsUse their results to make predictions and identify when further observations, comparative and fair tests might be needed.
Physics Waves carry energy	Sound	<ul style="list-style-type: none">The basic physical phenomena of sound, with associated vocabulary.Sound is caused by an object vibrating rapidly.Sounds travel through solids, liquids and gases.Sound waves are much slower than light waves.Speed of sound: ConcordeQualities of sound o Pitch: high or low, faster vibrations = higher pitch, slower vibrations = lower pitchIntensity: loudness and quietnessHuman voice o Larynx (voice box)- Vibrating vocal chords: longer, thicker vocal chords create lower, deeper voicesSound and how the human ear worksOuter ear, ear canal; Eardrum; Three tiny bones (hammer, anvil and stirrup) pass vibrations to the cochlea; Auditory nerveProtecting your hearing	
Biology All organisms are classified based on how closely related they are on the tree of life	Classification of animals	<ul style="list-style-type: none">Scientists classify animals according to the characteristics they share, for example:<ul style="list-style-type: none">- Cold-blooded or warm-blooded- Vertebrates (have backbones and internal skeletons) or invertebrates (do not have backbone or internal skeletons).Different classes of vertebratesCharacteristics of each class, such as:<ul style="list-style-type: none">Fish: aquatic animals, breath through gills, cold-blooded, most have scales, most develop from eggs that the female lays outside her bodyAmphibians: live part of their life cycle in water and part on land, have gills when young, later develop lungs, cold-blooded, usually have moist skinReptiles: hatch from eggs, cold-blooded, have dry, thick, scaly skinBirds: warm-blooded, most can fly, have feathers and wings, most build nests, hatch from eggs, most baby birds must be fed by parents and cared for until they can survive on their own (though some, like baby chickens and quail, can search for food a few hours after hatching)Mammals: warm-blooded, have hair on their bodies, parents care for the young, females produce milk for their babies, breathe through lungs, most are terrestrial (live on land) though some are aquatic	
Biology Organisms interact with each other and with their environment	Muscular & Skeletal system	<p>The Muscular System:</p> <ul style="list-style-type: none">Muscles: Involuntary and voluntary muscles <p>The Skeletal system</p> <ul style="list-style-type: none">Skeleton, bones, marrowMusculo-skeletal connection: Ligaments; Tendons, - Achilles tendon; CartilageSkull, craniumSpinal column, vertebraeJointsRibs, rib cage, sternumScapula (shoulder blades), pelvis, tibia, fibulaBroken bones, X-rays	
Physics Waves carry energy	Light	<ul style="list-style-type: none">Basic physical phenomena of light, with associated vocabulary.The speed of light: light travels at an amazingly high speed.Light travels in straight lines (as can be demonstrated by forming shadows).Use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eyeExplain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyesUse the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them.Transparent and opaque objectsReflection o Mirrors: plane, concave, convex o Use of mirrors in telescopes and some microscopesThe spectrum: use a prism to demonstrate that white light is made up of a spectrum of colours.Lenses can be used for magnifying and bending light (as in magnifying glass, microscope, camera, telescope, binoculars).	
