

Year 4: Autumn 1

Biology: Classifying Organisms



	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	<ul style="list-style-type: none"> Insects like ants, bees, and ladybirds are animals. Spiders and insects live in the habitats around our school (Rec Spr2). Plants are classed as living things because they grow, move, reproduce, and need nutrition (Y1 Aut). Animals move from place to place, while plants move on the spot (Y2 Spr). Animals can be grouped into fish, amphibians, reptiles, birds and mammals (name common examples) (Y1 Sum). Animals, including humans, reproduce. This means they have offspring that grow into adults (Y2 Aut). Living things are called organisms (Y2 Spr). Habitats are the places that living things live. A very small habitat is called a microhabitat (Y2 Spr). Biodiversity is all the living things in an area (Y2 Spr). A species is a group of living things that are the same type (Y2 Spr). The Earth is getting warmer. We call this global warming. Global warming will cause solid ice to melt and become liquid water (Y2 Sum). Some organisms have endoskeletons, some have exoskeletons, and some have neither (Y3 Aut). Pollinators like bees and other insects, bats, hummingbirds are vital for the reproduction of many plants. (Y3 Spr2). 	<ul style="list-style-type: none"> Classification refers to a method used to place all living things into groups. Organisms can be classified in a number of ways. Fish, amphibians, reptiles, birds and mammals are all vertebrates. Vertebrates have endoskeletons. Vertebrates can be grouped in a number of ways based on their characteristics, e.g. warm/cold blooded; or physical features like fur, beak, wings etc. Invertebrates can be grouped based on their characteristics as snails and slugs; worms; spiders and insects. Invertebrates can be placed into groups based on their skeletons; endoskeletons, exoskeletons, or hydrostatic skeletons. Plants can be grouped into flowering and non-flowering plants. A species is a group of one type of organism. Individuals in this group can breed with each other to produce offspring that can go on to reproduce. Protecting biodiversity is important as the different species depend on each other to provide food, shelter and many other resources. This is called interdependence. Many things threaten biodiversity, including the loss of habitats (from global warming, building and extracting resources), agriculture, and hunting. 	<ul style="list-style-type: none"> Invertebrates can be grouped based on their characteristics as poriferans (sponges) cnidarians, echinoderms, molluscs, annelids, platyhelminths and arthropods (spiders, insects, crustaceans and myriapods). Plants can be grouped into moss, ferns, conifers and flowering plants (Y6 Spr) Fungi are different to plants and animals. They cannot make their own food (like animals) but do not move (like plants) (Y6 Spr). Micro-organisms are organisms that are so small that we cannot see them with our eyes alone (Y6 Spr). Some fungi are microorganisms (e.g. yeast), but not all are (e.g. mushrooms) (Y6 Spr). Bacteria are microorganisms, some bacteria can cause disease in other organisms (Y6 Spr). Variation occurs within and between species (Y6 Aut).
Disciplinary	<ul style="list-style-type: none"> M&O: Observe using a magnifying glass safely. 	<p>Exploring classification debates (e.g. duck-billed platypus)</p> <ul style="list-style-type: none"> A&P: Identify scientific evidence that has been used to support or refute ideas. <p>Use a classification key to sort organisms</p> <ul style="list-style-type: none"> R&P: Use a classification key to identify an object. <p>Draw a classification key to identify four animals, and then several leaves (using a magnifying glass)</p> <ul style="list-style-type: none"> R&P: Draw a dichotomous classification key to help others identify an object. 	<ul style="list-style-type: none"> A&E: Science is never 'complete' and scientists are always working to make models more accurate or to discover new explanations (Y5)
VCs	<ul style="list-style-type: none"> 9: A species is a group of living things of the same type (Y2). 	<ul style="list-style-type: none"> 9: A species is a group of one type of organism. Individuals in this group can breed with each other to produce offspring that can go on to reproduce. 	

