**St Catherine’s Catholic Primary school SEP 2022-2023**

St Catherine’s curriculum intent is rooted in our drivers for our pupils to be Amazing Adventurers, Confident Communicators, Ready Readers and Writers being Happy and Healthy and Spiritual and Secure.

Our science curriculum provides for all children using core threads to provide learning coherence with the National curriculum as our starting point we make meaningful connections across subjects to enrich and support knowledge. We review foundational knowledge and skills so that pupils can develop mastery in all subjects through carefully selected vocabulary, sequenced learning and learning that is brought to life through relevant contexts and experiences. Our program in science is drawn together using our science core threads.

**Our Science Big Ideas**

1. All matter in the Universe is made of very small particles
2. Objects can affect other objects at a distance
3. Organisms are organised on a cellular basis and have a finite life span
4. The total amount of energy in the Universe is always the same but energy can be transformed when things change or are made to happen
5. The composition of the Earth and its atmosphere and the processes occurring within them shape the Earth’s surface and its climate.
6. The solar system is a very small part of one of millions of galaxies in the Universe.
7. Organisms are organised on a cellular basis.
8. Organisms require a supply of energy and materials for which they are often dependent on or in competition with other organisms.
9. Genetic information is passed down from one generation of organisms to another.
10. The diversity of organisms, living and extinct, is the result of evolution.

**Core Threads**

The learning of Science is linked by the interplay of the core threads. Pupils at St Catherine’s learn to become scientists linking our core threads of knowledge and skills together.

* Scientific enquiry- methods, technique, equipment, data and evidence.
* Biology
* Chemistry
* Physics.

**EYFS/Year 1 : Autumn 1 and 2 Biology and Physics : The Natural World and Seasonal changes**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | * Use their senses in hands on exploration. * Able to sort clothing to wear in different climates/ types of weather. * Able to dress appropriately to go outside in wet, cold and windy weather. * Can match animals to their young. * Can plant seeds and look after growing plants with support. * Identify that certain animals live in different environments. * Recognise differences between two seasons: spring and winter * Types of weather include sunny, rainy, and windy | Week 1:  Describe some the effects of changing seasons on the natural world.   * 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)   How do seasons change?  Week 2 :   * Investigation – Pzaz – what season was I born in? (Y1)   What season was I born in?  Week 3:   * 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)   Does the weather change through the seasons?  Week 4:  Investigation – Pzaz – What should my rain coat be made of?  What should my raincoat be made of?  Week 5:   * Daytime is when the Earth is facing the Sun; night time is when the Earth is facing away from the Sun * In the summer that there are more hours of daylight and in winter there are fewer hours of daylight * In the summer, we face the sun for more of the day and so it is lighter/darker when we travel to school in summer/winter   How does the daytime and night time change throughout the year?  Week 6: Investigation  Week 7: Assessment and misconceptions  Autumn 2  Week 1:   * The Moon is more visible at night   Why do we see the moon clearer at night?  Week 2:   * Talk about changes they observe e.g. melting and freezing, cooking.   How can water change?  Week 3/4:   * Sequences and talk about the life cycles of living things. Care for the natural world and living things. * Pzaz – observation on worms… (under bugs)   Can I explain what a life cycle is?  What does a worm need to survive?  Week 5:   * Begin to understand what they can do to help the environment (focus on plastic: plastic pollution and reducing their own use of plastics)   How does plastic pollute?  Week 6:  Plastic parade ( music instruments, art work, etc.) (La dauto si links )  How can I protect my planet?  Core thread throughout:   * *Describe what they see, hear and feel when exploring forces and materials* | * • Geography: Observing weather patterns (Y2 Aut) * Earth rotates in 24 hours, meaning that only half of the Earth is facing the Sun at any one time; this creates night and day (Y5 Sum) * The Moon orbits the Earth in 28 days and, during this time, the sun shines on different parts (Y5 Sum) * Seasons are caused by the Earth’s tilt (KS3)   • Geography: Observing weather patterns (Y2 Aut) • Earth rotates in 24 hours, meaning that only half of the Earth is facing the Sun at any one time; this creates night and day (Y5 Sum) • The Moon orbits the Earth in 28 days and, during this time, the sun shines on different parts (Y5 Sum) • Seasons are caused by the Earth’s tilt (KS3) Disciplinary Knowledge Use information from images of four seasons to identify and record differences in wildlife and weather in four season  VOCAB  Season, spring, summer, autumn, winter, weather, hot, warm, cool cold, sunny, cloudy, windy, rainy, snowing, hailing, sleet, frost, fog, mist, icy, rainbow, thunder, lightning, storm, light, dark, day, night, moon, sun  Plastic, pollution, lifecycle, stage |
| **Disciplinary knowledge** |  | * Use information from images of four seasons to identify and record differences in wildlife and weather 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 | * A&P: Scientists look for patterns in data to try to identify correlations (Y5) * M&O: Gather information from the internet (Y3 ) |
| **Core threads** |  | • 5: The weather can change rapidly. Different seasons have different weather patterns  • 6: Daytime is when the Earth is facing the Sun; nighttime is when the Earth is facing away from the Sun | • 5: The air is all around us on Earth (Y2)  • 5: Weather is determined by conditions of the air. The temperature, pressure, direction and speed of the movement and the amount of water vapour in the air combine to create the weather (KS3)  • 6: The Moon reflects light from the Sun (Y3 |

