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Science Whole School Overview

	Unit	Substantive Knowledge	Disciplinary Knowledge
Nursery	**Autumn** Marvellous MeBears Special Days	• Use all their senses in hands-on exploration of natural materials. • Explore collections of materials with similar and/or different properties.	• Use their senses in hands on exploration. • Sort clothing to wear in different climates/ types of weather. • Dress appropriately to go outside in wet, cold and windy weather. • Match animals to their young. • Plant seeds and look after growing plants with support. • Identify that certain animals live in different environments
	Spring Toys On the Farm	• Explore and talk about different forces they can feel. • Explore how things work. • Explore collections of materials with similar and/or different properties. • Plant seeds and care for growing plants. • Understand the key features of the life cycles. • Begin to understand the need to respect and care for the natural environment and all livingthings.	
	Summer Once Upon aTime All CreaturesGreat and Small	• Use all their senses in hands-on exploration of natural materials. • Explore collections of materials with similar and/or different properties. • Talk about the differences between materials and changes they notice. • Talk about what they see, using a wide vocabulary. • Understand the key features of the life cycle of a plant and an animal.	

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Reception	**Spring** Castles, knights and dragons Spring in our Step	• Explore the natural world around them. • Describe what they see, hear and feel whilst outside. • Understand the effect of changing seasons.	• Identify some key signsof each season. • Can talk about what a plant needs to survive • Care for the natural world and living things. • Sequences and talk about the life cycles of living things. • Talk about changes they observe e.g. melting and freezing, cooking. • Describe some the effects of changing seasons on the natural world. • Begin to understand what they can do to help the environment.
	Summer Where we live Science Detectives	• Recognise some environments that are different to the one in which they live. • Understand the effect of changing seasons on the natural world around them.	

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Science Whole School Overview

	Unit	Substantive Knowledge	Disciplinary Knowledge
Year 1	**Autumn 1** **Biology** **Plants**	• A **plant** is a **living** thing that usually grows in one place • **Coniferous** plants keep their leaves all year round (e.g. pine, yew, juniper in UK) • **Deciduous** plants lose their leaves in winter (e.g. oak, silver birch, horse chestnut, sycamore, ash) • **Trees** are a type of plant that have a tall **stem** made of **wood** • The basic parts of a plant are **leaves**, **flowers**, **roots**, **stem/trunk/branch**	***Draw and label a scientific diagram of a plant*** • R&P: Draw a diagram, a simple scientific drawing that explains or informs ***Classify trees as deciduous or coniferous using imagesof them at different times in the year*** • R&P: Use a table to classify items based on properties
	Autumn 2 **Biology and Physics** **Seasonal Changes**	• There are four **seasons**: **spring**, **summer**, **autumn** and **winter** • The **weather** changes gradually as we move from season to season • The weather can change rapidly in one day (e.g. sunny morning and rainy afternoon) • Recognise differences between four seasons in terms of living things (trees lose leaves; flowers drop and we see different animals, such as butterflies in the summer) • **Daytime** is when the **Earth** is facing the **Sun**; nighttime is when the Earth is facing awayfrom the Sun • In the **summer** that there are more hours of **daylight** and in **winter** there are fewer hoursof daylight • In the summer, we face the sun for more of the day and so it is lighter/darker when wetravel to school in summer/winter • The **Moon** is more visible at night	***Use information from images of four seasons toidentify and record differences in wildlife andweather in four seasons*** • A&P: Scientists look for patterns in the world around them • M&O: Gather information from text/books/images • R&P: Record numerical or descriptive observations in a table
	Spring 1 **Chemistry**	• An **object** is a 'thing' that can be seen and touched • Objects have a name and often have a **purpose.** For example a cup is the object, andits purpose is for drinking from.	***Sort materials into a Carroll diagram based on their characteristics***

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	Everyday Materials	• The **material** is what an object is made of, for example a cup can be made of paper or plastic • Common materials include **wood**, **paper**, **metal**, **glass**, **water**, **rock** • 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** whereasothers are **shiny**. • Materials can be grouped in a number of ways based on their physical properties • The material that we choose to make an object from depends on its purpose (e.g. no chocolate kettle)	• A&P: Scientists group objects or living things based on their properties • R&P: Use a Carroll diagram to classify items based on properties ***Find the best material for adog bed (waterproof and soft)*** • A&P: It is important that we keep as much as we can the same, apart from the thing we measure and the one thing we change • A&E: Make simple statements about the results of an enquiry
	Summer 1 **Biology** **Animals**	• **Animals** are different to **plants** because they usually move around, rather than stay in the same place • Animals can be placed into different groups (**carnivores**, **herbivores** and **omnivores**) based the foods they eat. • Animals have different features, including **fins**, **wings**, **scales**, **legs**, **feathers**, **claws**, **paws** etc. • Animals can be grouped into **fish**, **amphibians**, **reptiles**, **birds** and **mammals** (name common examples)	***Research different animals and use images and text toclassify the animals as herbivores, carnivores or omnivores, and based on their physical characteristics*** • A&P: Scientists conduct secondaryresearch to learn from what other scientists have already learned • R&P: Use a Venn diagram to classify items into two or