Year 4: Autumn 2

Biology: Food & Digestion



	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	<ul style="list-style-type: none"> • Deciduous plants lose their leaves in winter (e.g. oak, silver birch, horse chestnut, sycamore, ash) (Y1 Aut). • Animals can be placed into groups (carnivores, herbivores and omnivores) based on the food they eat. Humans are omnivores, but some choose to eat only plants (Y1 Sum). • Animals get their food from plants and other animals; this food provides the energy animals need. • Humans need to practise hygiene to stay healthy (Y2 Aut). • Most plants produce their own food and are called producers (Y2 Spr). • In a food chain, the arrows show where the energy is being transferred from and to (Y2 Spr). • Different animals have different nutritional needs (Y3 Spr). • Organs are parts of the body that do a particular job, like the heart pumps blood around the body and the lungs are used for breathing, which gets air into the body (Y3 Spr). 	<ul style="list-style-type: none"> • A food chain starts with a producer (usually a plant) who can produce its own food. Organisms that eat producers are called consumers (primary and secondary). • A predator hunts prey to eat. • A food web shows the transfer of energy between different organisms (include water as well as land organisms). • An ecosystem is made up of all organisms living in an area and the non-living features of the environment. • There are four main types of teeth: incisors, canines, pre-molars and molars. They each have a different purpose. • Herbivores, carnivores and omnivores have teeth types in different proportions. • Babies' teeth develop before they are born, deciduous (milk) teeth push through the gums when a child is about 6 months. • Deciduous teeth fall out from the age of 5 and are replaced with adult teeth. • Bacteria can cause tooth decay. • Animals and plants need to digest food to transfer energy from it. • The digestive system is the group of organs that help your body digest food. Digestion in humans is chemical and mechanical. • Chemical and mechanical digestion takes place in the mouth (saliva and chewing). • Food travels down the oesophagus from the mouth into the stomach. • In the stomach, mechanical (churning) and chemical digestion takes place to break down food further. • Food is further broken down by enzymes (chemical digestion) in the small intestines where most of the nutrients are absorbed. • Water is absorbed in the large intestine, leaving behind the faeces. • Faeces are mainly made of food we could not digest; faeces are stored in the rectum and pass out of the human body via the anus. 	<ul style="list-style-type: none"> • Each organ and muscle in the human body needs oxygen and nutrients (from breathing in and eating/digesting) (Y6 Sum). • Blood carries oxygen, nutrients and carbon dioxide around the body (Y6 Sum). • Nutrients are absorbed by the blood along the small intestine, and transported to other organs in the body (Y6 Sum). • Some bacteria are helpful for other organisms (e.g. those that help break down food in our digestive system) and those that form part of a symbiotic relationship (Y6 Spr). • The role of enzymes in chemical digestion (KS3). • The interdependence of organisms in an ecosystem and how organisms affect and are affected by their environment to include the accumulation of toxic materials (KS3).
Disc.	<ul style="list-style-type: none"> • R&P: Draw a diagram, a simple scientific drawing that explains or informs (Y1 Spr). 	<p>Explain the digestion process using a prop to others in school or at home</p> <ul style="list-style-type: none"> • R&P: Present information orally using a prop or demonstration. • R&P: Drawings can be labelled and annotated. 	
VCS	<ul style="list-style-type: none"> • 4 & 8: All food chains start with a producer (a living thing that makes its own food). The arrows in a food chain show where energy is being transferred from and to (Y2). • 8: Plants and animals are often dependent on each other (Y2). • 11: Humans need to practise good hygiene, like brushing teeth and washing hands, to stay healthy (EYFS). 	<ul style="list-style-type: none"> • 4 & 8: The arrows in a food web show where energy is being transferred from and to. • 11: Bacteria are tiny living things. Some are useful for humans, and some can cause diseases. Bacteria can cause tooth decay. 	<ul style="list-style-type: none"> • 4: Many processes and phenomena are explained in terms of energy exchanges. Energy cannot be created or destroyed. When energy is transferred from one object to others, the total amount of energy in the universe remains the same; the amount that one object loses is the same as the other objects gain. Two examples of energy stores are thermal stores and chemical stores of energy (Y5). • 4 & 8: Food chains, food webs and the transfer of biomass (KS3). • 11: Bacteria are microorganisms (Y6).

