Cabot Learning Federation

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? *About 13.8 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.*	**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 Y5 Force
	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? *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.*	**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? *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.*	**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 *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.*	**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, archaebacteria, 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

	Working as a scientist/scientifically				
	Ask Questions Asking simple questions	**Observe** Observe using simple equipment	**Test** Perform a simple test	**Identify and Classify** Identify and Classify	**Record** Suggest answers to questions Gather and record to help answer a question
	question, idea, investigate, test, equipment, predict, observe, identify, classify, sort, group, record, table, graph, pictogram, answer, conclude.				

Key Concepts	Context	Key knowledge	Key Vocabulary	Learning checkpoints	*Common Misconceptions*
Chemistry : The properties of materials derive from the identity and arrangement of particles.	Everyday Materials	• Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses • Explain 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.	suitable, materials, (wood, metal, plastic, glass, brick, rock, paper, cardboard), natural, man made, solid, changed, squash, bend, twist, stretch	• Name a variety of materials • Compare and group materials on physical properties • Explain why materials are chosen • Explain why some solid objects can be changed (squashing, bending, twisting, stretching) • Describe natural and man-made materials	*Some children may think:* *• only fabrics are materials* *• only building materials are materials* *• only writing materials are materials* *• the word 'rock' describes an object rather than a material* *• 'solid' is another word for hard.*
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	• Identify and name a variety of common animals including fish, amphibians, reptiles, birds and mammals. • Describe common features of different animal types *e.g. fins, wings, beaks, tails, eyes, skin type* • Identify and name a variety of common animals that are carnivores, herbivores and omnivores. • Describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals, including pets). • 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.	common, fish, amphibians, reptiles, birds, mammals, herbivore, omnivore, carnivore, plants, offspring, parents, pets, fins, beaks, tails, fur, feathers	• Identify and name a variety of animals • Sort animals that are carnivores, herbivores and omnivores • Describe and compare common features of different animals • Explain why animals like plants need food, water and space to grow and live • Describe why animal offspring/babies need to be fed and cared for when they are young • Explain why pets need to be cared for	*Some children may think:* *• only four-legged mammals, such as pets, are animals* *• humans are not animals* *• insects are not animals* *• all 'bugs' or 'creepy crawlies', such as spiders, are part of the insect group* *• amphibians and reptiles are the same.* *• a baby grows in a mother's tummy* *• a baby is "made".*
Earth and Space Science : The Earth works in cycles	Seasonal Changes	• Identify the four seasons: Autumn, winter, spring, summer • Be 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 temperature • Clouds: rainfall comes from clouds • Rainfall: how the condition of the ground varies with rainfall; rainbows • Thunderstorms: lightning, thunder, hail, safety during thunderstorms • Snow: snowflakes, blizzards (As detailed within Geography curriculum Year 1 Seasons and daily weather patterns)	seasons, autumn, winter, spring, summer, daily, weather, light, warmth, temperature	• Understand that weather changes daily • Describe how weather changes within seasons • Name the 4 seasons • Explain that rain and snow comes from clouds • Explore thunderstorms and thunderstorm safety	*Some children may think:* *• it always snows in winter* *• it is always sunny in the summer* *• there are only flowers in spring and summer* *• it rains most in the winter.*
Biology: All organisms share a common set of essential life processes	Humans	• Identify the five senses and associated body parts: • Sight: eyes; hearing: ears; smell: nose; taste: tongue; touch: skin • Review the importance of taking care of your body: exercise, cleanliness, healthy foods and rest.	sight, hearing, smell, taste, touch, exercise, cleanliness, health, rest	• Name and describe the importance of the 5 senses • Explain the importance of taking care of our bodies	*Some children may think:* • *Only our fingers/ hands are used for the sense of touch*
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	• 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.	seeds, roots, stems, branches, leaves, deciduous, evergreen	• Label the parts of a plant • Explain what plants need to grow • Describe the importance of a flower and a seed • Describe the differences of Evergreen and Deciduous plants • Understand that plants make their own food	*Some children may think:* *• plants are flowering plants grown in pots with coloured petals and leaves and a stem* *• trees are not plants* *• all leaves and stems are green* *• a trunk is not a stem* *• blossom is not a flower.* *• plants eat food* *• all plants start out as seeds* *• all plants have flowers* *• plants that grow from bulbs do not have seeds* *• food comes from the soil via the roots* *• flowers are merely decorative rather than a vital part of the life cycle in reproduction* *• plants only need sunlight to keep them warm* *• roots suck in water which is then sucked up the stem.*
Physics: There are four fundamental forces. **Chemistry:** The properties of materials derive from the identity and arrangement of particles	Magnetism	• 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.	magnets, attract, repel, north pole, south pole	• Explore everyday magnets in toys, fridge magnets • Sort and classify magnets • Understand that magnets attract other magnets	*Some children may think:* *• the bigger the magnet the stronger it is* *• all metals are magnetic.*

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

	Working as a scientist/scientifically				
	Ask Questions • Asking simple questions	**Observe** • Observe using simple equipment	**Test** • Perform a simple test	**Identify and Classify** • Identify and Classify	**Record** • Suggest answers to questions • Gather and record to help answer a question
	question, idea, investigate, test, equipment, predict, observe, identify, classify, sort, group, record, table, graph, pictogram, answer, conclude.				