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Science Whole School Overview

			three sets based on properties
	Summer 2 **Biology** **Humans**	• Humans are **omnivores**, but some choose to eat only plants • Humans are made of many different body parts including head, neck, back, ears, eyes, nose, mouth, arms, shoulders, elbows, hands, fingers, legs, knees, feet, toes, face, ears, eyes, nose, mouth, arms, legs, hands, feet, toes. • Humans have five **senses**, smell, taste, touch, sight and hearing. • The five senses are each associated with different body parts (eyes, ears, nose, tongue)	***Draw a scientific diagram, labelling key human body parts***
Year 2			
	Autumn 1 **Biology Plant** **Growth**	• A seed is **living** • A seed is the **embryonic** stage of the plant life cycle. • A seed consists of three parts, the **seed coat**, the **endosperm** and the **embryo** • **Germination** is the development of a plant from a **seed**. During germination **roots** and **shoots** emerge and grow • To **germinate** a seed needs water and a certain temperature • **Temperature** is a measure of how hot or cold something is • Some plants grow from **bulbs**. A bulb is a resting stage for certain plants. They have alarge underground food store, short **stems** and fleshy leaves. • When a plant grows it gets bigger. • Plants need **water**, **light** and a suitable **temperature** to grow • Many plants make **fruits** or **vegetables**; some of these grow below ground	***Investigate the conditionsrequired for germination*** • A&P: Make a prediction based on substantive knowledge ***Investigate how light affectsthe growth of plants*** • M&O: Make systematic observations of an object
	Autumn 2 **Biology** **Needs of Animals**	• Animals, including humans, need **food** to survive • Animals, including humans, need **water** and **oxygen** to survive • Animals, including humans, the **right temperature** to survive • Animals, including humans, **reproduce**. This means they have **offspring** that grow into adults • As animals **grow** they get bigger. • Some animals change during their life cycle as the mature (e.g. tadpole to frog) • Humans need **exercise** to stay healthy • Humans need to eat a healthy and **balanced diet** • Humans need to practice **hygiene** to stay healthy	***Gather information from images and/or text and group animals into those that change form as they grow and those that do not.***
	Spring **Biology**	• Everything in the world can be categorised as either **alive**, used to be alive or has never been alive. • Living things are called **organisms** • Living things grow, need air and **nutrients**, react to their surroundings, move, get rid oftheir **waste**, **reproduce** • Animals move from place to place, while plants move on the spot	***Examine microhabitats using a magnifying glass and counting the number and type of living organismsfound in an area*** • A&P: Scientists conduct

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	Living **Thingsand** **their** **habitats**	• **Habitats** are the places that living things live, a very small habitat is called a **micro-habitat**, these can be found within larger habitats • Animals and plants in a habitat depend on each other e.g. for food or shelter • Animals get their food from plants and other animals, this food provides the **energy** animals need. • Most plants produce their own food and are called **producers**. • In a **food chain**, the arrows show where the **energy** is being transferred from and to • Living things are **adapted** to their **environment**. This means they may not be able to survive in other habitats • Some animals and plants have adapted to life in a **hot desert**: **camels** and **cacti.** Some animals and plants have adapted to life in a **cold desert**: **Arctic fox** and **shrubs**	investigations to identify whether a pattern they think they've seen is really there M&O: Observe usinga magnifying glass safely

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Science Whole School Overview

	Summer 1 **Chemistry** **Uses of Everyday Materials**	• **Matter** is all the 'stuff' that we experience in everyday life, including air, water, tables andus! • Materials have different **physical properties** such as **malleable**, **waterproof**, **heatproof**, **windproof** and **absorbent**. • These physical properties make the materials more suitable for certain uses Everyday materials such as **wood**, **metal**, **plastic**, **brick**, **rock**, **paper** and **cardboard** havethese physical properties but to different extents • Different combinations of materials can be used to create different objects, for examplea saucepan or a mop. • The shape of some solid objects made from some materials can be changed by • **squashing**, **bending**, **twisting** or **stretching** the material.	***Classify materials based onthe extent of its properties by using a pair of axes*** • R&P: Use a pair of axes to classify items based on the extent to which it displaystwo properties ***Investigate the best materialto use to make an umbrella that is waterproof and windproof*** • A&P: There are four main stages of enquiry (A&P, M&O, R&P, A&E) • A&P: Scientists identify potential hazards in their experiments and plan ways to reduce them • A&E: Ask further questions that could be explored to • extend findings
	Summer 2 **Chemistry**	• All **materials** are made of a single **substance** or a **mixture** of **substances** • There are three **states of matter**: **solids**, **liquids** and **gases** • Substances can exist as solids, liquids and gases	***Classify different substances as solids, liquids or gases***