Introduction & exploration			
Physics Some quantities are conserved Chemistry Energy plays a key role in determining the changes that	Materials	<ul style="list-style-type: none">Compare and group materials together, according to whether they are solids, liquids or gasesObserve 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)	

matter can undergo			
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Key Concepts, Knowledge, Vocabulary and Skills - Scientists: Year 5

Key Concepts	Contexts	Key Knowledge and Vocabulary	Scientific Skills: Enquiry & Application
<p>Physics The Earth works in cycles Earth is dynamically part of the solar system and beyond</p> <p>Biology All organisms share a common set of essential life processes</p>	Life cycles & Seasonal cycles	<ul style="list-style-type: none"> The life cycle: birth, growth, reproduction, death Describe the life process of reproduction in some plants and animals Explain the differences in the life cycles of a mammal, an amphibian, an insect and a bird <ul style="list-style-type: none"> From seed to seed with a plant From egg to egg with a chicken; From frog to frog; From butterfly to butterfly: metamorphosis (Review Year 3 insects); Describe the changes as humans develop from birth to old age. The four seasons and Earth's orbit around the Sun Seasons and life processes o Spring: sprouting, sap flow in plants, mating and hatching o Summer: growth o Fall: ripening, migration o Winter: plant dormancy, animal hibernation 	<ol style="list-style-type: none"> Raise their own relevant questions about the world around them Should be given a range of scientific experiences including different types of science enquiries to answer questions Start to make their own decisions about the most appropriate type of scientific enquiry they might use to answer questions Recognise when and how secondary sources might help them to answer questions that cannot be answered through practical investigations Set up simple practical enquiries, comparative and fair tests Recognise when a simple fair test is necessary and help to decide how to set it up Talk about criteria for grouping, sorting and classifying; and use simple keys Make systematic and careful observations Help to make decisions about what observations to make, how long to make them for and the type of simple equipment that might be used Take accurate measurements using standard units learn how to use a range of (new) equipment, such as data loggers/ thermometers appropriately Collect and record data from their own observations and measurements in a variety of ways: notes, bar charts and tables, standard units, drawings, labelled diagrams, keys and help to make decisions about how to analyse this data Begin to look for naturally occurring patterns and relationships and decide what data to collect to identify them With help, pupils should look for changes, patterns, similarities and differences in their data in order to draw simple conclusions and answer questions Use relevant simple scientific language to discuss their ideas and communicate their findings in ways that are appropriate for different audiences, including oral and written explanations, displays or presentations of results and conclusions With support, they should identify new questions arising from the data, making predictions for new values within or beyond the data they have collected and finding ways of improving what they have already done. Use their science experiences to explore ideas and raise different kinds of questions Talk about how scientific ideas have developed over time Select and plan the most appropriate type of scientific enquiry to use to answer scientific questions Recognise which secondary sources will be most useful to research their ideas and begin to separate opinion from fact Recognise when and how to set up comparative and fair tests and explain which variables need to be controlled and why Use and develop keys and other information records to identify, classify and describe living things and materials, and identify patterns that might be found in the natural environment Make their own decisions about what observations to make, what measurements to use and how long to make them for Choose the most appropriate equipment to make measurements with increasing precision and explain how to use it accurately. Take repeat measurements where appropriate. Decide how to record data and results of increasing complexity from a choice of familiar approaches: scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs Look for different causal relationships in their data and identify evidence that refutes or supports their ideas Identify scientific evidence that has been used to support or refute ideas or arguments Use relevant scientific language and illustrations to discuss, communicate and justify their scientific ideas Use oral and written forms such as displays and other presentations to report conclusions, causal relationships and explanations of degree of trust in results Use their results to make predictions and identify when further observations, comparative and fair tests might be needed.
<p>Physics The universe is made of matter and energy</p> <p>Earth and Space science Distance/time scales in Earth and space systems vary greatly</p> <p>Earth is dynamically part of the solar system and beyond</p>	Astronomy	<ul style="list-style-type: none"> The 'Big Bang' as one theory The universe: an extent almost beyond imagining Galaxies: Milky Way and Andromeda Our solar system o Sun: source of energy (heat and light) o The nine planets: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto [Note that, in 2006, Pluto was classified as a dwarf planet] Planetary motion: orbit and rotation: How day and night on Earth are caused by the Earth's rotation; sunrise in the east and sunset in the west; How the seasons are caused by the Earth's orbit around the sun, tilt of the Earth's axis Gravity, gravitational pull: Gravitational pull of the moon (and to a lesser degree, the sun) causes ocean tides on Earth; Gravitational pull of 'black holes' prevents light from escaping Asteroids, meteors ('shooting stars'), comets, Halley's Comet How an eclipse happens Stars and constellations Orienteering (finding your way) by using North Star, Big Dipper Exploration of space o Observation through telescopes: Rockets and satellites: from unmanned flights; Apollo 11, first landing on the moon: 'One small step for a man, one giant leap for mankind'; Space shuttle 	