Key Concepts	Context	Key knowledge	Key Vocabulary	Learning checkpoints	*Common Misconceptions*
Chemistry: All matter is made of particles The properties of materials derive from the identity and arrangement of particles	Matter & Properties & Measurements	• Basic concept of atoms: Everything-(matter- basically materials) is made of tiny particles/pieces called atoms. • Names 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 substance: *Water changes to ice-solid (freezes) back to water-liquid (melts), and steam -gas (evaporates).* • Units of measurement: Length: centimetre, metre; volume: millilitre, litre. Temperature: degrees Celsius	atoms, model, electrons, protons, matter, particles, solid, liquid, gas, measurement: millilitre, litre, temperature, degrees, melt, freeze, steam	• Name and group materials (solids, liquids or gases) • Describe an atom • Understand that temperature is recorded in degrees Celsius • Research how materials can be measured. • Understand that some materials (water) can change state	*Some children may think:* *• solid is another word for hard or opaque* *• solids are hard and cannot break or change shape easily and are often in one piece* *• substances made of very small particles like sugar or sand cannot be solids* *• particles in liquids are further apart than in solids and they take up more space* *• when air is pumped into balloons, they become lighter* *• water in different forms – steam, water, ice – are all different substances*
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	Habitats: • 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 Environmental change and habitat destruction: • Environments are constantly changing, and this can sometimes pose dangers to specific habitats, for example: Effects of population and development; Rainforest clearing, pollution, litter (Detailed within Geography Curriculum Year 2: Changing environments Special classification of animals: • 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)	environments, habitats, microhabitats, basic needs, survival, adapted, forest, meadow, plains, underground, desert, food chain, nutrients, soil, air, sunlight, herbivore, omnivore, carnivore, destruction, pollution, climate change, extinct	• Describe how living things live in their environment • Explain which animals live in which habitats • Research what basic needs animals need to survive • Explain what a food chain is • Classify animals into herbivore, carnivore, omnivore and extinct • Explain the impact of environmental change and habitat destruction	*Some children may think:* *• an animal's habitat is like its 'home'* *• plants and seeds are not alive as they cannot be seen to move* *• fire is living* *• arrows in a food chain mean 'eats'.* *• all animals that live in the sea are fish* *• respiration is breathing* *• breathing is respiration.* *• the death of one of the parts of a food chain or web has no or limited consequences on the rest of the chain* *• there is always plenty of food for wild animals* *• animals are only land-living creatures* *• animals and plants can adapt to their habitats, however they change* *• all changes to habitats are negative.*
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	• Sun: source of energy, light, heat • Moon: phases of the moon (full, half, crescent, new) • The eight planets (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune) (Note that, in 2006, Pluto was classified as a dwarf planet). • Stars, constellations e.g. the Plough . • The sun is a star. • Earth and its place in the solar system: -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 • Geographical features of the Earth's surface: - The shape of the Earth, the horizon - Oceans and continents - North Pole and South Pole, Equator	earth, sun, moon, planets (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune) constellations, solar system, source, energy, light, heat, orbits, reflects, sphere, equator, north pole, south pole, night, day	• Describe the sun and what it does in our solar system • Name the 8 planets in our solar system • Describe how Earth moves • Describe the moon phases • Explore sunrise and sunset (U.K and Australia) • Name and recognise a famous constellation ➔ Some additional learning to be linked with Geography content (Earth's surface)	*Some children may think:* *• the Earth is flat* *• the Sun is a planet* *• the Sun rotates around the Earth* *• the Sun moves across the sky during the day* *• the Sun rises in the morning and sets in the evening* *• the Moon appears only at night* *• night is caused by the Moon getting in the way of the Sun or the Sun moving further away from the Earth.*
Physics: There are four fundamental forces **Chemistry:** The properties of materials derive from the identity and arrangement of particles	Electricity	• Static electricity • Basic parts of simple electric circuits (for example, batteries, wire, bulb or buzzer, switch) • Conductive and non-conductive materials • Safety 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.)	electrons, flow, atoms, electrical, circuit, battery, wire, lightbulb, buzzer, switch, energy, connected, disconnected, conductive, non-conductive, safety, electric shock, electrical appliance, wire casing, static, metal, non-metal	• Explain what electricity is (static) • Describe what is needed to make an electric circuit • Investigate conductive and non-conductive materials • Describe and explain the safety rules for electricity	*Some children may think:* *• electricity flows to bulbs, not through them* *• electricity flows out of both ends of a battery* *• • electricity works by simply coming out of one end of a battery into the component.*