Science Whole School Overview

	Solids, liquids, and gases ***Additional Unit***	• The three states of matter have different properties • Liquids take the shape of the container they are in, when you move the liquid into a different container the shape will change • Solids keep their shape unless a force is put on it. They will change their shape if you cutthem or squash them. • Gases have no fixed shape or volume, they spread out to fill a container. If they are notin a container, they will keep spreading out • We can decide is a substance is a solid, liquid or gas by looking at its properties • One substance can exist in the different states, when the substance is in a different stateit is still the same substance • Each substance in its state of matter is made up of parts that are too small to see without **magnification**	
Year 3			
	Autumn 1 **Light** **Physics**	• **Light** travels in straight lines • We see when light enters our eyes • **Sources** of light **emit** their own light, and others **reflect** light; both occur in nature as wellas man-made objects • Some objects are more **reflective** than others • **Opaque**, **translucent** and **transparent** materials allow no, some or all light to pass throughthem • **Shadows** form behind an opaque object when light from a source is blocked • The shape and position of shadows changes with the angle of the light source • The size of shadows changes when the distance of the light source changes • Light from the sun can be dangerous and there are ways to protect our eyes and skin.**Darkness** is the absence of light	• ***Investigate how the height of a shadow varies as the distance between light source and object changes***A&P: A dependent variable is what youmeasure; an independent variable is what you change; controlled variables are things that stay the same • A&P: Scientists identify factors in an investigation that should be controlled, and try to find ways to control them • A&P: Recognise risk and build a plan to minimise them • A&P: Select most appropriate equipment to measure (the

			variables) A&P: Write an appropriate method
	Autumn 2 **Chemistry** Rocks	• A rock is a naturally occurring material which is made up of different minerals. • The Earth's crust is it's the outermost layer of our planet. It is made of rocks and minerals. • Natural rocks are either **igneous**, **sedimentary** or **metamorphic** • Man-made rocks, like concrete, are called **anthropic** rocks • **Igneous** rock is formed when **magma** cools down • **Sedimentary** rock is formed when layers of small **sediments** are **compressed** over a long period of time. Igneous rock can become sedimentary rock if it breaks down into small pieces and forms layers • **Metamorphic** rock is formed when igneous or sedimentary rock is put under lots of **pressure** • Different rocks have different properties, including **permeable/impermeable** • A **fossil** is physical evidence of an ancient plant or animal , this could be their **preserved** remains or other **traces** that they made when they were alive. • **Trace fossils** are not physical remains of living things they are indirect evidence of life, examples include imprints of, or a mark left by an organism such as a footprint, imprint ofa feather or poo • Fossils are formed when a living thing or trace is buried under sediment. The remains break down slowly and as layers of sediment build up the layers are squashed, turningthem into sedimentary rock	***Make observations aboutrocks using senses and magnifying glass, and classify them in a Carroll diagram/pair of axes***

		• Fossils can form when dead organisms are frozen in ice or preserved in amber • **Soil** is a mixture of tiny pieces of rock, dead plants and animals, air and water. Differentsoils have different properties	

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Science Whole School Overview

	Spring 1 **Biology** **Organisms**	• The main food groups are **carbohydrates** (starch and sugars), **proteins**, **fats**, **dairy**, **fruit** and **vegetables** • Humans need a **balanced diet** which is made of main food groups • **Vitamins**, **minerals** and **fibre** are needed and being deficient in these causes **diseases** • Different animals have different **nutritional** needs • Our **skeleton** is made up of bones that grow as we grow • Humans and some other animals have skeletons • **Organs** are parts of the body that do a particular job, the **heart** pumps blood around the body and the **lungs** are used for breathing which gets air into your body. • The skeleton **protects** organs, e.g. the skull protects the brain; and the ribcage protectsthe lungs, heart and other important organs • The skeleton **supports** the body, e.g. the spine helps the body stand • The skeleton **helps the body move**, e.g. pelvis and knee joints • The **muscles** and skeleton are required to help the body move. When muscles **contract** • they pull the bone • Some organisms have **endoskeletons**, some have **exoskeletons**, and some have neither Endoskeletons grow with the organisms, exoskeletons do not so need to be shed andreplaced	***Label the main bones on a diagram of a human skeleton, give the functionof each bone.***

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Science Whole School Overview

	Spring 2 **Biology** **Plants**	• **Oxygen** and **carbon dioxide** are found in the air • Plants need air (oxygen and carbon dioxide), water, light, nutrients from the soil, space,and a suitable temperature to grow • Requirements for life vary from plant to plant and they adapt to their **environment** • **Roots** absorb **nutrients** from the soil and help anchor the plant • The **stem/trunk** supports the plant and transports water up the plant. The **xylem** transportswater and nutrients from the roots, and the **phloem** transports food from the leaves to the all parts of the plant • Leaves use sunlight, carbon dioxide from the air and water to make their own food • The four main stages of the plant's life cycle include **germination**, **pollination**, **fertilisation** and **seed dispersal** • **Coniferous** trees transport their seeds in cones; **deciduous** trees use seeds and flowers/fruit • **Pollination** and **fertilisation** usually takes place in flowers. Dispersal is important to make sure there is enough space for seeds to germinate and plants to grow. • Seeds can be dispersed by wind (e.g. sycamore), by animals in their droppings (e.g. things that are eaten, like a raspberry), attached to animal fur (e.g. goosegrass), or seedscan be **self-propelled** (pea pod)	***Investigate the impact of light on the growth of plants,drawing a block diagram toillustrate results*** • R&P: Design a table to collect data with the appropriate number of rows and columns and correct headings ***Research methods of seed dispersal of different plants*** • M&O: Gather information from the internet
	Summer 1 **Physics** **Forces and Motion**	• **Forces** are **pushes** or **pulls** or **twists** • Forces can cause a change in speed, direction or shape of an object • Forces act in particular **directions** • Forces that act in opposite directions are called **opposing forces**. • Forces that are equal and act in opposite directions are described as **balanced forces**, they 'cancel each other out' • When forces are balanced, an object will move at a constant speed in the same direction. This includes being stationary! • When the forces acting in the opposite directions are not equal this can cause the object they are acting on to move at a different speed, in a different direction or to change shape. • We can work out the **speed** of an object if we know how far it travelled and how long it took to get there • The greater the **mass** of an object, the longer it will take to speed it up or slow it down.	***Investigate the how long it takes cars of different masses to stop after travelling down a ramp*** • M&O: Data is repeatable if the same person repeats the investigation and gets the same results; data is reproducible if the investigation is repeated by a different person and the results are the same