**EYFS/Year 1 : Spring 1 Chemistry: Everyday Materials**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | * Materials melt when it is hot and freeze when it is cold * Able to name different material from their everyday life. | Week 1:   * 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, and its purpose is for drinking from. * Pzaz - The Curly Wurly experiment   What is an object?  Week 2:   * 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 * Describe what they see, hear and feel when exploring forces and materials.   What are objects made of?  Week 3:   * 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.   Are all materials the same?  Week 4:   * Materials can be grouped in a number of ways based on their physical properties   How can I group materials?  Week 5 :   * Talk about changes they observe e.g. melting and freezing, cooking * The material that we choose to make an object from depends on its purpose (e.g. no chocolate kettle * Pzaz – Year 1 – design an umbrella   How do we choose the best material to make an object?  Week 6 : Assessment and Misconceptions | * Materials have physical properties that make them better or worse for certain uses, such as waterproof, absorbent, windproof, heatproof, malleable * Materials such as wood, metal, plastic, brick, rock, paper and cardboard have these physical properties to different extents (Y2 ) * Different combinations of materials could be used to create different object, including a wall, a mop and a saucepan (Y2)   VOCAB  Object, material, wood, plastic, glass, metal, water, rock, brick, paper, fabric, elastic, foil, cardboard, rubber, wool, clay, hard, soft, stretchy, stiff, bendy, waterproof, absorbent, tear, rough, smooth, shiny, dull, see through, not see through |
| **Disciplinary knowledge** | • Use a table to classify items based on properties | * Sort materials into a Carroll diagram based on their characteristics * 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 a dog 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 | * A&P: The thing that we measure is called the dependent variable; the thing we change is the independent variable (Y3 |
| **Core threads** |  | * 4: Things around us can be made to change or happen. We can pull objects behind us or push them across the table | * 4: All living things need food to give them energy (Y2) * 4: The arrows in a food chain show where energy is being transferred from and to (Y2 |

**EYFS/Year 1 : Spring 2 Biology: Plants**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | * Recognise differences between two seasons: spring and winter | Week 1:  A plant is a living thing that usually grows in one place   * Tree hunt observation   Is a plant a living thing?   * Week 2:  Trees are a type of plant that have a tall stem made of wood  - Plant hunt observation   How can you recognise a tree?  Week 3:   * Coniferous plants keep their leaves all year round (e.g. pine, yew, juniper in UK)   What makes a plant coniferous?  Week 4:   * Deciduous plants lose their leaves in winter (e.g. oak, silver birch, horse chestnut, sycamore, ash)   What makes a plant deciduous?  Week 5:   * The basic parts of a plant are leaves, flowers, roots, stem/trunk/branch * Can talk about what a plant needs to grow   What are the parts of a plant and what do they need to grow?  Week 6: Assessment and misconceptions | • Plant growth from germination (Y2)  • Requirements for plant life (Y2, Y3)  • Purpose of leaves, stem/trunk, roots and flowers (Y3)  • Coniferous trees transport their seeds in cones; deciduous trees use seeds and flowers/fruit (Yr3 Spr)  • Classifying plants (Y4  VOCAB  Names of: wild plants, garden pants, flowering plants, trees, leaf, flower, blossom, petal, fruit, berry, root, bulb, seed, trunk, branch, stem, bark, stalk, vegetable  Coniferous, deciduous |
| **Disciplinary knowledge** | • M&O: Measure/observe using senses | * 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 images of them at different times in the year * R&P: Use a table to classify items based on properties | * R&P: Use Carroll diagrams (Y1 Spr), * Venn diagrams (Y1 Sum), and a pair of axes (Y2) to classify items based on properties |
| **Core threads** |  | • 5: Plants grow in soil  • 8: There is a wide variety of living things  • 10: There are many different kinds of plants and animals in the world today. | • 5: Much of the solid surface of the Earth is covered in soil, which is a mixture of pieces of rock of various sizes and the remains of organisms. Some soil also contains air, water and some nutrients (Y3) |

**EYFS/Year 1 : Summer 1 Biology: Animals**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | * A plant is a living thing that usually grows in one place (Y1 Aut) * Coniferous plants keep their leaves all year round (e.g. pine, yew, juniper in UK) (Y1) * Deciduous plants lose their leaves in winter (e.g. oak, silver birch, horse chestnut, sycamore, ash) (Y1) | Core thread: Care for the natural world and living things.   * Week 1:  -Animals are different to plants because they usually move around, rather than stay in the same place   How are animals and plants different?  Week 2:   * Animals have different features, including fins, wings, scales, legs, feathers, claws, paws etc.   Do all animals look the same?  Week 3:  Animals can be grouped into fish, amphibians, reptiles, birds and mammals (name common examples) How can we group animals?  Week 4:   * Animals can be placed into different groups (carnivores, herbivores and omnivores) based the foods they eat.   What do animals eat?  Week 5:   * Sequences of and talk about the life cycles of living things   How do living things grow?  Week 6: Assessment and misconceptions | • Classification refers to a method used to place all living things into groups.(Yr4 )  • 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 breed(Yr4)  • Early classification from Aristotle placed animals into groups based on land, water and air, plants were grouped according to size, small, medium and large(Yr4)  • Fish, amphibians, reptiles, birds and mammals are all vertebrates (Yr4)  • Vertebrates have endoskeletons (Yr4)  • 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.(Yr4)  • Invertebrates can be grouped based on their characteristics as snails and slugs; worms; spiders and insects (Yr4)  VOCAB  tail, wing, claw, fin, scales, feathers, fur, beak, fish, amphibians, reptiles, birds, mammals, carnivores, herbivores and omnivores |
| **Disciplinary knowledge** | • A&P: Scientists group objects or living things based on their properties (Y1 Spr)  • M&O: Gather information from text/books/images (Y1 Aut)  • R&P: Use a Carroll diagram to classify items based on properties (Y1 Spr | -Research different animals and use images and text to classify the animals as herbivores, carnivores or omnivores, and based on their physical characteristics • A&P: Scientists conduct secondary research to learn from what other scientists have already learned  • R&P: Use a Venn diagram to classify items into two or three sets based on properties | • A&E: Science is never 'complete' and scientists are always working to make models more accurate or to discover new explanations (Y5) |
| **Core threads** |  | • 8: There is a wide variety of living things, including plants and animals | • 8: Plants and animals are dependent on each other (Y2) |