Biology All organisms share a common set of essential life processes	The Human Body & health	• Describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene. Germs, Diseases and preventing illness: • Taking care of your body: exercise, cleanliness, healthy foods, rest • Vaccinations	exercise, food types, germs, disease, illness	• Describe why being healthy is important and what you can do to keep healthy • Explain why vaccinations are important • Understand how to take care of our body (exercise, eating healthy, cleanliness etc)	*Some children may think:* *• when we exercise, our heart beats faster to work the muscles more* *• we just eat food for energy* *• all fat is bad for you* *• all dairy is good for you* *• protein is good for you, so you can eat as much as you want* *• foods only contain fat if you can see it* *• all drugs are bad for you.*
Biology Organisms interact with each other and with their environment	The Human Body & systems	• Identify basic parts of the following body systems: - Skeletal system: skeleton, bones, skull - Muscular system: muscles - Digestive system: mouth, stomach - Circulatory system: heart and blood • Nervous system: brain and nerves • Skeletal system: Name some main bones in the skeleton and know the skeleton helps us move and keeps things like the lungs and heart and brain safe. • Muscular system: Know muscles are attached to our bones and help us move. • Digestive system: We eat food, chew, swallow, goes to our stomach and then is taken to parts of the body that need it in the blood- gives us energy. • Circulatory system: Heart pumps blood which carries oxygen to our body parts to help them work e.g., muscles, so beats faster when we exercise to give our muscles what they need	skeleton, bones, skull, heart, lungs, brain, muscles, attached, chew, swallow, stomach, digest, blood, energy, pumps, oxygen,	• Explain the role of the skeleton • Name some of the bones in our skeleton • Understand that muscles are attached to our bones (help us move) • Understand what happens once we swallow food • Understand that the heart pumps blood around our body	*Some children may think:* *• certain whole food groups like fats are 'bad' for you* *• certain specific foods, like cheese are also 'bad' for you* *• diet and fruit drinks are 'good' for you* *your stomach is where your belly button is* *• food is digested only in the stomach* *• when you have a meal, your food goes down one tube and your drink down another* *• the food you eat becomes "poo" and the drink becomes "wee".* *• your heart is on the left side of your chest* *• the heart makes blood* *• when we exercise, our heart beats faster to work the muscles more* *• some blood in our bodies is blue and some blood is red*

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

	Working as a scientist/scientifically				
	Ask Questions: • Ask relevant questions • Answer relevant questions • Select appropriate enquiry to help answer questions/equipment	**Test:** • Set up simple fair tests	**Observe and measure:** • Make careful observations • Take accurate measurements	**Record and Present:** • Collect and record results • Suggest criteria for grouping, sorting and classifying/use a simple key	**Conclude:** • Draw conclusions • Use scientific language in discussions • Make predictions • Look for patterns in results
	question, theory, idea, hypothesis, equipment, investigate, investigation, predict, predictions, fair test, control, variables, observe, observations, measure, measurements, record, data, results, sort, groups, classify, key, table, graph, conclude, conclusions, scientific vocabulary, patterns, evaluate.				

Key Concepts	Context	Key knowledge	Key Vocabulary	Learning checkpoints	Common Misconceptions
Physics There are four fundamental forces. **Chemistry** The properties of materials derive from the identity and arrangement of particles.	Forces and Magnets	• 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	Magnet, iron, attract, repel, metal, copper, aluminium, steel, brass, magnetic poles, Friction, resistance, force, smooth, rough, (force) acting on, equal and opposite	• Recognise that magnetic forces can act at a distance and can be 'invisible' • Compare and group materials as to whether they are magnetic or not • Compare and investigate how things move on different surfaces • Explain what is meant by a magnetic pole / magnetic field • Understand how a compass uses magnets to work •	*Some children may think:* *• the bigger the magnet the stronger it is* *• all metals are magnetic.* *• the heavier the object the faster it falls, because it has more gravity acting on it* *• forces always act in pairs which are equal and opposite* *• smooth surfaces have no friction* *• objects always travel better on smooth surfaces* *• a moving object has a force which is pushing it forwards and it stops when the pushing force wears out* *• a non-moving object has no forces acting on it* *• heavy objects sink and light objects float.*
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	• 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 - 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) - Some insects go through distinct stages of egg, larva, pupa, adult (for example: butterflies, ants) • Social Insects • - Most insects live solitary lives, but some are social (for example: ants, honeybees, termites, wasps) o Ants: colonies o Honeybees: workers, drones, queen bee	Helpful, harmful, beeswax, pollination, exoskeleton, chitin, head, abdomen, thorax, wings, egg, larva, pupa, adult, metamorphosis, moulting	• Group insects according to their characteristics • Understand the difference between and endoskeleton and an exoskeleton • Give examples of a lifecycle of an insect • Explain why some insects are helpful and some are harmful • Complete a mini study on a colony of ants or bees	*Some children may think:* *All minibeasts are insects* *That insects do not have a skeleton* *All insects are harmful*
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	• 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	Earth, crust, mantel, core, volcano, geysers, metamorphic, sedimentary and igneous rocks, fossils	• Name and label the layers of the Earth • Sort and compare (name properties) of different types of rock • Describe how fossils are formed • Recognise that soils are made from rocks and organic matter • Explore Volcanoes and geysers	*Some children may think:* *• rocks are all hard in nature* *• rock-like, man-made substances such as concrete or brick are rocks* *• materials which have been polished or shaped for use, such as a granite worktop, are not rocks as they are no longer 'natural'* *• certain found artefacts, like old bits of pottery or coins, are fossils* *• a fossil is an actual piece of the extinct animal or plant* *• soil and compost are the same thing.*
Biology All organisms share a common set of essential life processes	Plants	• Identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers. • Know and describe the main parts of a flowering plant • Explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal • 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.	Plant, flowering plants, root, stem, trunk, leaves, flowers, air, light, water, nutrients, soil, water transportation, pollination, seed formation, dispersal	• Identify and list the functions of the parts of a flowering plant • Explore what a plant needs to grow and that different plants may have different needs • Explore how water is transported within a plant • Explore the lifecycle of a flowering plant (including pollination and seed dispersal)	*Some children may think:* *• plants are flowering plants grown in pots with coloured petals and leaves and a stem* *• trees are not plants* *• all leaves are green* *• all stems are green* *• a trunk is not a stem* *• blossom is not a flower.* *-plants are not alive as they cannot be seen to move* *• seeds are not alive* *• all plants start out as seeds* *• seeds and bulbs need sunlight to germinate.* *plants eat food* *• food comes from the soil via the roots* *• flowers are merely decorative rather than a vital part of the life cycle in reproduction*