Year 4: Spring 1

Chemistry: Particle Model



	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	<ul style="list-style-type: none"> We see puddles when it's rainy, shadows during the day and rainbows when there is sunshine and rain (N3-4 Aut1). Melting and freezing can be observed in the world around us (N3-4 Aut1). Geography: Precipitation is the fall of water as rain, sleet, snow or hail (Y2 Spr). All materials are made of a single substance or a mixture of substances (Y2 Sum). There are three states of matter: solids, liquids and gases (Y2 Sum). Liquids take the shape of the container they are in, when you move the liquid into a different container the shape will change (Y2 Sum). Solids keep their shape unless a force is put on it. They will change their shape if you cut them or squash them (Y2 Sum). Gases have no fixed shape or volume, they spread out to fill a container. If they are not in a container, they will keep spreading out (Y2 Sum). One substance can exist in the different states, when the substance is in a different state it is still the same substance (Y2 Sum). 	<ul style="list-style-type: none"> The different substances in their different forms (solids, liquids and gases) are all made of particles. The particles in the different states of matter are arranged differently. In solids, the particles are packed tightly together, they vibrate slowly, and are unable to move away from their neighbours. In liquids, the particles are close together but can slide past each other. In gases, the particles are spread out and can move freely. Substances can change from one state of matter to another. The process that changes a substance from solid to a liquid is called melting. The process that changes a substance from liquid to a gas is called evaporation. Evaporation is different from boiling. The process that changes a gaseous substance to liquid is called condensation. The process that changes a liquid substance to solid is called freezing. Substances change state at different temperatures. Different substances are different states at room temperature. The water cycle relies on evaporation and condensation. Water is collected in the oceans from rivers; it evaporates and then condenses to form clouds; it then precipitates, and the cycle begins again. 	<ul style="list-style-type: none"> Geography: Water cycle: Evaporation from the air, and transpiration from trees means that water vapour rises into the air. It condenses to form clouds and precipitation occurs when the clouds get heavy. Surface runoff is the flow of water overground; throughflow is the flow of water underground (Y5 Spr). Conservation of material and of mass, and reversibility, in melting, freezing, evaporation, sublimation, condensation, dissolving (KS3). Similarities and differences, including density differences between solids, liquids and gases (KS3). Brownian motion of gases (KS3). Diffusion in terms of the particle model (KS3). Energy changes on changes of state (KS3).
Disciplinary	<ul style="list-style-type: none"> Mathematics: Measure temperature (°C) and volume (ml/litres) (Y3). A&P: dependent, independent and control variables (Y3). A&P: Scientists identify factors in an investigation that should be controlled, and try to find ways to control them (Y3). A&P: Scientists identify potential hazards in their experiments and plan ways to reduce them (Y2 Aut). R&P: Label and annotate a diagram (Y4 Aut2). 	<p>Investigate the effect of temperature on the rate of evaporation</p> <ul style="list-style-type: none"> A&P: Set a hypothesis to test. A&E: Scientists use models to help explain their ideas. 	<ul style="list-style-type: none"> A&P: Scientists must work out if the factor is the cause of the outcome in a correlation (Y5).
VCS	<ul style="list-style-type: none"> 1: Matter can exist in three different states: as solids, liquids and gases. The amount and type of substance does not change when the matter changes state (Y2). 	<ul style="list-style-type: none"> 1: If a material could be divided into smaller and smaller pieces, it would be found to be made of particles, which smaller than can be seen even with a microscope. These particles are not in a material; they are the material. The particles of a substance are arranged differently when it is solid, liquid or gas. 5B: The water cycle involves evaporation of water from oceans and condensation of water, which falls as precipitation. 	<ul style="list-style-type: none"> 1: A pure substance is one that contains only one type of particle. A mixture is created when two or more substances are mixed. The two types of particle are mixed together, but the particles themselves stay the same (Y5). 5B: Geography – Addition of transpiration and surface runoff as aspects of water cycle (Y5).