**EYFS/Year 1 : Summer 2 Biology: Humans.**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | • Animals can be grouped into fish, amphibians, reptiles, birds and mammals (name common examples) (Y1 Sum)  • Animals can be placed into different groups (carnivores, herbivores and omnivores) based the foods they eat (Y1 Sum) | Week 1:   * Humans are omnivores, but some choose to eat only plants   Do all humans eat the same foods?  Week 2:   * 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.   Can I name parts of the human body?  Week 3: - Pzaz - Do older pupils have bigger hands?  Investigation  Week 4:   * Humans have five senses, smell, taste, touch, sight and hearing. * Pzaz – mystery smells   What are the five senses?  Week 5:   * The five senses are each associated with different body parts (eyes, ears, nose, tongue)   Can I match the different senses to the body part?  Week 6: Assessment and misconceptions | • The main food groups are carbohydrates (starch and sugars), proteins, fats, dairy, fruit and vegetables(Y3)  • Humans need a balanced diet which is made of main food groups (Y3)  • Our skeleton is made up of bones that grow as we grow (Y3)  • Humans and some other animals have skeletons (Y3)  • 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. (Y3)  • The skeleton protects organs, e.g. the skull protects the brain; and the ribcage protects the lungs, heart and other important organs (Y3)  • The skeleton supports the body, e.g. the spine helps the body stand (Y3)  • The skeleton helps the body move, e.g. pelvis and knee joints (Y3)  • The muscles and skeleton are required to help the body move. When muscles contract they pull the bone (Y3)  VOCAB  Body, head, neck, arms, elbows, legs, knees, face, ears, eyes, eyebrows, eyelashes, nose, hair, mouth, teeth, tongue, feet, toes, fingers, nails, ankle, calf, thigh, hips, waist, trunk, chest, shoulders, back, hands, wrist,  smelling, tasting, smooth, bright, dim, loud, quiet, high, low, , senses, hearing, seeing, touching, |
| **Disciplinary knowledge** | • Draw a diagram, a simple scientific drawing that explains or informs. | * Draw a scientific diagram, labelling key human body parts |  |
| **Core threads** |  | • 7: Living things, including humans, react to their surroundings with their senses | 7: Living things grow, need, water, air and food, react to their surroundings, move, get rid of their waste, reproduce (Y2) |

**Year 2/3: Autumn 1 Physics : Light**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | • Daytime happens when we are facing the sun; nighttime happens we are facing away from the sun (Y1)  • The Moon is more visible at night (Y1) | Week 1:   * Solid objects cast a shadow, the shadow can be changed if the solid object is changed in shape. * Shadows form behind an opaque object when light from a source is blocked   Do all objects cast a shadow?  Week 2   * The shape of shadows changes with the angle and the distance of the light source   Investigation – Pzaz – Shadow length investigation  Can you change the shape of a shadow?  Week 3:   * Light travels in straight lines * We see when light enters our eyes * Light from the sun can be dangerous and there are ways to protect our eyes   How does light travel?  Week 4:   * Darkness is the absence of light * Sources of light emit their own light, and others reflect light; both occur in nature as well as man-made objects   Does all light have its own source?  Week 5:   * Some objects are more reflective than others * Opaque, translucent and transparent materials allow no some or all light to pass through them   What properties do good reflectors have?  Week 6:  Assessment and misconceptions | • In ray diagrams, straight lines with arrows show where the energy is being transferred from and to by light (Y6)  • 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 (Y6)  • On a rough surface, light will be reflected in all directions. This is known as diffuse reflection (Y6)  • Specular reflection between mirrors allow us to see the objects that do not directly reflect light into our eyes (e.g. periscope) (Y6)  • When light meets an opaque object, some of the light is reflected and some of it is absorbed (Y6)  • White light, which comes from most light sources we use in the classroom, contains all the colours of the visible spectrum (Y6)  • When a light meets a surface, some colours are absorbed and some are reflected. We see the colour(s) that are reflected (Y6)  • 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 (Y6)  VOCAB  Light, light source, darkness, reflect, reflective, mirror, shadow, block, direction, transparent, opaque, translucent, properties, absence |
| **Disciplinary knowledge** | Mathematics: Measure length and height (cm/m) (Y2)  • A&P: There are four main stages of enquiry (A&P, M&O, R&P, A&E) (Y2)  • A&P: Scientists look for patterns in the world around them; they conduct investigations to identify whether a pattern they think they've seen is really there (Y2)  • 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 (Y1 | * Investigate how the height of a shadow varies as the distance between light source and object changes * A&P: A dependent variable is what you measure; 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 | • A&P: Scientists must work out if the factor is the cause of the outcome in a correlation (Y5 |
| **Core threads** | * 6: Daytime is when the Earth is facing the Sun; nighttime is when the Earth is facing away from the Sun (Y1) | • 2: Objects can have an affect on other objects even when they are not in contact with them. Light reaches our eyes, even though the light source may be far away  • 6: The Moon reflects light from the Sun | • 2: The non-contact force of magnetism mean magnets can attract or repel other magnets (Y3)  • 6: Our Sun is one of many stars that make up the Universe (Y5) |