					• *plants only need sunlight to keep them warm* • • *roots suck in water which is then sucked up the stem.*
Biology Organisms interact with each other and with their environment	The human body: Cells, systems, and health	Cells • 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: • 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 and their role in eating food. - Oesophagus, stomach, liver, small intestine, large intestine Taking care of your body: A healthy diet • The 'food pyramid' • Vitamins and minerals	Cell, tissue, organ, digestion, digestive system, saliva (salivary glands), taste buds, oesophagus, stomach, liver, small and large intestine, anus, teeth – incisors, canines, premolars, molars, tooth, root, decay,	• Understand the function of a cell • Name and label the parts of the digestive system • Explain the function of each part of the digestive system • Name and label different teeth and explain the role that each one plays • Name the different food groups and give examples • Explore the food pyramid and explain why it is important to have a healthy diet	*Some children may think:* *• certain whole food groups like fats are 'bad' for you* *• certain specific foods, like cheese are also 'bad' for you* *• diet and fruit drinks are 'good' for you* *your stomach is where your belly button is* *• food is digested only in the stomach* *• when you have a meal, your food goes down one tube and your drink down another* *• the food you eat becomes "poo" and the drink becomes "wee".*
Chemistry **Earth and Space Science** The Earth works in cycles	The Water Cycle	Introduce and explore the concept of the water cycle: • 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	Water, evaporation, condensation, precipitation, vapour, humidity, clouds, cirrus, cumulus, stratus, groundwater	• Understand the part that evaporation and condensation plays in the water cycle • Recognise types of clouds • Know that most of the Earth's surface is covered in water	*Some children may think:* *clouds are made of water vapour or steam* *• the substance on windows etc. is condensation rather than water* *• the changing states of water (illustrated by the water cycle) are irreversible* *• evaporating or boiling water makes it vanish* *• evaporation is when the Sun sucks up the water, or when water is absorbed into a surface/material.*

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

	Working as a scientist/scientifically				
	Ask Questions: • Ask relevant questions • Answer relevant questions • Select appropriate enquiry to help answer questions/equipment	**Test:** • Set up simple fair tests	**Observe and measure:** • Make careful observations • Take accurate measurements	**Record and Present:** • Collect and record results • Suggest criteria for grouping, sorting and classifying/use a simple key	**Conclude:** • Draw conclusions • Use scientific language in discussions • Make predictions • Look for patterns in results
	Question, theory, idea, hypothesis, equipment, investigate, investigation, predict, predictions, fair test, control, variables, observe, observations, measure, measurements, record, data, results, sort groups, classify, key, table, graph, conclude, conclusions, scientific vocabulary, patterns, evaluate.				

Key Concepts	Context	Key knowledge	Key Vocabulary	Learning checkpoints	Common Misconceptions
Physics There are four fundamental forces **Chemistry** The properties of materials derive from the identity and arrangement of particles	Electricity	• Identify common appliances that run on electricity. • Construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers • Identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery • Recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit • Recognise some common conductors and insulators, and associate metals with being good conductors • Associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit • Compare and give reasons for variations in how components function, including the brightness of bulbs and the on/off position of switches • Use recognised symbols when representing a simple circuit in a diagram.	Electricity, electric, motor, circuit, battery, lead, crocodile clip, bulb, buzzer, conduct, conductor, insulate, insulator, switch, break	• Identify appliances that run on electricity • Construct a simple circuit and name the parts • Use symbols to represent a circuit in a diagram • Make predictions using knowledge of a complete and incomplete circuits • Group materials according to whether they are conductors or insulators • Draw conclusions and give reasons for why variations happen in some components	*Some children may think:* *• larger-sized batteries make bulbs brighter* *• a complete circuit uses up electricity* *• components in a circuit that are closer to the battery get more electricity.*
Physics Waves carry energy	Sound	• 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: Concorde • Qualities of sound o Pitch: high or low, faster vibrations = higher pitch, slower vibrations = lower pitch • Intensity: loudness and quietness • Human voice o Larynx (voice box) - Vibrating vocal chords: longer, thicker vocal chords create lower, deeper voices • Sound and how the human ear works Outer ear, ear canal; Eardrum; Three tiny bones (hammer, anvil and stirrup) pass vibrations to the cochlea; Auditory nerve • Protecting your hearing	Sound, wave, travel vibrate, vibrations, fast/slow vibrations, pitch, high, low, volume, loud, quiet, travel through, solids, gases, liquids, frequency, speed of sound, speed of light, ear, hear, hearing, ear drum, Pinna (Outer Ear), Stirrup. Eardrum. Cochlea. Hammer. Nerve. ustachian Tube. Anvil.	• Understand that sound is caused due to vibrations and travel slower than light • Understand that sounds can travel through all the states of matter • Explore the qualities of sound and pitch and how these relate to our vocal chords • Understand the basic functions of the ear • Name and label the parts of the ear	*Some children may think:* *• sound is only heard by the listener* *• sound only travels in one direction from the source* *• sound can't travel through solids and liquids* *• high sounds are load and low sounds are quiet.*
Biology All organisms are classified based on how closely related they are on the tree of life	Classification of animals	• Scientists classify animals according to the characteristics they share, for example: - Cold-blooded or warm-blooded - Vertebrates (have backbones and internal skeletons) or invertebrates (do not have backbone or internal skeletons. • Different classes of vertebrates Characteristics of each class, such as: • Fish: aquatic animals, breath through gills, cold-blooded, most have scales, most develop from eggs that the female lays outside her body • Amphibians: live part of their life cycle in water and part on land, have gills when young, later develop lungs, cold-blooded, usually have moist skin • Reptiles: hatch from eggs, cold-blooded, have dry, thick, scaly skin • Birds: 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	Living things, characteristics, features, similarities, differences, sort, group, classify, vertebrates, invertebrates, backbone, spine, mammals, fish, reptiles, birds, amphibians, insects, animal, insects, kingdom, plant kingdom, fungi, mushrooms, micro-organisms, bacteria, virus,	• Sort and classify animals according to a variety of characteristics • Identify and sort a variety of vertebrates and invertebrates • List characteristics of different types of vertebrates and invertebrates • Name the 5 vertebrate groups	*Some children may think:* *• all micro-organisms are harmful* *• mushrooms are plants.* *• only four-legged mammals, such as pets, are animals* *• humans are not animals* *• insects are not animals* *• all 'bugs' or 'creepy crawlies', such as spiders, are part of the insect group* *• amphibians and reptiles are the same.*
Biology Organisms interact with each other and with their environment	Muscular & Skeletal system	The Muscular System: • Know that muscles are attached to our bones by tendons, bone attached to bone by ligaments and both help us to move. • Muscles: Involuntary and voluntary muscles • Some muscles are voluntarily moved e.g. biceps (work as an antagonistic pair with triceps- feel it/ can use elastic bands attached to card and a pivot split pin to show expand and contract to move arm and elbow joint up and down, feel muscles changing shape in arm) • Some muscles move involuntarily e.g. heart pumping constantly.	Skeleton, movement, support, protection, skull, jaw, spine, ribs, rib cage, hip, breastbone, shoulder, scapula, knee, patella, vertebra, vertebrae, femur, pelvis, fibula, tibia, humerus, radius, ulna, tarsals, carpals,	• Explain the function of a skeleton in humans • Explain the difference between voluntary and involuntary muscle movements • Explore the musculo-skeletal system • Name the main bones in the human skeleton by their scientific names • Understand the importance of x-rays and how the help • Know that muscles are attached by tendons	*Some children may think:* • *Bones hold up the body and when someone is standing, the muscles are not working.* • *Organs are not supported muscles.* • *The heart is not a muscle.*