Year 4: Spring 2

Physics: Sounds



	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	<ul style="list-style-type: none"> Humans have features that are associated with each sense (eyes, ears, nose, mouth and tongue) (Y1 Sum). In a solid the particles are packed tightly together, they vibrate slowly, and are unable to move away from their neighbours (Y4 Spr). In a liquid the particles are close together, but they can slide past each other (Y4 Spr). In a gas the particles are spread out and can move freely (Y4 Spr). 	<ul style="list-style-type: none"> Sounds are made when objects vibrate. Sounds are transmitted from a source to a detector. Vibrations travel through a medium (e.g. air, water) to the ear. Vibrations enter the ear, our inner ear vibrates and we hear them as sound. Vibrations are passed on from one particle to the next, and so it travels more easily when particles are closer together (solids and liquids). Sound cannot travel in a vacuum. The volume of a sound is how loud or quiet it is. Louder sounds are caused by bigger vibrations, smaller sounds are caused by smaller vibrations. The pitch of a sound is how high or low it is. Sounds get fainter as the distance from the sound source increases. Different animals hear different sounds. Humans' hearing changes as we age. 	<ul style="list-style-type: none"> Sound cannot travel in a vacuum, in space (Y5 Sum). Frequencies of sound waves, measured in hertz (Hz) (KS3). Echoes, reflection and absorption of sound (KS3). Sound needs a medium to travel in (KS3). The speed of sound in air, water and solids (KS3). Sound produced by vibrations of objects, in loudspeakers, detected by their effects on microphone diaphragm and the ear drum (KS3). Sound waves are longitudinal waves (KS3). The auditory range of humans and animals (KS3).
Disciplinary	<ul style="list-style-type: none"> A&P: A dependent variable is what you measure; an independent variable is what you change; controlled variables are things that stay the same (Y3 Aut2). 	<p>Investigate the tautness on pitch using an app</p> <ul style="list-style-type: none"> M&O: Gather information using a data logger (e.g. sound meter app; heart rate app). 	<ul style="list-style-type: none"> M&O: Gather information using other data loggers (Y6).
VCs	<ul style="list-style-type: none"> 2: Objects can affect other objects even when they are not in contact with them. Light reaches our eyes, even though the light source may be far away (Y3). 11: Humans have five senses. Some people have impairments, like visual and hearing impairments (Y1). 	<ul style="list-style-type: none"> 2: Sound comes from objects that vibrate and can be detected at a distance from the source, because the air or other material around is made to vibrate. Sounds are heard when the vibrations in the air reach our ears. 11: Humans with hearing loss may use closed captions, hearing aids and/or sign language. 	<ul style="list-style-type: none"> 2: There is attraction and repulsion between objects that are electrically charged. Visible light and other forms of radiation can travel through any empty space (KS3).

Year 4: Summer 1

Physics: Electricity



	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	<ul style="list-style-type: none"> Common materials include wood, paper, metal, glass, water, rock (Y1 Spr). Materials have different physical properties, some materials are hard whilst others are soft, some can be described as rough whilst others are smooth, some are dull whereas others are shiny (Y1 Spr). Materials can be grouped in a number of ways based on their physical properties (Y1 Spr). The material that we choose to make an object from depends on its purpose (e.g. no chocolate kettle) (Y1 Spr). 	<ul style="list-style-type: none"> Electrical appliances have a purpose and require electricity to work (e.g. toaster, kettle, fan, phone, game). Electrical appliances should be switched off when not in use. A lamp in a circuit will only light if there is a complete circuit. A complete circuit must have at least one cell and have all the components connected in a loop. If it is missing any of these things it is an incomplete circuit. Switches complete or break a circuit. A short circuit can be created by accident by connecting just the wire to the cell in a circuit. They can be dangerous. Components include wire, lamp, buzzer, motor or switch. Materials that allow electricity to pass through them easily are called electrical conductors. Metals and water are good conductors of electricity. Materials that do not allow electricity to pass through them easily are called electrical insulators. Plastic, rubber, wood, glass, paper and fabric are electrical insulators. 	<ul style="list-style-type: none"> In a circuit that has a battery, the battery is the chemical store of energy. Energy is transferred electrically to the device in the circuit but the device does not store the energy, the device changes the way the energy is transferred (Y5 Aut). There are recognised symbols for cell, lamp, buzzer, motor, and switch. Wires are represented with straight lines (Y6 Aut). Increasing the voltage in a circuit will increase the brightness of a lamp and increase the volume of a buzzer (Y6 Aut). The more components in the circuit, the dimmer the lamps in the circuit (Y6 Aut). As long as batteries have the same voltage, the size of the battery does not affect the brightness of the lamp/loudness of the buzzer (though the smaller batteries will not last as long as the larger ones) (Y6 Aut).
Disciplinary	<ul style="list-style-type: none"> A&P: Dependent, independent and control variables (Y3 Aut). A&P: Scientists identify factors in an investigation that should be controlled, and try to find ways to control them (Y3 Aut). A&P: Scientists identify potential hazards in their experiments and plan ways to reduce them (Y2 Aut). A&E: Use findings of investigation to make further predictions (Y3 Sum). R&P: Design a table to collect data with the appropriate number of rows and columns and correct headings (Y3 Spr). 	<p><i>Investigate which materials are electrical conductors and which are electrical insulators</i></p> <ul style="list-style-type: none"> A&P: Draw diagram of the investigation. R&P: Present information in a written format. 	
VCs	<ul style="list-style-type: none"> 4: We have to push or pull objects to make them move; they do not move on their own. 	<ul style="list-style-type: none"> 4: A cell in a complete circuit can make a bulb light or buzzer sound. This will not happen without a cell. 	<ul style="list-style-type: none"> 4: A cell is a chemical store of energy, and this energy will be transferred to components in the circuit (Y5).