**Year 2/3: Autumn 1 Physics: Forces and Motion**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** |  | Week 7: 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.   What are pushes and pulls? | • Contact forces require contact between two objects (e.g. friction). Non-contact forces can affect an object at a distance (e.g. magnetism) (Y3)  • Friction is a contact force between two surfaces that are sliding or trying to slide over each other (Y3)  • Magnetism is a non-contact force exerted by magnets when they attract or repel each other (Y3)  • Gravity is a non-contact force (Y5)  • Air and water resistance are contact, frictional forces (Y5) |
| **Disciplinary knowledge** | • Mathematics: Measure length and height (cm/m) (Y2)  • A&P: Science is studied as three disciplines: biology (study of living organisms), chemistry (study of materials) and physics (study of energy) (Y3)  • A&P: Dependent, independent and control variables (Y3)  • R&P: Design a table to collect data with the appropriate number of rows and columns and correct headings  • A&E: Make simple statements about the results of an enquiry | 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  • 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…') | • The difference between accurate data and precise data (KS3)  • Using the mean as a method of analysing a set of data (Y6 |
| **Core threads** |  | • 3: Forces can push, pull or twist objects, making them change shape or motion  • 3: Things can only change their motion if there is a net force acting on them  • 3: When forces acting on an object are not equal and opposite in direction, they are unbalanced and will change an object’s speed, direction or shape | • 3: An object on Earth pulls the Earth as much as the Earth pulls the object, but because the Earth’s mass is much bigger, we observe the motion of the object (Y5) • 3: The downward force of gravity on an object on the Moon is less than that on Earth because the Moon has less mass on Earth (Y5 |

**Year 2/3 Autumn Term 2 Physics: Friction and Magnetism**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | Forces are pushes or pulls or twists (Y3)  Forces can cause a change in speed, direction or shape of an object (Y3)  Forces act in particular directions (Y3)  Forces that act in opposite directions are called opposing forces (Y3)  Forces that are equal and act in opposite directions are described as balanced forces, they cancel each other out (Y3)  Geography: The North Pole and the South Pole are at the top and bottom of the Earth (Y1) | Week 1:   * Contact forces require contact between two objects (e.g. friction). Non-contact forces can 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   What is a contact force?  Week 2:   * 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   Compare how things move on different surfaces. -Pzaz – Shoe friction investigation.  Can I calculate speed? Do different surfaces affect speed?  Week 3:   * 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 magnets pull 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  - Pzaz -Polar opposites (inc. predict whether two magnets will attract or repel each other)   Can I explain if magnetism is a force?  Week 4   * Some metals are magnetic but not all are. Plastics, wood, fabric, glass are all non-magnetic  -Pzaz – magnetic materials investigation   Are all materials attracted to magnets?  Week 5   * The stronger the magnet, the heavier the object it can attract or the further away it can attract the object from   Can I link of magnets to force?  Week 6: Assessment and misconceptions | • Force is measured in newtons (Y5)  • Gravity is a non-contact force that pulls all objects towards each other (Y5)  • The greater the mass of an object, the greater the gravitational pull around it (Y5)  • Gravity is most commonly experienced as the pull of the Earth (and all objects on it) towards each other (Y5)  • 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 (Y5)  • Air resistance is a frictional force that acts between air and a moving object to slow it down (Y5)  • Water resistance is a frictional force that acts between water and a moving object to slow it down (Y5)  VOCAB  Force, contact force, non contact force, magnetic force, magnet, strength, attract, repel, magnetic material, metal, iron, steel, non magnetic, poles, north/south pole |
| **Disciplinary knowledge** | • Mathematics: Measure length and height (cm/m) (Y2)  • A&P: Dependent, independent and control variables (Y3)  • A&E: Draw conclusions (e.g. 'the greater the… , the greater the…') | * Investigating shoe on different surfaces• 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 | • |
| **Core threads** | • 2: Objects can have an affect on 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) | * 2: The non-contact force of magnetism mean magnets can attract or repel other magnets | • 2: Sound comes from things 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 (Y4) |