		The Skeletal system • Skeleton, bones, marrow • Musculo-skeletal connection: Ligaments; Tendons, - Achilles tendon; Cartilage • Skull, cranium • Spinal column, vertebrae • Joints • Ribs, rib cage, sternum • Scapula (shoulder blades), pelvis, tibia, fibula Broken bones, X-rays	Joints, elbow, knee, hip, muscles, ligaments, tendons, organs, brains, heart, lungs, protects, biceps, triceps, antagonistic pairs, voluntary muscles, involuntary muscles- heart, musculo-skeletal system, x-rays		
Physics Waves carry energy	Light	• 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 eye • Explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes • Use 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 objects • Reflection o Mirrors: plane, concave, convex o Use of mirrors in telescopes and some microscopes • The 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).	Light, light source, natural, man-made, artificial, travel, wave, straight lines, speed of light, shadow, dark, darkness, transparent, translucent, opaque, shadow, reflect, bend, refract, magnified, eyes, prism, light spectrum, infra-red, unltr-violet, colour, rainbow, Isaac Newton,	• Understand that light travels at a high speed and in straight lines • Explain how we see objects • Sort opaque and transparent objects • Explain why we get shadows • Explain how mirrors work – plane, concave and convex • Use a prism to understand that white light is made up of spectrum colours	*Some children may think:* *• we see objects because light travels from our eyes to the object.* *• we can still see even where there is an absence of any light • our eyes 'get used to' the dark • the moon and reflective surfaces are light sources • a transparent object is a light source • shadows contain details of the object, such as facial features on their own shadow • shadows result from objects giving off darkness.*
Physics Some quantities are conserved **Chemistry** Energy plays a key role in determining the changes that matter can undergo	Materials	• Compare and group materials together, according to whether they are solids, liquids or gases • Observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C), specifically water.	Material names, solid, liquid, gas, gases, fluid, runny, rigid, flexible, pour, maintains its shape, floaty, visible, invisible, viscous liquid, heat, cold, cooled, temperature, degrees Celsius and the unit recording, thermometer, boiling point, freezing pint, melting point, reversible change, irreversible change, changing state, physical change,	• Compare and group materials (solids, liquids or gases) • Observe that some materials can change state when heated or cooled • Understand that temperature is recorded in degrees Celsius • Research temperatures linked with changing state	*Some children may think:* *• all liquids boil at the same temperature as water (100 degrees)* *• melting, as a change of state, is the same as dissolving* *• steam is visible water vapour (only the condensing water droplets can be seen)*

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

	Working as a scientist/scientifically				
	Plan and Questions • Ask relevant questions • Answer relevant questions • Select appropriate enquiry to help answer questions/equipment	**Test** • Set up simple fair tests	**Observe and measure** • Make careful observations • Take accurate measurements	**Record and Present** • Collect and record results • Suggest criteria for grouping, sorting and classifying/use a simple key	**Predict and Conclude** • Draw conclusions • Use scientific language in discussions • Make predictions • Look for patterns in results
	question, theory, idea, hypothesis, equipment, investigate, investigation, predict, predictions, fair test, control, variables, observe, observations, measure, measurements, record, data, results, sort, groups, classify, key, table, graph, conclude, conclusions, scientific vocabulary, patterns, evaluate.				