Science Whole School Overview

			• A&E: Suggest ways to improve practical procedures to obtain more accurate measurements • A&E: Draw conclusions (e.g. 'the greater the… , the greater the…')
	Summer 2 **Physics** **Friction and Magnetism**	• **Contact** forces require contact between two objects (e.g. friction). **Non-contact** forcescan affect an object at a distance (e.g. magnetism) • **Friction** is a force between two surfaces that are sliding or trying to slide over each other • Friction is a contact force because it requires the two objects to be touching • The bumpier or rougher the surfaces, the more friction there will be • **Magnetism** is the force exerted by magnets when they attract or repel each other • Magnets can exert a force at a distance, which is called a non-contact force • Magnets have a **north** and a **south** pole. • If opposite poles are facing the magnets will be **attracted** to one another (the magnetspull towards each other). If the same poles are facing the magnets will **repel** (the magnets will push away from each other). • Magnets attract **magnetic** objects • Some metals are magnetic but not all are. Plastics, wood, fabric, glass are all non-magnetic • The stronger the magnet, the heavier the object it can attract or the further away it can attract the object from	***Investigating how the surface of a ramp affects the distance a car will roll*** • M&O: Anomalous results should be discarded and re recorded • M&O: Taking multiple readings allows you to see if your data is repeatable, helps identify outliers and allows a mean to be calculated • A&E: Use scientific understanding to explain their findings • A&E: Use findings of an investigation to make further predictions ***Test which materials are magnetic, and use this knowledge to make predictions about which objects will be magnetic***

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Science Whole School Overview

Year 4	**Autumn 1** **Biology** **Classifying Organisms**	• **Classification** refers to a method used to place all living things into groups. • **Organisms** can be classified in a number of ways • 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** • 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 • Buildings and new developments have destroyed many **habitats**. This means numberand types of organisms in these areas has gone down • Creating **nature reserves** is one way to prevent the loss of habitat. Setting aside land that cannot be used for building (**greenbelt**) helps keep habitats intact	***Identifying animals and plants that do not supportAristotle's approach to classifying living things; exploring history of other debates (e.g. duck-billed platypus)*** • A&P: Identify scientific evidence that has been used to support or refute ideas ***Use a classification key tosort organisms*** • R&P: Use a classification key to identify an object ***Draw a classification key to identify four animals, and then several leaves (using a magnifying glass)*** • R&P: Draw a dichotomous classification key to help others identify an object
	Autumn 2 **Biology** **Food and Digestion**	• 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 aswell as land organisms) • An **ecosystem** is made up of all organisms living in an area and the non-living features ofthe environment • There are four main types of teeth: **incisors**, **canines**, **pre-molars** and **molars**. They eachhave a different purpose. • **Herbivores**, **carnivores** and **omnivores** have these 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	***Explain the digestion process using a prop to others in school or at home*** • R&P: Present information orally using a prop or demonstration

Science Whole School Overview

		• 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**.	
	Spring 1 **Chemistry** **Particle Model** ***Additional Unit***	• 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 a solid the particles are packed tightly together, they vibrate slowly and are unable to move away from their neighbours • In a liquid the particles are close together but they can slide past each other • In a gas the particles are spread out and can move freely • Substances can change from one state of matter to another. Solids can change to become a liquid, liquids can change to become a gas, gases can change to becomeliquids and liquids can change to become a solid • The process that changes a solid to a liquid is called **melting** • When you heat a solid it becomes a liquid. Different substances melt at different temperatures, this is called the **melting point** • The process that changes a liquid to a gas is called **evaporating** • Evaporation happens when a liquid is heated. This is called the **boiling point** • The process that changes a gas to a liquid is called **condensing** • The process that changes a liquid to a solid is called **freezing** • Substances change state at different temperatures, i.e. they have different melting and boiling points • 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	***Investigate the effect of temperature on the rate of evaporation*** • A&P: Set a hypothesis to test • A&P: Science is studied as three disciplines: biology (study of living organisms), chemistry (study of properties of matter and how it interacts with energy) and physics (study of energy) • A&E: Scientists use models to help explain their ideas
	Spring 2 **Physics** **Sound**	• **Sounds** are made when objects **vibrate**. These vibrations cause the air **particles** surrounding them to vibrate and **collide**, causing the vibrations to pass between particles • 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.	***Investigate the tautness onpitch using an app*** • M&O: Gather information using a data logger (e.g.