Year 4: Summer 2

Chemistry: Properties of Materials



	Required prior knowledge	Knowledge to be explicitly taught	How knowledge will be built upon
Substantive	<ul style="list-style-type: none"> Materials have different physical properties, some materials are hard whilst others are soft, some can be described as rough whilst others are smooth, some are dull whereas others are shiny (Y1 Spr). Materials have different physical properties such as malleable, waterproof, heatproof, windproof and absorbent. (Y2 Spr). The shape of some solid objects made from some materials can be changed by squashing, bending, twisting, or stretching the material (Y2 Spr). Opaque, translucent and transparent materials allow no, some or all light to pass through them (Y3 Aut). Magnets attract magnetic objects (Y3 Sum). Materials that allow electricity to pass through them easily are called electrical conductors (Y4 Sum). Materials that do not allow electricity to pass through them easily are called electrical insulators (Y4 Sum). 	<ul style="list-style-type: none"> Physical properties are properties that we can measure or observe in the classroom. Physical properties include electrical conductivity; melting and boiling points; thermal conductivity; being malleable; windproof; hard/soft; and magnetic. Energy will be transferred from places with a higher temperature to places with a lower temperature. Thermal conductors allow energy to be transferred through them easily when they are heated. Metals are good thermal conductors. Thermal insulators do not allow energy to be transferred through them easily when heated. Thermal insulators include trapped air, plastic and wood. Elasticity is a physical property. Elastic materials can stretch and then return to its original form. Chemical properties are properties that scientists need specialist equipment to measure. Chemical properties include how easy a substance is to set on fire (flammability) or how poisonous something is (toxicity). As we learn more about a substance's properties, we may decide to stop using it to make certain objects (e.g. lead in pencils is toxic; asbestos is a good insulator but is toxic). 	<ul style="list-style-type: none"> Differences between physical and chemical changes (Y6 Sum). The varying physical and chemical properties of different elements (KS3). The properties of metals and non-metals (KS3). The chemical properties of metal and non-metal oxides with respect to acidity (KS3). Properties of ceramics, polymers and composites (KS3).
Disciplinary	<ul style="list-style-type: none"> A&P: Scientists conduct secondary research to learn from what other scientists have already learned (Y1 Sum). A&P: Scientists identify factors in an investigation that should be controlled, and try to find ways to control them (Y3 Aut). M&O: Gather information from text/books/images (Y1 Aut) and the internet (Y3 Spr). A&E: Ask further questions that could be explored to extend findings (Y2 Spr). A&E: Identify scientific evidence that has been used to support or refute ideas (Y4 Aut). 	<p>Investigating the physical properties (thermal conductivity; malleability; transparency; magnetism; electrical conductivity etc.) of materials, using own knowledge or setting up comparative tests.</p> <p>Conduct secondary research to identify an object that was once made of one material but, when new evidence showed other chemical or physical properties, are now made of new materials (e.g. asbestos insulation; lead pencils; plastic bottles).</p>	
VCS	<ul style="list-style-type: none"> 1: Materials have different properties, which make them suitable for specific purposes (Y2). 11: Humans need to practise good hygiene, like brushing teeth and washing hands, to stay healthy (EYFS). 	<ul style="list-style-type: none"> 1: Properties of materials can be physical (such as hardness) or chemical (such as toxicity). 11: Some substances are toxic; this means they can be poisonous. Humans and other organisms need to avoid these to stay healthy. 	<ul style="list-style-type: none"> 11: Barrier methods that the body uses to prevent toxic substance damaging health (KS3).