**Year 2/3 : Spring Term 1 Chemistry: Uses of everyday materials (including Rocks uses and types.)**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | * An object is a ‘thing’ that can be seen and touched (Y1) * Objects have a name and often have a purpose for example a cup is the object and its purpose is for drinking from.(Y1) * 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 (Y1) * 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) * Materials can be grouped in a number of ways based on their physical properties (Y1) * The material that we choose to make an object from depends on its purpose (e.g. no chocolate kettle) (Y1) | Week 1   * Matter is all the 'stuff' that we experience in everyday life, including air, water, tables and us! * The shape of some solid objects made from some materials can be changed by squashing, bending, twisting or stretching the material   Can you change the shape of a solid object?  Week 2   * Materials have different physical properties such as malleable, waterproof, heatproof, windproof and absorbent. * These physical properties make the materials more suitable for certain uses Investigation * Everyday materials such as wood, metal, plastic, brick, rock, paper and cardboard have these physical properties but to different extents * Different combinations of materials can be used to create different objects, for example a saucepan or a mop.   Do all materials have the same properties?  Week 3  Rocks   * . Soils are made from rocks and organic matter.   Pzaz investigation Making a Metamorphic Rock  How are rocks formed?  Week 4   * Rocks can be grouped on the basis of their appearance and simple physical properties   Pzaz investigation - Rock Porosity  How can rocks be grouped?  Week 5   * Fossils are formed by layers of mud and sediment hardening the organic remains of a body of plant into rock. Erosion reveals the fossil   How are fossils formed?  Week 6  Assessment and misconceptions | * There are three states of matter: solid, liquid and gas (Y2) * Physical properties include being malleable, windproof, hard/soft, opaque/transparent, magnetic, electrical conductivity, thermal conductivity, and boiling and melting points (Y5) * Chemical properties are properties that scientists need specialist equipment to measure (Y5)   VOCAB  Suitable/unsuitable, use, , property, wood, plastic, glass, metal water, rock, fabrics, stretchy, flexible, waterproof, absorbent, transparent, translucent, opaque, shape, change, twist, squash, bend, stretch, roll, squeeze  Rock, stone, sedimentary, igneous, metamorphic, permeable, impermeable, marble, chalk, granite, sandstone, slate, sandy soil, clay soil, chalky soil, peat, sediment, organic matter, fossil |
| **Disciplinary knowledge** | * 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 (Y1) * M&O: Make systematic observations of an object (Y2 ) * R&P: Use a Carroll diagram to classify items based on properties (Y1 ) * A&E: Make simple statements about the results of an enquiry (Y1) | * Classify materials based on the 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 displays two properties * 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 |  |
| **Core threads** |  | * 1: All the ‘stuff’ encountered in everyday life, including air, water and different kinds of solid substances is called matter * 1: Different materials are recognisable by their properties | • 1: The amount of material does not change when a solid melts or a liquid evaporates (Y4)  • 1: If a material could be divided into smaller and smaller pieces it would be found to be made of pieces, particles, smaller than can be seen even with a microscope. These particles are not in a material; they are the material (Y4). |

**Spring Term 1 Chemistry: Solids, liquids and gases- states of matter ( To be covered in a science day)**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | * Understand some important processes and changes in the natural world around them, including the seasons and changing states of matter (EYFS) * An object is a ‘thing’ that can be seen and touched (Y1) * Objects have a name and often have a purpose for example a cup is the object and its purpose is for drinking from (Y1) | * 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 • 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 cut them or squash them. * 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 * 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 state it 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   How do states of matter differ from each other?  Assessment and misconceptions | VOCAB  States of matter, solid, liquid, gas, substance  air, oxygen, change state, ice/water/steam, water vapour, heating, cooling, temperature, melt, freeze, solidify, melting |
| **Disciplinary knowledge** | * A&P: Scientists group objects or living things based on their properties (Y1) | * Classify different substances as solids, liquids or gases |  |
| **Core threads** | * 1: All the ‘stuff’ encountered in everyday life, including air, water and different kinds of solid substances is called matter (Y1) |  | • 1: If a material could be divided into smaller and smaller pieces it would be found to be made of pieces, particles, smaller than can be seen even with a microscope. These particles are not in a material; they are the material (Y4). |

**Year 2/3 Spring Term 2 Biology- Plants- including functions of flowering plants (Yr3)**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | • The basic parts of a plant are leaves, flowers, roots, stem/trunk/branch (Y1 )  • Plants are classed as living things because they grow, move, reproduce, and need nutrition (food) (Y1) | Week 1   * Plants need water, light and a suitable temperature to grow * When a plant grows it gets bigger. * Many plants make fruits or vegetables; some of these grow below ground   What does a plant need to grow and how does it change?  Week 2   * 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   Can I identify the parts of a seed?  Week 3   * Germination is the development of a plant from a seed. During germination roots and shoots emerge and grow   Can I describe the embryonic stage of the plant life cycle?  Week 4   * To germinate a seed needs water and a certain temperature * Temperature is a measure of how hot or cold something is * Pzaz investigation What Conditions Do Seeds and Bulbs Need to Germinate?   What does a seed need to germinate?  Week 5   * Some plants grow from bulbs. A bulb is a resting stage for certain plants. They have a large underground food store, short stems and fleshy leaves.   Can I describe how some plants grow from bulbs?  Week 6  Assessment and misconceptions | * The four main stages of the plant's life cycle include germination, pollination, fertilisation and seed dispersal (yr3) * 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.(Y3) * Seeds can be dispersed in a variety of ways (Y3) * Plants need air (oxygen and carbon dioxide), water, light, nutrients from the soil, space, and a suitable temperature to grow (Y3) * Requirements for life vary from plant to plant and they adapt to their environment (e.g. some plants need less space, a lower temperature, fewer nutrients etc.) (Y3) * Roots absorb nutrients from the soil and help anchor the plant (Y3) * The stem/trunk supports the plant and transports water up the plant. The xylem transports water and nutrients from the roots, and the phloem transports food from the leaves to the all parts of the plant (Y3) * Leaves use sunlight, carbon dioxide from the air and water to make their own food (Y3 Spr)   VOCAB  seeds, bulbs, shoot, seedling, nutrients, soil, fertiliser, transported, life cycle, pollination, seed formation, germination, embryonic  transported, life cycle, pollination, seed formation, seed dispersal, xylem, phloem germination |
| **Disciplinary knowledge** | * Maths: Use words to describe lengths and heights (Y1) * 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 (Y1) * M&O: Measure/observe using senses (EYFS) * R&P: Record numerical or descriptive observations in a table (Y1) * A&E: Make simple statements about the results of an enquiry (Y1) | * Investigate the conditions required for germination * A&P: Make a prediction based on substantive knowledge Investigate how light affects the growth of plants * M&O: Make systematic observations of an object | * Explain findings using scientific knowledge (Y3) * The thing that we measure is called the dependent variable; the thing we change is the independent variable (Y3) |
| **Core threads** |  | * 9: Plants and animals reproduce (have offspring) | * 9: Organisms produce offspring of the same kind, but in many cases offspring are not identical with each other or with their parents (Y5) |