<p>Earth and Space science The Earth is a single system with four dynamically interconnected 'spheres'</p> <p>The Earth works in cycles All parts of the Earth system are constantly changing</p>	Meteorology	<ul style="list-style-type: none"> The water cycle (review from Year 3): evaporation, condensation, precipitation Clouds: cirrus, stratus, cumulus (review from Year 3) The atmosphere: Troposphere, stratosphere, mesosphere, thermosphere, exosphere; How the Sun and the Earth heat the atmosphere Air movement: wind direction and speed, prevailing winds, air pressure, low and high pressure, air masses Cold and warm fronts: thunderheads, lightning and electric charge, thunder, tornadoes, hurricanes Forecasting the weather: barometers (relation between changes in atmospheric pressure and weather), weather maps, weather satellites Weather and climate: 'weather' refers to daily changes in temperature, rainfall, sunshine, etc., while 'climate' refers to weather trends that are longer than the cycle of the seasons 	
<p>Biology Organisms interact with each other and with their environment</p>	Circulatory and Respiratory System	<p>Circulatory</p> <ul style="list-style-type: none"> Pioneering work of William Harvey Heart: four chambers (atrium/atria or atriums [plural] and ventricle/ventricles), aorta Blood: Red blood cells, white blood cells, platelets, haemoglobin, plasma, antibodies; Blood vessels: arteries, veins, capillaries o Blood pressure, pulse Filtering function of liver and spleen Fatty deposits can clog blood vessels and cause a heart attack. Blood types (four basic types: A, B, AB, O) and transfusions <p>Respiratory system</p> <ul style="list-style-type: none"> Process of taking in oxygen and getting rid of carbon dioxide Nose, throat, voice box, trachea (windpipe) Lungs, bronchi, bronchial tubes, diaphragm, ribs, alveoli (air sacs) Smoking: damage to lung tissue, lung cancer 	
<p>Chemistry All matter is made of particles</p> <p>The properties of materials derive from the identity and arrangement of particles</p> <p>Some quantities are conserved</p>	Chemistry	<p>Atoms</p> <ul style="list-style-type: none"> All matter is made up of particles too small for the eye to see, called atoms Scientists have developed models of atoms; while these models have changed over time as scientists make new discoveries, the models help us imagine what we cannot see. Atoms are made up of even tinier particles: protons, neutrons, electrons. The concept of electrical charge <ul style="list-style-type: none"> Positive charge (+): proton Negative charge (-): electron Neutral (neither positive or negative): neutron 'Unlike charges attract, like charges repel' (relate to magnetic attraction and repulsion). <p>Properties of matter</p> <ul style="list-style-type: none"> Mass: the amount of matter in an object, similar to weight Volume: the amount of space a thing fills 	

Chemistry is everywhere		<ul style="list-style-type: none"> • Density: how much matter is packed into the space an object fills • Vacuum: the absence of matter <p>Elements</p> <ul style="list-style-type: none"> • Elements are the basic kinds of matter, of which there are a little more than one hundred. <p>-There are many different kinds of atoms, but an element has only one kind of atom.</p> <p>-Familiar elements, such as gold, copper, aluminium, oxygen, iron</p> <p>-Most things are made up of a combination of elements.</p> <p>Solutions</p> <ul style="list-style-type: none"> • A solution is formed when a substance (the solute) is dissolved in another substance (the solvent), such as when sugar or salt is dissolved in water; the dissolved substance is present in the solution even though you cannot see it. • Describe how to recover a substance from a solution • Concentration and saturation (as demonstrated through simple experiments with crystallisation) • Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating • Demonstrate that dissolving, mixing and changes of state are reversible changes 	
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Key Concepts, Knowledge, Vocabulary and Skills - Scientists: Year 6

Key Concept	Contexts	Key Knowledge and Vocabulary	Scientific Skills: Enquiry & Application
Biology All organisms are classified based on how closely related they are on the tree of life All organisms share a common set of essential life processes Organisms interact with each other and with their environment	Plant Structures & Processes	Structure: Non-vascular and vascular plants <ul style="list-style-type: none"> Non-vascular plants (for example: algae) Vascular plants o Vascular plants have tube-like structures that allow water and dissolved nutrients to move through the plant: Parts and functions of vascular plants: roots, stems and buds, leaves Photosynthesis <ul style="list-style-type: none"> Photosynthesis is an important life process that occurs in plant cells, but not animal cells (photo = light; synthesis = putting together). Unlike animals, plants make their own food, through the process of photosynthesis. Role in photosynthesis of: energy from sunlight, chlorophyll, carbon dioxide and water, xylem and phloem, stomata, oxygen, sugar (glucose) 	1. Raise their own relevant questions about the world around them 2. Should be given a range of scientific experiences including different types of science enquiries to answer questions 3. Start to make their own decisions about the most appropriate type of scientific enquiry they might use to answer questions 4. Recognise when and how secondary sources