Science Whole School Overview

		• 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** and **pitch** of sound can change	sound meter app; heart rate app)
	Summer 1 **Physics** **Electricity**	• A **lamp** in a **circuit** will only light if there is a **complete circuit**. • A complete circuit must have a **power** source (**cell/batteries**) and have all the **components** connected in a loop. If it is missing any of these things it is an **incomplete circuit** • A **short circuit** is the easiest route for electricity to travel and can be created by accidentby 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 • **Appliances** use electricity to serve a purpose (e.g. toaster, kettle, fan, phone, game)	***Investigate which materialsare electrical conductors and which are electrical insulators*** • A&P: Draw diagram of the investigation • R&P: Present information in a written format
	Summer 2 **Chemistry** **Properties of Materials**	• **Thermal conductors** allow energy to be transferred through it easily when it is **heated** • Metals are good thermal conductors • **Thermal insulators** do not allow heat to be transferred (conducted) through it easily. Thermal insulators include air, plastic and wood • **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 • **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	***Investigating the physical properties (thermal conductivity; malleability; transparency; magnetism; electrical conductivity etc.)of materials, using own knowledge or setting up comparative tests*** ***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 ofnew materials (e.g. asbestos insulation; lead pencils; plastic bottles)***

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Science Whole School Overview

Year 5	**Autumn 1** **Chemistry** **Separating Materials**	• A **pure substance** is one that contains only one substance and only type of particle, e.g. oxygen, iron, pure water • A **mixture** is two or more different substances, e.g. air, steel • **Mixtures** can be made of two gases (e.g. air), two solids (e.g. steel), two liquids (e.g. squash and water), or a liquid and a solid (e.g. salt water) • A **solvent** is a liquid that is used to **dissolve** other substances. • A **soluble** substance that **dissolves** in a **solvent** is a called a **solute** • An **insoluble** substance is one that will not dissolve in a solvent • When a solute dissolves in a solvent, a **solution** is formed. A solution is a mixture • When no more solute can dissolve in the solvent, the solution is **saturated** • Solutes dissolve more quickly when the particles have more energy (i.e. when heated or stirred) • Two solids can be separated by using **magnets** or **filters** (e.g. sieve) • A solid and a liquid can be separated by using **filtration** (if the solid is insoluble) or **evaporation** (if the solid is soluble) • A **reversible** change is a change that can be undone, where the original substances can be recovered. An **irreversible** change is a change that cannot be undone, where the original substances cannot be recovered	***Separate a mixture including coarse sand, water, salt and lumps of amagnetic material.***
	Autumn 2 **Biology,** **Chemistry,** **Physics** **Energy** **Additional Unit**	• **Energy** can be **transferred** from one **store** to another store • **Fossil fuels**, **batteries** and the **Sun** are all examples of chemical energy stores • **Energy stores** are needed for something to happen • When energy is transferred from one store to another it can be transferred by **light**, or **electrically**. • When energy is removed from one store and is transferred to another store, the amount of energy in the first store goes down and the amount of energy in the second store goesup • Energy is not used up it is just moved around from store to store • In a **food chain** an amount of energy from the Sun (a **chemical store**) is transferred to theplant by light. The energy is then transferred along the food chain as the different organisms are eaten. • 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**. • When a solid is heated the solid becomes a liquid. Energy from a **chemical store** is **transferred** to the solid, and as the solid becomes hotter its **thermal store** of energy goesup. The particles in the solid therefore move more • When a person **pushes** or **pulls** an object their chemical energy store decreases a little. • When a person hits a drum to make a **sound**, their chemical energy store decreases a little.	A&P: Science is studied as three disciplines: biology (study of living organisms), chemistry (study of properties of matter and how it interacts with energy)and physics (study of energy)

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	Spring 1 **Biology** **Life Cycles**	• Plants and animals look similar to their parents in many features because information is passed from one **generation** to the next. This information comes from the parents' **genome**. • **Sexual reproduction** involves two parents - usually male and female - create a new **organism** by mixing their **genomes** • Sexual reproduction begins with **fertilisation** of an egg, which mixes the genes from two parents. Fertilisation can be internal or external • After an egg is fertilised, an embryo will develop. Embryos develop inside the body in the **gestation** period for **viviparous** animals. Embryos develop outside the body in eggs for **oviparous** animals • Viviparous animals are **born**, oviparous animals **hatch** from eggs, plant seeds **germinate** • Almost all mammals are viviparous; all birds and most amphibians are oviparous • Amphibians and most insects undergo **metamorphosis** • Life cycle of: hedgehog: internal fertilisation, gestation, hoglet, adult, senior peregrine falcon: internal fertilisation, embryo is incubated in eggs, hatchling, nestling, fledgling, adult, senior frog: external fertilisation, frogspawn, tadpole, tadpole with legs, adult frog (metamorphosis)ladybird: internal fertilisation, eggs hatch, larva, pupa, adult • Most plants have both male and female parts • The male part of the plant is called the **stamen**, made up of the **anther** and **filament**, andthe anther produces **pollen grains**. • The female parts of the plant are the **ovary** (which produces the female sex cells whichare contained in the **ovule**) and the **stigma** which collects pollen • **Asexual reproduction** does not involve sex cells or fertilisation. Only one parent is neededand offspring are (**genetically**) identical to the parent and each other. • Potatoes develop **tubers** and daffodils have **bulbs**, which will grow to be identical copiesof the plant	***Using images, text and the internet to research internaland external fertilisation, and viviparous and oviparous organisms***
	Spring 2 **Biology** **Human Development**	• The human life cycle goes through the same stages as those for other animals: **fertilisation**, **gestation**, **growth** • Fertilisation in most humans is internal, but it can happen externally (**in vitro fertilisation** -IVF - which means 'in glass' fertilisation) • The human life cycle: **embryo**, **foetus**, **infant**, **child**, **adolescent**, **adult**, **senior** • Human are **viviparous** and a **foetus** develops inside the mother (or **surrogate** mother) • A human embryo is considered a foetus at the end of the 10th week of pregnancy • The **gestation** period for humans is 40 weeks • The bigger the animal, the longer the gestation period • A foetus is considered a baby when it is born • **Cognitive**, **physical** and **social** and **emotional** development takes place at the greatest rate during infancy	***Draw a scatter graph to suggest whether there is a relationship between animalsize and length of gestation period*** • A&P: Scientists look for patterns in data to try to identify correlations • R&P: Scatter graphs can help you decide if there is a