**Year2/3 Summer Term 1 Biology: Living things and their habitats including needs of animals and organisms**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | * Geography: Deserts are places where there is very little precipitation (Y2) * Geography: Hot deserts have a very hot and dry climate (Y2 ) * Geography: Cold deserts have a very cold and dry climate (Y2) * Temperature is a measure of how hot or cold something is (Y2) * Plants need water, light and a suitable temperature to grow (Y2) * Animals, including humans, need water, food, air, and the right temperature to survive (Y2) * Animals can be grouped into fish, amphibians, reptiles, birds and mammals (name common examples) (Y1 ) * Temperature is a measure of how hot or cold something is (Y2) * Plants need water, light and a suitable temperature to grow (Y2) * Plants are classed as living things because they grow, move, reproduce, and need nutrition (food) (Y1) | Week 1   * 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 of their waste, reproduce * Animals move from place to place, while plants move on the spot. Mrs Gren   How can I identify if something is alive?  Week 2   * 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. * Pzaz Habitat Survey and Habitat File   What is a habitat and what does it provide?  Week 3   * 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 * Animals, including humans, need water, food, air, and the right temperature to survive * 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   What is a food chain? How do living things adapt to their environment?  Week 4   * 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) * Animals, including humans, need water, food, air, and the right temperature to survive   What is a life cycle?  Week 5   * The main food groups are carbohydrates (starch and sugars), proteins, fats, dairy, fruit and vegetables * Vitamins, minerals and fibre are needed and being deficient in these causes diseases • Different animals have different nutritional needs   Can food be put into different groups? Do all animals have the same nutritional needs?  Week 6   * Humans need exercise to stay healthy * Humans need to eat a healthy and balanced diet. * Humans need to practice hygiene to stay healthy   What do humans need to stay healthy?  Assessment and Addressing misconceptions | The main food groups are carbohydrates (starch and sugars), proteins, fats, dairy, fruit and vegetables. Humans need a balanced diet of these (Y3).  Vitamins, minerals and fibre are needed and being deficient in these causes diseases (Y3)  Different animals have different nutritional needs (Y4)  A food chain starts with a producer (usually a plant) who can produce its own food. Organisms that eat producers are called consumers (Y4)  A predator hunts prey to eat (Y4)  A food web shows the transfer of energy between different organisms (Y4)  An ecosystem is made up of all organisms living in an area and the non-living features of the environment (Y4) Animals and plants need to digest food to transfer energy from it (Y4)  Geography: Adaptations of plants and animals in different climate zones, including tundra and hot desert (Y5)  • Life cycles of hedgehogs, peregrine falcons, frog and ladybird, including metamorphosis (Y5)  • Living things grow, need air and nutrients, react to their surroundings, move, get rid of their waste, reproduce (Y2)  • Living things are adapted to their environment. This means they may not be able to survive in other habitats (Y2)  • The main food groups are carbohydrates (starch and sugars), proteins, fats, dairy, fruit and vegetables (Yr3)  • Humans need a balanced diet which is made of main food groups (Y2)  • Vitamins, minerals and fibre are needed and being deficient in these causes diseases (Y2)  • Different animals have different nutritional needs (Y2 )  VOCAB  Living, dead, never been alive, names of local habitats, pond,  woodland, meadow, micro habitats, under log, stony path, under bushes, suited, basic needs, depend, food, food chain, shelter, food chain, producer, consumer, predator, prey  offspring, life cycles, grow, change, adults, basic needs, water, food, air survival, exercise, hygiene, balanced diet, vitamin, ,carbohydrates, dairy, fats and oils, fruits and vegetables, proteins |
| **Disciplinary knowledge** | * A&P: Scientists conduct secondary research to learn from what other scientists have already learned (Y1 ) * A&P: Scientists group objects or living things based on their properties (Y1 ) * M&O: Gather information from text/books/images (Y1) * R&P: Use a Carroll diagram to classify items based on properties (Y1) | * Gather information from images and text and sort images into a Carroll diagram based on the animal kingdom and extent of change. * Science is studied as three disciplines: biology (study of living organisms), chemistry (study of materials) and physics (study of energy | • Using and drawing a classification key to classify organisms (Y4  • 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) (Y5) |
| **Core threads** | • 7: Living things, including humans, react to their surroundings with their senses (Y1)  • 9: Plants and animals reproduce (have offspring) (Y1) | * 5: The air is all around us on Earth • 7: Living things grow, need, water, air and food, react to their surroundings, move, get rid of their waste, reproduce * 8: All living things need energy for food, as well as air, water and certain temperature conditions | • 5: There is less and less air further away from the Earth’s surface; space is a vacuum (Y5)  • 7: Living things need water, air, food, a way of getting rid of water and an environment that stays within a particular temperature range (Y3 |