Key Concepts	Context	Key knowledge	Key Vocabulary	Learning checkpoints	Common Misconceptions
Physics The Earth works in cycles Earth is dynamically part of the solar system and beyond Biology All organisms share a common set of essential life processes	Life cycles & Seasonal cycles	• 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 - 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	Earth, sun, light source, Moon, sphere, revolve, orbit, spin, rotate, axis, sunrise, sunset, north south, east, west, seasons, autumn, winter, summer, spring, life cycle, adult, baby, teenager, child, mature, immature, juvenile, flower, seed, anther, stamen, stigma, style, pollen, pollination, fertilisation, ovary, ovule, male, female, germination.	• Explain the life cycle in humans • Describe the life processes of reproduction in plants and animals • Explain the differences in the life cycles of mammals, amphibians, insects and birds • Describe the life changes in a human • Explore seasonal change and the life processes associated • Suggest criteria for grouping, sorting and classifying/use a simple key • Explain the link between seasons and the Earth's orbit	*Some children may think:* *• a baby grows in a mother's tummy* *• a baby is "made".* *• plants are flowering plants grown in pots with colored petals and leaves and a stem* *• trees are not plants* *• all leaves and / or stems are green* *• a trunk is not a stem* *• blossom is not a flower.* *• plants eat food* *• all plants start out as seeds* *• all plants have flowers* *• plants that grow from bulbs do not have seeds* *• food comes from the soil via the roots* *• flowers are merely decorative rather than a vital part of the life cycle in reproduction* *• plants only need sunlight to keep them warm* *• roots suck in water which is then sucked up the stem.*
Physics The universe is made of matter and energy Earth and Space science Distance/time scales in Earth and space systems vary greatly Earth is dynamically part of the solar system and beyond	Astronomy	• 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	Earth, sun, light source, Moon, sphere, revolve, orbit, spin, rotate, axis, sunrise, sunset, north south, east, west, seasons, day, night, shade/shadow, darkness, gravity, gravitational pull, solar system, milky way, galaxy, Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, star, eclipse, constellations, comets, space, space exploration, satellites, shuttles, telescopes, **Skills vocab:** Question, theory, idea, hypothesis, equipment, investigate, investigation, predict, predictions, fair test, control, variables, observe, observations, measure, measurements, record, data, results, sort, groups, classify, key, table, graph, conclude, conclusions, scientific vocabulary, patterns, evaluate.	• Name the nine planets and recognise their place in the solar system and in relation to the sun • Explain how we get day and night • Understand that seasons are caused by the Earth's orbit • Explore gravitational pulls and discuss findings • Explain how and why an eclipse happens • Name and recognise constellations and comets • Take part in a space exploration and discuss findings • Explain key terms and theories: Big bang, The universe and Galaxies	*Some children may think:* *• the Earth is flat* *• the Sun is a planet* *• the Sun rotates around the Earth* *• the Sun moves across the sky during the day* *• the Sun rises in the morning and sets in the evening* *• the Moon appears only at night* *• night is caused by the Moon getting in the way of the Sun or the Sun moving further away from the Earth.*
Physics	Forces	Link to Y5 Designers - Mechanisms • identify the effects of air resistance, water resistance and friction, that act between moving surfaces • explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object. • When an object falls to the ground it is affected by two forces: the force of gravity pulling it down and the force of air resistance, a type of friction, which slows down its fall. • the force of air resistance affects moving objects, pushing and pulling and directions in which forces act • measure the force and weight of objects using newton meters • recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.	Force, air resistance, water resistance, gravity, gravitational pull, push, pull, distance, Earth, object, slow, force, affect, moving, direction, Newton, weigh, measure, gear, pulley, leaver, gear, mechanism	• Identify the effects of air resistance, water resistance and friction that act on surfaces • Explain that unsupported objects fall as a result of gravity and explain how air resistance slows it down. • Explain how air resistance affects moving objects • Measure using a Newton meter • Explore mechanisms including levers, pulleys and gears	*Some children may think:* *• of forces in terms of movement, not staying still. If an object is not moving they think that there are no forces acting upon it.*