Science Whole School Overview

		• During **puberty**, adolescents' bodies change, e.g. pubic hair, voice deepen, hips widen • **Primary aging** of adults occurs naturally as our bodies get older (e.g. slower reaction time, reduced hearing) • **Secondary ageing** relates to environmental factors, like poor diet, not enough exercise, smoking etc. • There are ages where humans at their peak for different things (e.g. reproduction, running etc.) • Different cultures around the world have different perceptions around the life cycle and ageing	relationship between two variables ***Discuss one aspect of IVF that is appropriate to your class (e.g. who in the worldhas access; post code lottery within the UK)*** • A&E: Some people may agree or disagree with the use of some scientific discoveries
	Summer 1 **Physics** **Forces**	• **Force** is measured in **newtons** (N) • **Gravity** is a **non-contact force** that pulls all objects towards each other. The greater the **mass** of the object, the greater the **gravitational pull** around it. Gravity is most commonly experienced as the pull of the Earth (and all objects on it) towards each other • The Earth's **gravitational pull** is so large that all objects - regardless of how heavy they are - are pulled towards Earth at the same rate • **Air resistance** is a **frictional force** that acts between air and a moving object to slow it down • **Cross-sectional area** is the area that is facing the direction the object is travelling in. The larger the cross-sectional area of an object, the greater the air resistance • **Water resistance** is a frictional force that acts between water and a moving object to slow it down • **Levers**, **pulleys** and **gears** allow a smaller force to have a greater effect. Examples of levers, pulleys and gears include wheelbarrows, lifts, bicycle gears, in construction • Levers consist of a **beam** and a **fulcrum** (**pivot**). **Effort** lifts a **load** • The components of levers can be arranged in different orders: effort-fulcrum-load (e.g.see saw, neck joint); effort-load-fulcrum (e.g. wheelbarrow, calf muscle); load-effort- fulcrum (e.g. tweezers, bicep) • The greater the distance from the effort to the fulcrum, the less effort is required to movethe load	***Fair test to investigate how the distance between the load and the fulcrum affectsthe force required to lift it*** • A&P: Scientists must work out if the factoris the cause of the outcome in a correlation • M&O: Measure force using a Newtonmeter • R&P: Line graphs can be used whendata is continuous;bar charts can beused when data is discrete • A&E: Make judgements on the reliability of the data
	Summer 2 **Physics**	• The **universe** is made up of many **galaxies**. Our galaxy is called the **Milky Way** • The **Milky Way** is made up of lots of **solar systems** • Our solar system consists of a **star** (**Sun**), **planets** (which **orbit** a star), **satellites** (which orbit **planets**), and other bodies including **asteroids**, **meteoroids**, **meteors** and **meteorites** • The sun, planets and **moons** are approximately **spherical** bodies	***Look for patterns between a planet's distance from the Sun and it's temperature and size***

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	Earth and Space	• The Sun is at the centre of the solar system - the **heliocentric model** • Planets orbit the Sun in the same **plane**; moons orbit planets • The Earth takes 365.25 days to orbit the sun (one year). Every four years our Earth year isone day longer, this is called a **leap year**, this year accounts for the four 0.25 days • Bodies are held in their orbit by **gravity** • There are eight planets (M, V, E, M, J, S, U and N). Each planet has different characteristics, e.g. temperature; time taken to orbit the sun; number of moons; size. • The Earth **rotates** on its **axis** once every 24 hours, so only half of the Earth is facing the Sunat any one time; this creates night and day • The Earth's rotation means that the sun 'rises' in the east and 'sets' in the west, and that the Sun is highest in the sky at midday, this explains why the sun appears to move acrossthe sky. • The time taken for the Moon to **orbit** the Earth is 28 days and, during this time, the sunshines on different parts of the Moon • The phases of the Moon include **new moon**, **crescent**, **quarter moon**, **gibbous moon** and **full moon** • Space is a **vacuum**, which means there are no air particles • The Earth's Moon is smaller than the Earth and has less **mass** so its **gravitational** force isless	***Consider how the number of planets that humans consider to be planets has changed over time*** • A&E: Science is never 'complete' and scientists are always working to make models more accurate or to discover new explanations
Year 6			
	Autumn 1 **Physics** **Electricity**	• There are recognised **symbols** for cell, lamp, buzzer, motor, and switch. Wires are represented with straight lines • 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) • Adding more cells in the circuit increases the voltage. Increasing the voltage in a circuit makes the lamp in the circuit get brighter or the buzzer get louder. • More than one lamp can be put into one circuit. They can be placed in **series** or in **parallel**. • In a **series** circuit, the lamps are placed in a **continuous** loop. In **parallel**, the lamps are placed in separate loops that both connect to the cell • Connecting lamps in parallel means that if one lamp burns out the other will stay on and switches can be used to turn each lamp off independently. • Many of the **appliances** used in the home do not use batteries they use **mains electricity**. • Mains electricity is **generated** in a **power station** and transferred to our homes by overhead cables. Power stations can use both **renewable** and **non-renewable** sources of energy to generate electricity. • A **non-renewable energy source** is one where we have a fixed amount of the source, and where it would taketoo long for more to be formed. Burning fossil fuels to transfer electrical energy is a non-renewable energy source • **Renewable energy** sources quickly replenish themselves, meaning that we can use them again and again. **Wind**, **solar**, **geothermal** and **hydrological** power are all examples of renewable energy sources • Coal, oil and gas are all used to generate electricity. The store of chemical energy in the fuel is transferred electrically to the appliances that we use in the home.	**Three different enquiries, where pupils will plan the most appropriate type of investigation and how they should present their results:** 1. **Investigating the effect of increasing voltage on the volume of a buzzer or the brightness of a lamp** 2. **Investigating the effect of changing the number of components in a circuit on the volume of a buzzer** • R&P: Decide which graph is most