**Year 2/3 Summer 2 Biology: Growing Things- humans and plants.**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | • 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, ears, eyes, nose, mouth, arms, legs, hands, feet, toes(Y2 ) | Week 1   * 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 protects the 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 joint. * The muscles and skeleton are required to help the body move. When muscles contract they pull the bone   What is the human body made up of?  Week 2   * Some organisms have endoskeletons, some have exoskeletons, and some have neither. * Endoskeletons grow with the organisms,   Are all skeletons on the inside of organisms?  Week 3   * 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   What do plants need to grow?  Week 4   * 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 transports water 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   Pzaz investigation Celery Xylems  What are the functions of the parts of a plant?  Week 5   * 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 seeds can be self-propelled (pea pod)   What are the stages of the plant’s life cycle?  Week 6  Assessment and misconceptions | • Invertebrates can be placed into groups based on their skeletons; endoskeletons, exoskeletons, or hydrostatic skeletons (Y4)  • There are four main types of teeth: incisors, canines, pre-molars and molars. They each have a different purpose (Y4)  • Herbivores, carnivores and omnivores have these types of teeth in different proportions (Y4 )  • Animals and plants need to digest food to transfer energy from it (Y4)  • The digestive system is the group of organs that help your body digest food (Y4 )  • The heart is a muscle that pumps blood around the body through blood vessels (Y6)  VOCAB  skeleton, muscles, support, protection, vertebrate, invertebrate, endoskeleton, exoskeleton,  transported, life cycle, pollination, seed formation, seed dispersal, xylem, phloem germination, pollination, fertilisation and seed dispersal |
| **Disciplinary knowledge** | • R&P: Draw a diagram, a simple scientific drawing that explains or informs  • Mathematics: Measure length and height (cm/m) (Y2); Interpret and construct block diagrams (Y2)  • A&P: Dependent, independent and control variables (Y3) • A&P: Make a prediction based on substantive knowledge (Y2)  • A&P: Scientists identify factors in an investigation that should be controlled, and try to find ways to control them | * Science is studied as three disciplines: biology (study of living organisms), chemistry (study of materials) and physics (study of energy) Label the main bones on a diagram of a human skeleton, give the function of each bone. * Investigate the how water travels up the xylem * 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. | * 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) (Y5 |
| **Core threads** | • 4: All living things need food to give them energy (Y2)  • 4: All living things need food to give them energy (Y2)  • 7: Living things grow, need, water, air and food, react to their surroundings, move, get rid of their waste, reproduce (Y2)  • 8: Most plants make their own food (Y2) | * 7: Living things – organisms – need water, air, food, a way of getting rid of water and an environment that stays within a particular temperature range * 8: Plants make their own food using sunlight, carbon dioxide and water | • 7: Micro-organisms are organisms that are so small that we cannot see them with our eyes alone (Y6)  • 8: Animals are ultimately dependent on plants for their survival (Y4) |

**Year 3/4 : Autumn Term 1 Physics -Forces and Motion/ states of matter**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | * Solids keep their shape unless a force is put on it. They will change their shape if you cut or squash them (Y2) * • Materials melt when it is hot and freeze when it is cold (EYFS) * Geography: Precipitation is the fall of water as rain, sleet, snow or hail (Y2) * All materials of made of a single substance or a mixture of substances (Y2 Sum) * There are three states of matter: solids, liquids and gases (Y2) * Liquids take the shape of the container they are in, when you move the liquid into a different container the shape will change (Y2) * Solids keep their shape unless a force is put on it. They will change their shape if you cut them or squash them (Y2) * 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) * We can decide if 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 state it is still the same substance (Y2) * • Each substance in its state of matter is made up of parts that are too small to see without magnification (Y2) | Week 1:   * 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!   Do forces behave in different ways?  Week 2:   * 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.   What happens when forces are unbalanced?  Week 3:   * 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 * Compare how things move on different surfaces. -Pzaz – Shoe friction investigation.   How does the surface type affect the speed of an object?  Week 4:   * 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   How do particles differ in a solid, liquid and gas?  Week 5:   * 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 become liquids 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   Can substances change their state of matter?  Week 6:   * 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   Can I describe the processes of change?  Week 7: Assessment and misconceptions | • Contact forces require contact between two objects (e.g. friction). Non-contact forces can affect an object at a distance (e.g. magnetism) (Y3)  • Friction is a contact force between two surfaces that are sliding or trying to slide over each other (Y3)  • Magnetism is a non-contact force exerted by magnets when they attract or repel each other (Y3)  • Gravity is a non-contact force (Y5)  • Air and water resistance are contact, frictional forces (Y5)  • 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 goes up. The particles in the solid therefore move more (Y5)  • 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  VOCAB  Force, contact force, non contact force, magnetic force, magnet, strength, attract, repel, magnetic material, metal, iron, steel, non magnetic, poles, north/south pole  States of matter, solid, liquid, gas, air, oxygen, ice/water/steam, water vapour, heating, cooling, temperature, degrees celcius, melt, freeze, solidify, melting point, boil, boiling point, evaporation, condensation, water cycle, precipitation, transpiration |
| **Disciplinary knowledge** | • Mathematics: Measure length and height (cm/m) (Y2)  • A&P: Science is studied as three disciplines: biology (study of living organisms), chemistry (study of materials) and physics (study of energy) (Y3 Spr)  • A&P: Dependent, independent and control variables (Y3 Aut)  • R&P: Design a table to collect data with the appropriate number of rows and columns and correct headings  • A&E: Make simple statements about the results of an enquiry | * Investigate the friction on shoes with different surfaces * • 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 * • 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…' | • The difference between accurate data and precise data (KS3)  • Using the mean as a method of analysing a set of data (Y6 |
| **Core threads** | • 1: All the ‘stuff’ encountered in everyday life, including air, water and different kinds of solid substances is called matter (Y2)  • 1: Different materials are recognisable by their properties (Y2) | • 3: Forces can push, pull or twist objects, making them change shape or motion  • 3: Things can only change their motion if there is a net force acting on them  • 3: When forces acting on an object are not equal and opposite in direction, they are unbalanced and will change an object’s speed, direction or shape  • 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: Science is studied as three disciplines: biology (study of living organisms), chemistry (study of materials) and physics (study of energy) (Y3)  • A&P: Scientists identify potential hazards in their experiments and plan ways to reduce them (Y2)  • R&P: Draw a diagram, a simple scientific drawing that explains or informs  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  1: The amount of material does not change when a solid melts or a liquid evaporates  • 1: If a material could be divided into smaller and smaller pieces it would be found to be made of pieces, particles, smaller than can be seen even with | * 3: An object on Earth pulls the Earth as much as the Earth pulls the object, but because the Earth’s mass is much bigger, we observe the motion of the object (Y5) * 3: The downward force of gravity on an object on the Moon is less than that on Earth because the Moon has less mass on Earth (Y5) * A&P: Scientists must work out if the factor is the cause of the outcome in a correlation (Y5) * 1: When some materials combine, they do not change permanently and can be separated again (Y5) • 1: Materials can be changed by heating and cooling (Y5 |