might help them to answer questions that cannot be answered through practical investigations 5. Set up simple practical enquiries, comparative and fair tests 6. Recognise when a simple fair test is necessary and help to decide how to set it up 7. Talk about criteria for grouping, sorting and classifying; and use simple keys 8. Make systematic and careful observations 9. Help to make decisions about what observations to make, how long to make them for and the type of simple equipment that might be used 10. Take accurate measurements using standard units learn how to use a range of (new) equipment, such as data loggers/ thermometers appropriately 11. Collect and record data from their own observations and measurements in a variety of ways: notes, bar charts and tables, standard units, drawings, labelled diagrams, keys and help to make decisions about how to analyse this data 12. Begin to look for naturally occurring patterns and relationships and decide what data to collect to identify them 13. With help, pupils should look for changes, patterns, similarities and differences in their data in order to draw simple conclusions and answer questions 14. Use relevant simple scientific language to discuss their ideas and communicate their findings in ways that are appropriate for different audiences, including oral and written explanations, displays or presentations of results and conclusions 15. With support, they should identify new questions arising from the data, making predictions for new values within or beyond the data they have collected and finding ways of improving what they have already done. 16. Use their science experiences to explore ideas and raise different kinds of questions 17. Talk about how scientific ideas have developed over time 18. Select and plan the most appropriate type of scientific enquiry to use to answer scientific questions 19. Recognise which secondary sources will be most useful to research their ideas and begin to separate opinion from fact 20. Recognise when and how to set up comparative and fair tests and explain which variables need to be controlled and why 21. Use and develop keys and other information records to identify, classify and describe living things and materials, and identify patterns that might be found in the natural environment 22. Make their own decisions about what observations to make, what measurements to use and how long to make them for 23. Choose the most appropriate equipment to make measurements with increasing precision and explain how to use it accurately. 24. Take repeat measurements where appropriate. 25. Decide how to record data and results of increasing complexity from a choice of familiar approaches: scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs 26. Look for different causal relationships in their data and identify evidence that refutes or supports their ideas 27. Identify scientific evidence that has been used to support or refute ideas or arguments 28. Use relevant scientific language and illustrations to discuss, communicate and justify their scientific ideas 29. Use oral and written forms such as displays and other presentations to report conclusions, causal relationships and explanations of degree of trust in results 30. Use their results to make predictions and identify when further observations, comparative and fair tests might be needed.
Biology All organisms are classified based on how closely related they are on the tree of life All organisms share a common set of essential life processes Organisms interact with each other and with their environment	Classifying Living Things	<ul style="list-style-type: none"> Study animal classifications, discuss: why do we classify? How does classification help us understand the natural world? Scientists have divided living things into five large groups called kingdoms, as follows: Plant; Animal; Fungus (Mushrooms, yeast, mould, mildew); Protist (algae, protozoans, amoeba, euglena); Prokaryote (blue-green algae, bacteria) Each Kingdom is divided into smaller groupings as follows: Kingdom; Phylum; Class; Order; Family; Genus; Species; Variety When classifying living things, scientists use special names made up of Latin words (or words made to sound like Latin words), which help scientists around the world understand each other and ensure that they are using the same names for the same living things o Homo Sapiens: the scientific name for the species to which human beings belong to (genus: Homo, species: Sapiens); Taxonomists: biologists who specialise in classification Different classes of vertebrates and major characteristics: fish, amphibians, reptiles, birds, mammals (review from Year 4) Cells: Structures and processes <ul style="list-style-type: none"> All living things are made up of cells Structure of cells (both plant and animal) o Cell membrane: selectively allows substances in and out: Nucleus: surrounded by nuclear membrane, contains genetic material, divides for reproduction: Cytoplasm contains organelles, small structure that carry out the chemical activities of the cell, including mitochondria (which produce the cell's energy) and vacuoles (which store food, water, or wastes) Plant cells, unlike animal cells, have cell walls and chloroplasts. Cells without nuclei: monerans (bacteria) Some organisms consist of only a single cell: for example, amoeba, protozoans, some algae. Cells are shaped differently in order to perform different functions. Organisation of cells into tissues, organs, and systems: <ul style="list-style-type: none"> In complex organisms, groups of cells form tissues (for example: in animals, skin tissue or muscle tissue; in plants, the skin of an onion or the bark of a tree). Tissues with similar functions form organs (for example: in some animals, the heart, stomach, or brain; in some plants, the root or flower). In complex organisms, organs work together in a system (recall, for example, from earlier studies of the human body, the digestive, circulatory, and respiratory systems). 	