			appropriate for the enquiry
	Autumn 2 **Biology** **Evolution**	• **ariation** occurs within and between **species** • Variation can be **environmental** or **genetic**, or a mixture of both • **Genetic** variation happens randomly through the mixing of **genomes** in **sexual reproduction**. • Some variation is **advantageous** to the organism in their environment; sometimes it is **disadvantageous**; and sometimes it gives no advantage/disadvantage • An **organism** with **advantageous traits** are more likely to survive and reproduce, passing those traits to the next generation. This is called **natural selection** • These advantageous traits - **adaptations** - can be **physiological**, **structural** and **behavioural** • Over many generations, the species will **evolve** so that all organisms have this adaptation/advantageous trait • **Homo sapiens** originated in many parts of Africa • **Fossils** provide evidence for evolution, because they show how organisms have changed over time • Scientists involved in the development of evolutionary biology include Al-Jahiz, Charles Darwin, Alfred Wallace, Mary Anning and Dr Danielle Lee	***Sort variations within speciesin a Venn diagram, based on whether they are genetic, environmental or a mixture of both*** ***Identify how evidence offossils has been used to support to change the theory of the evolution ofHomo sapiens*** • A&P: Science is never 'complete' and scientists are always working to make models more accurate or to discover new explanations
	Spring 1 **Physics** **Light**	• In **ray diagrams**, straight lines with arrows show where the **energy** is being transferred from and to by light • Objects **emit** (give out) or **reflect** light into the eye. We see things because light travelsfrom **light sources** to our eyes, or from light sources to objects and then to our eyes • Objects would be invisible if they did not reflect light. • Many problems with our vision are caused by parts of the eye that are the not the right shape or size, or that have become cloudy. Many of these problems can be corrected through surgery or **prescription** glasses • People living with sight loss or blindness may use long canes or guide dogs when outside, talking books or **Braille**, and different devices in the home • The size and shape of shadows behind an **opaque** object can be explained using ray diagrams • Shadows have the same shape as the objects that cast them because light travels in straight lines. • On a flat surface, all light meeting a surface from one direction will be reflected in the same direction. This is known as **specular reflection** • On a rough surface, light will be reflected in all directions. This is known as **diffuse reflection**	***Draw ray diagrams to showhow light travels and how shadows are formed***

		• Specular reflection between mirrors allow us to see the objects that do not directly reflectlight into our eyes (e.g. periscope) • When light meets an opaque object, some of the light is reflected and some of it is absorbed • **White light**, which comes from most light sources we use in the classroom, contains all the colours of the **visible spectrum** (red, orange, yellow, green, blue, indigo, violet) • When a light meets a surface, some colours are **absorbed** and some are **reflected**. Wesee the colour(s) that are reflected • Objects appear black if they absorb all the colours in white light, and reflect none. Objects appear white if they reflect all the colours in white light, and absorb none	
	Spring 2 **Biology** **Further Classification**	• **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 • **Fungi** are different to plants and animals. They cannot make their own food (like animals)but do not move (like plants) • **Micro-organisms** are organisms that are so small that we cannot see them with our eyes alone. • Some **fungi** are microorganisms (e.g. yeast), but not all are (e.g. mushrooms) • **Bacteria** are microorganisms. Some bacteria can cause disease in other organisms • Some bacteria are helpful for other organisms (e.g. those that help break down food inour digestive system) and those that form part of a **symbiotic relationship**	***Use and draw classificationkeys to help classify invertebrates and plants Research the harmful and helpful effects that bacteria can have on humans and other organisms, and present this information in awritten format***
	Summer 1 **Biology** **Function of the Human Body**	• Each **organ** and **muscle** in the human body needs **oxygen** and **nutrients** (from breathingin and eating/digesting). Each organ and muscle releases **carbon dioxide**, which needs to be removed (and breathed out) • **Blood** carries **oxygen**, **nutrients** and **carbon dioxide** around the body • The **heart** is a muscle that pumps the blood through the **blood vessels**. Blood is pumpedat a high **pressure**. • The heart pumps **deoxygenated** blood to the lungs, where oxygen is transferred to it andit flows back to the heart. The heart pumps **oxygenated** blood to the rest of the body, where the oxygen is transferred to the organs/muscles and carbon dioxide is transferred to the blood • **Deoxygenated** blood then travels back to the heart to begin the process again • **Nutrients** are absorbed by the blood along the **small intestine**, and transported to other organs in the body. **Water** is absorbed by the blood along the small and large intestines,and transported to other organs in the body • **Arteries** carry blood away from the heart. Arteries have thick walls because they carry blood from the heart which is at a high pressure. blood is being pumped through very quickly. They mostly carry oxygenated blood	***Investigate the effect ofexercise on heart rate*** • M&O: Planning to take multiple readings allows anomalous data to be identified and enables a mean to be calculated. Repeats show if our data is repeatable. • A&E: Calculating the mean can be used as a method of analysing data ***Research effects of smokingon the human body, and***