Earth and Space science The Earth is a single system with four dynamically interconnected 'spheres' The Earth works in cycles All parts of the Earth system are constantly changing	Meteorology	• 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	Earth, sun, light source, Moon, sphere, revolve, orbit, spin, rotate, axis, sunrise, sunset, north south, east, west, seasons, day, night, shade/shadow, darkness, gravity, gravitational pull, solar system, milky way, galaxy, Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, star, eclipse, constellations, comets, space, space exploration, satellites, shuttles, telescopes, **Skills vocab:** Question, theory, idea, hypothesis, equipment, investigate, investigation, predict, predictions, fair test, control, variables, observe, observations, measure, measurements, record, data, results, sort, groups, classify, key, table, graph, conclude, conclusions, scientific vocabulary, patterns, evaluate.	• Confidently explain the roles of evaporation, condensation and precipitation in the water cycle • Name and discuss features of different types of clouds (year 3 review) • Explain what is meant by atmosphere and the role that the sun and Earth play • Study air movement and discuss findings • Understand what is meant by cold and warm fronts and give examples • Study weather maps and use key vocabulary to explain • Understand what atmospheric pressure is	*Some children may think:* • *clouds are made of water vapour or steam* • *the substance on windows etc. is condensation rather than water* • *the changing states of water (illustrated by the water cycle) are irreversible* • *evaporating or boiling water makes it vanish* • *evaporation is when the Sun sucks up the water, or when water is absorbed into a surface/material.*
Biology Organisms interact with each other and with their environment	Circulatory and Respiratory System	**Circulatory** • 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 **Respiratory system** • 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	changing state, solid, gases, liquid, evaporate, evaporation, condense, condensation, water cycle, precipitation, melt, melting, freeze, freezing, solidify, freezing point, boiling point, temperature, thermometer, conditions, cloud, types of cloud, stratus, cumulus, cumulo, cirrus, nimbus, atmosphere, air movement, layers of atmosphere, cold front, warm front, weather map, isobars, rain, hail, snow, fog etc atmospheric pressure, barometer.	• Explain the functions of the heart • Label a diagram to show the components of the heart • Recognise the role that blood plays in the human body • Name the 4 basic blood types • Have an understanding of the functions of the liver and the spleen • Explore the respiratory system • Explain the process of taking in Oxygen and getting rid of carbon dioxide	*Some children may think:* • *your heart is on the left side of your chest* • *the heart makes blood* • *the blood travels in one loop from the heart to the lungs and around the body* • *when we exercise, our heart beats faster to work the muscles more* • *some blood in our bodies is blue and some blood is red* • *we just eat food for energy* • *all fat is bad for you* • *all dairy is good for you* • *protein is good for you, so you can eat as much as you want* • *foods only contain fat if you can see it* • • *all drugs are bad for you.*
Chemistry All matter is made of particles The properties of materials derive from the identity and arrangement of particles Some quantities are conserved Chemistry is everywhere	Chemistry	Atoms • 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 - Positive charge (+): proton - Negative charge (-): electron - Neutral (neither positive or negative): neutron - 'Unlike charges attract, like charges repel' (relate to magnetic attraction and repulsion). Properties of matter • Mass: the amount of matter in an object, similar to weight • Volume: the amount of space a thing fills • Density: how much matter is packed into the space an object fills • Vacuum: the absence of matter Elements • Elements are the basic kinds of matter, of which there are a little more than one hundred. -There are many different kinds of atoms, but an element has only one kind of atom. - Familiar elements, such as gold, copper, aluminium, oxygen, iron - Most things are made up of a combination of elements. Solutions • 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	matter, particles, atoms, molecules, elements, proton, neutron, electron, positive charge, negative charge, bond, compound, oxygen, O2, water H2O, Carbon-dioxide CO2, solid, liquid, gas, state of matter, material, density, mass, volume, vacuum, chemical, chemical reaction, reversible change, irreversible change, change state, dissolve, solution, solute, substance, mixture, separate, filter, evaporate, condense, saturation point.	• Understand that all particles are made up of atoms • Understand the structure of an atom: protons, neutrons and electrons • Understand the concept of electrical charge • Be able to define the terms mass, volume, density, elements and vacuum • Understand that a solution is formed when a substance is dissolved in another substance • Use prior knowledge to explain how mixtures may be separated • Explore elements and understand that they are the basic kind of matter	

Key Concepts, Knowledge, Vocabulary and Skills - Scientists: Year 6

	Working as a scientist/scientifically				
	Plan and Questions • Ask relevant questions • Answer relevant questions • Select appropriate enquiry to help answer questions/equipment	**Test** • Set up simple fair tests	**Observe and measure** • Make careful observations • Take accurate measurements	**Record and Present** • Collect and record results • Suggest criteria for grouping, sorting and classifying/use a simple key	**Predict and Conclude** • Draw conclusions • Use scientific language in discussions • Make predictions • Look for patterns in results
	Skills vocab: Question, theory, idea, hypothesis, equipment, investigate, investigation, predict, predictions, fair test, control, variables, observe, observations, measure , measurements, record, data, results, sort, groups, classify, key, table, graph, conclude, conclusions, scientific vocabulary, patterns, evaluate.				

Key Concepts	Context	Key knowledge	Key Vocabulary	Learning checkpoints	Common Misconceptions
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 • 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 • 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)	Plant, vascular plant, non-vascular plant, veins, vascular bundle, vascular tissues, transport, xylem, phloem, root, stem, leaf, leaves, moss, algae, liverwort, hornworts, lichens, flowering plants, photosynthesis, oxygen, carbon-dioxide, water, glucose, sunlight, chloroplasts, chlorophyll, stomata, exchange gases, synthesise, cells	• Understand the structure of non-vascular and vascular plants • Understand and explain the process of photosynthesis • Recognise why photosynthesis is an important life process in plants but not animals • Explain how plants make their own food	*Some children may think:* *plants are flowering plants grown in pots with colored petals and leaves and a stem* *• trees are not plants* *• all leaves are green* *• all stems are green* *• a trunk is not a stem* *• blossom is not a flower.* *• plants eat food* *• all plants start out as seeds* *• all plants have flowers* *• plants that grow from bulbs do not have seeds* *• food comes from the soil via the roots* *• flowers are merely decorative rather than a vital part of the life cycle in reproduction* *• plants only need sunlight to keep them warm* *• roots suck in water which is then sucked up the stem.*
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	• 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** • 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: - 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).	classify, classification, sort, group, key, Carl Linnaeus, Kingdom, Phylum, Class, Order, Family, Genus, Species, Latin, Latin name, fish, amphibians, reptiles, mammals, birds, insects, vertebrate, invertebrate, cells, cell structure, nucleus, cell membrane, cytoplasm, tissues, organs, organisms, single celled animal/plant, bacteria, virus,	• Recognise different classifications of animals • Classify living things according to the 5 main groups • Sort and classify a variety of vertebrates • Explain what a cell is and understand that living things are made up of cells • Name and label the structure of a cell • Understand that cells are shaped differently and have different functions (single cell, plant cell, cell tissue, complex organisms) • Explain how classification helps us to understand the natural world • Understand that scientists use special names of Latin words when classifying	