Biology Species arise, change, and become extinct over time Genetics maintain continuity plus allow for change	Evolution and Inheritance	<ul style="list-style-type: none"> Recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago Recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents Identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution. 	
Chemistry The universe evolves by means of interactions All matter is made of particles. The properties of materials derive from the identity and arrangement of particles Energy plays a key role in determining the changes that matter can undergo Chemistry is everywhere	Chemistry: Matter & Change	Atoms, molecules and compounds: <ul style="list-style-type: none"> Basics of atomic structure: nucleus, protons (positive charge), neutrons (neutral), electrons (negative charge) Atoms are constantly in motion, electrons move around the nucleus in paths called shells (or energy levels). Atoms may join together to form molecules or compounds. Common compounds and their formulas: o Water H₂O o Salt NaCl o Carbon Dioxide CO₂ Elements: <ul style="list-style-type: none"> Elements have atoms of only one kind, having the same number of protons. There are a little more than 100 different elements. The periodic table: organises elements with common properties; Atomic symbol and atomic number Some well-known elements and their symbols: Hydrogen H ; Helium He ; Carbon C ; Nitrogen N ; Oxygen O ; Sodium Na ;Aluminium Al ;Silicon Si ;Chlorine Cl ; Iron Fe ;Copper Cu ;Silver Ag ;Gold Au Two important categories of elements: metals and non-metals; Metals comprise about 2/3 of the known elements; Properties of metals: most are shiny, ductile, malleable, conductive Chemical and Physical change: <ul style="list-style-type: none"> Chemical change changes what a molecule is made up of and results in a new substance with a new molecular structure. Examples of chemical change: rusting of iron, burning of wood, milk turning sour Physical change changes only the properties or appearance of the substance, but does not change what the substance is made up of. Examples of physical change: cutting wood or paper, breaking glass, freezing water 	

<p>Biology All organisms share a common set of essential life processes Organisms interact with each other and with their environment</p>	<p>Human Body: Hormones & Reproduction</p>	<p>Human growth stages</p> <ul style="list-style-type: none"> • Puberty: <p>- Glands and hormones (see below, Endocrine System), growth spurt, hair growth, breasts, voice change</p> <p>The reproductive system:</p> <ul style="list-style-type: none"> • Females: ovaries, fallopian tubes, uterus, vagina, menstruation • Males: testes, scrotum, penis, urethra, semen • Sexual reproduction: intercourse, fertilisation, zygote, implantation of zygote in the uterus, pregnancy, embryo, foetus, newborn <p>The endocrine system</p> <ul style="list-style-type: none"> • The human body has two types of glands: duct glands (such as the salivary glands), and ductless glands, also known as the endocrine glands. • Endocrine glands secrete (give off) chemicals called hormones. Different hormones control different body processes. Pituitary gland: located at the bottom of the brain; secretes hormones that control other glands, and hormones that regulate growth • Thyroid gland: located below the voice box; secretes a hormone that controls the rate at which the body burns and uses food • Pancreas: both a duct and a ductless gland; secretes a hormone called insulin that regulates how the body uses and stores sugar; when the pancreas does not produce enough insulin, a person has a sickness called diabetes (which can be controlled). • Adrenal glands: secrete a hormone called adrenaline, especially when a person is frightened or angry, causing rapid heartbeat and breathing 	
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References

- Harari, Y. N. (2015). Sapiens: A Brief History of Humankind. New York, NY: HarperCollins. The Curriculum: Gallimaufry to coherence Mary Myatt, John Catt Publication
- <https://seniorsecondary.tki.org.nz/Science/Key-concepts>
- <http://www.coreknowledge.org.uk/>
- Ofsted Intention and substance: <https://www.gov.uk/government/publications/intention-and-substance-primary-school-science-curriculum-research>
- https://nutsaboutteaching.wordpress.com/2019/01/04/ramble-6-achieving-coherence-in-primary-science-why-primary-science-needs-to-be-less-like-the-simpsons-and-more-like-game-of-thrones/amp/?_twitter_impression=true