		• **Veins** carry blood back to the heart. They mostly carry deoxygenated blood • Arteries branch into smaller blood vessels called **capillaries**, capillaries are very small and supply our organs (and tissues) with oxygen and nutrients. The capillaries also remove carbon dioxide. • The **heart rate** is how quickly the heart pumps. It is usually measured in beats/min • Muscles need more oxygen when they are being used in exercise, so the heart rate increases • Smoking can damage the lungs, reducing the amount of oxygen that can enter the capillaries; this makes exercise harder. Smoke contains many chemicals, some of whichare also absorbed by the blood and transported around the body. These can causes diseases	***how our scientific understanding has changedover time, including in the current day. The difference between correlation and cause can be discussed in relation to the move from saying smoking is bad for your health to the idea of the many disease smoking cause.***
	Summer 2 **Chemistry** **Physical and Chemical Changes**	• A mixture is two or more substances that are mixed but not chemically joined together • A chemical change is a change where a new substance is formed. • A chemical change has usually taken place if: gas bubbles appear; a new solid appears; it changes colour; or smells different • A physical change is where the substance changes its properties, but it does not become a different substance • Some chemical changes are irreversible, (e.g. cook an egg, rusting iron), but some canbe reversed • Most physical changes are reversible (e.g. water to ice), but some are not (e.g. crack an egg, turn wood into sawdust) • Reversible and irreversible chemical changes can be written as word equations	***Use a Carroll diagram to classify changes as physical/chemical and reversible/irreversible Create and use a classification key to help identify whether a change ischemical/physical and reversible/irreversible Carry out changes and identify whether the changecreated is physical/chemical and reversible/irreversible***

KS3 Curriculum		
Biology	***Physics***	***Chemistry***

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Hereditary is the process by which genetic variation is transmitted from one generation tothe next (KS3) Chromosomes are made of DNA. Small sectionsof DNA are called genes. We inherit genes fromour parents and this is how genetic variation is transmitted from one generation to the next.(KS3) Variation between individuals of the same species is either continuous or discontinuous, thisvariation means that some individuals will compete more successfully and are more likely	• *Electric current is measured in amperes usingan ammeter. Current is a flow of charge (KS3)* • *Current can be measured in parallel and series circuits. The current will be the same atall points in a series circuit (KS3)* • *Current splits where the circuit branches in a parallel circuit, currents add where branches meet (KS3)* • *Potential difference is measured in volts (V) using a voltmeter. It is measured across a component (KS3)*	• In an chemical reaction mass is conserved (KS3) • In a chemical reaction there is a rearrangement of atoms. (KS3) • Chemical reactions can be represented using formulae and equations (KS3) • Examples of types of chemical reactions include combustion, thermal decomposition, oxidation neutralisation and displacement (KS3) • Reactions of acids with metals producesa salt and hydrogen (KS3)

to survive, this drives a process known as natural selection. In this process advantageous versionsof genes are passed onto offspring (KS3) Plants and animals are made of cells. There are similarities and differences between the cells of animals and plants. (KS3) Many plant cells have chloroplasts, and this enable plants to photosynthesise. The reactantsof this process are carbon dioxide and water, and the products are sugar (glucose) and oxygen. (KS3) The differences between species and how this difference can drive natural selection. (KS3) The hierarchical organisation of multicellular organisms. Organisms consist of organ systems which are made of organs. Organs are a collection of different tissues and tissues are made of cells. An example being the circulatory system (KS3) Aerobic respiration occurs in the cells of living organisms, it involves the breakdown of organic molecules (sugar) and using oxygen (KS3) The blood is oxygenated in the lungs and this is transported to the organs (and cells) that require it for aerobic respiration, along with sugar, by the blood vessels in the circulatorysystem (KS3)	• *In a series circuit the sum of the potential difference across all components will equal the battery voltage. In a parallel circuit the potential difference across each of the components will be the same as that of the battery (KS3)* • *Resistance is measured in ohms and is the ratio of potential difference to current (KS3) Conducting and insulating components will differ in resistance (KS3)*	• Reactions of acids with alkalis produces a salt and water (KS3) • Reactions can be endothermic or exothermic (KS3)