Biology Species arise, change, and become extinct over time Genetics maintain continuity plus allow for change	Evolution and Inheritance	• 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.	fossil, past, prehistoric, dinosaur, Evolve, evolution, adapt, adaptation, genetics, hereditary, genes, DNA, reproduce, reproduction, offspring, characteristics, features, Charles Darwin, survival of the fittest, Galapagos islands, finches, variation, change over time, peppered moth, environment, environmental factors,	• Understand that fossils provide information about the past • Give examples of animal offspring and recognise the role that genetics play • Explain how animals and plants are adapted to their environments • Understand that adaptation can lead to evolution	• *Some children may think: • adaptation occurs during an animal's lifetime: giraffes' necks stretch during their lifetime to reach higher leaves and animals living in cold environments grow thick fur during their life • offspring most resemble their parents of the same sex, so that sons look like fathers • all characteristics, including those that are due to actions during the parent's life such as dyed hair or footballing skills, can be inherited • cavemen and dinosaurs were alive at the same time.*
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: • 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: • 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: • 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	Matter, particles, atoms, molecules, elements, proton, neutron, electron, positive charge, negative charge, bond, compound, oxygen, O2, water H2O, Carbon- dioxide CO2, solid, liquid, gas, state of matter, material, density, mass, volume, vacuum, chemical, chemical reaction, physical reaction, reversible change, irreversible change, change state, dissolve, solution, solute, substance, mixture, separate, filter, evaporate, condense, periodic table, elements, Hydrogen (H2) Carbon (C) Oxygen (O2) Metal, properties, shiny, magnetic, conductive (thermal and electrical), malleable, opaque, sonorous- metallic sound.	• Explain the basic atomic structure • Recognise that some atoms join together to form molecules and compounds • Name common compounds and know their formulas • Have an understanding of the periodic table and name some symbols of known elements • Name properties of metals • Give examples of chemical and physical changes and describe how these occur • Know that atoms are constantly in motion	*Some children may think:* *• thermal insulators keep cold in or out* *• thermal insulators warm things up* *• solids dissolved in liquids have vanished and so you cannot get them back* *• lit candles only melt, which is a reversible change.*
Biology All organisms share a common set of essential life processes Organisms interact with each other and with their environment	Human Body: Hormones & Reproduction	Human growth stages • Puberty: - Glands and hormones (see below, Endocrine System), growth spurt, hair growth, breasts, voice change The reproductive system: • 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 The endocrine system • 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	Life cycle, baby, child, teenager, adolescent, adult, human, reproduce, reproduction, puberty, grow, growth, change, hormones, adrenal glands, pituitary gland, pancreas, insulin male reproductive system, penis, scrotum, testes, sperm, semen, erection, ejaculation, female reproductive system, vagina, cervix, womb, menstrual cycle, menstruation, period, blood, bleed, womb lining, ovary, ovaries, egg, fallopian tubes, sex, sexual intercourse, fertilisation, placenta, umbilical cord, pregnancy , birth,	• Understand what happens during puberty • Understand how the reproductive system is different in males and females • sexual reproduction and what happens • Name the different types of glands and explain their functions • Explore the role of insulin in the human body • Mini study – adreanal glands, recognise how this gland contributes to feelings and emotions	

Appendix 1: Curriculum Rationale

Why have particular contexts been chosen? Why is it organised in this way? Why will it help children?
The answers to these questions are rooted in the rationale of the design and curation of the curriculum.

This curriculum is coherent, which means it has been carefully considered and each context follows a deliberate order. That order starts with some of the knowledge that is directly observable and builds on some of the understanding of the world children will come to school with. As our children grow up, the curriculum will introduce them to ideas and knowledge that are not necessarily obvious through direct observation. The more abstract the curriculum content gets the greater the need for "book learning" (knowledge gained from books or study rather than personal experience) becomes. However, the scientific skills that children need to use to gain an understanding of the content are described so that children get opportunities to experience things first-hand with opportunities to observe, experiment and get their hands dirty.

The key concepts outlined will be revisited at different times throughout the curriculum when they are relevant. The depth to which the key concepts need to be covered is dependent on the age and the amount of knowledge the children have. A systematic approach to exploring these key concepts helps to provide the essential building blocks for deeper understanding at a later time.

Contexts have been organised to allow pupils to learn, building up their learning year on year, to develop breadth and depth in a variety of the sciences. Contexts in Science have been deliberately constructed and aligned to other curriculum areas such as Geography, which supports children to make connections and construct meaning.

Common misconceptions have been included within this framework to support subject knowledge when leading teaching and learning.

Learning Checkpoints has been included to support Key Assessment for CLF expected standard for understanding.

Research sources:

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- New Zealand Ministry of Education https://seniorsecondary.tki.org.nz/Science/Key-concepts
- Core Knowledge http://www.coreknowledge.org.uk/
- Ofsted Intention and substance: https://www.gov.uk/government/publications/intention-and-substance-primary-school-science-curriculum-research