**Year 3/4 : Autumn Term 2 Physics: Forces- friction, magnetism and sound.**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | Forces are pushes or pulls or twists (Y3)  Forces can cause a change in speed, direction or shape of an object (Y3)  Forces act in particular directions (Y3)  Forces that act in opposite directions are called opposing forces (Y3)  Forces that are equal and act in opposite directions are described as balanced forces, they cancel each other out (Y3)  Geography: The North Pole and the South Pole are at the top and bottom of the Earth (Y1)  Humans have features that are associated with each sense (eyes, ears, nose, mouth and tongue) (Y1) | Week 1:   * Contact forces require contact between two objects (e.g. friction). Non-contact forces can 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   What is a contact and non-contact force?  Week 2:   * 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 magnets pull 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  - Pzaz -Polar opposites (inc. predict whether two magnets will attract or repel each other)   Can you explain if magnetism is a force?  Week 3:   * Some metals are magnetic but not all are. Plastics, wood, fabric, glass are all non-magnetic  -Pzaz – magnetic materials investigation * The stronger the magnet, the heavier the object it can attract or the further away it can attract the object from   Are all materials attracted to magnets?  Week 4:   * 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.   How are sounds made?  Week 5:   * 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   Why do sounds travels through solids much better than other states of matter?  Week 6:   * The volume and pitch of sound can change - Pzaz – straw panpipes   How does the volume and pitch of sound change?   Week 7 : Assessment and misconceptions | • Force is measured in newtons (Y5)  • Gravity is a non-contact force that pulls all objects towards each other (Y5)  • The greater the mass of an object, the greater the gravitational pull around it (Y5)  • Gravity is most commonly experienced as the pull of the Earth (and all objects on it) towards each other (Y5)  • 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 (Y5)  • Air resistance is a frictional force that acts between air and a moving object to slow it down (Y5)  • Water resistance is a frictional force that acts between water and a moving object to slow it down (Y5)  VOCAB  magnetic force, magnet, strength, magnets, attract, repel, magnetic material, metal, iron, steel, non magnetic, poles  Sound, sound source, noise, vibration, travel, pitch, tune, high, low, volume, loud, quiet, fainter, muffle, strength of vibrations, insulation, |
| **Disciplinary knowledge** | • Mathematics: Measure length and height (cm/m) (Y2)  • A&P: Dependent, independent and control variables (Y3)  • A&E: Draw conclusions (e.g. 'the greater the… , the greater the…') | * 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 | • The non-contact force of gravity makes things fall to Earth (Y5)  • 2: There is gravitational force between all objects, but it is only felt when one or more of the objects has a very large mass (Y5) |
| **Core threads** | • 2: Objects can have an affect on other objects even when they are not in contact with them. | * 2: The non-contact force of magnetism mean magnets can attract or repel other magnets * 2: Sound comes from things 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 | • 2: Sound comes from things 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 (Y4) |

**Year 3/4 Spring Term 1 Biology: Living things and their habitats.**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | • Plants are classed as living things because they grow, move, reproduce, and need nutrition (Y1)  • Animals can be grouped into fish, amphibians, reptiles, birds and mammals (name common examples) (Y1)  • Animals can be placed into groups (carnivores, herbivores, omnivores) based on what they eat (Y1)  • Animals, including humans, reproduce. This means they have offspring that grow into adults (Y2)  • Living things are called organisms (Y2)  • Animals move from place to place, while plants move on the spot (Y2)  • Habitats are the places that living things live. A very small habitat is called a micro-habitat (Y2)  • Living things are adapted to their environment. This means they may not be able to survive in other habitats (Y2)  Trees are a type of plant that have a tall stem made of wood (Y1)  • The basic parts of a plant are leaves, flowers, roots, stem/trunk/branch (Y1)  • Germination is the development of a plant from a seed , during germination roots and shoots emerge and grow (Y1)  • Germination is the development of a plant from a seed. During germination roots and shoots emerge and grow  • 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. To germinate, a seeds needs water and a certain temperature (Y2)  • Many plants make fruits or vegetables; some of these grow below ground (Y2)  • Animals and plants depend on each other in their habitats (Y2)  • Living things have adapted to their environment. This means they may not be able to survive in other habitats (Y2)  • Soil is a mixture of particles of rock, dead plants and animals, air and water (Y2 Aut) | Week 1   * 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   How can species be grouped?  Week 2   * Plants can be grouped into flowering and non-flowering 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   What do plants need to grow and are all requirements the same?  Week 3   * 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 transports water 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   Pzaz investigation Celery Xylems  What are the functions of the parts of a plant?  Week 4   * 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 seeds can be self-propelled (pea pod)   What are the stages of a plants life cycle?  Week 5  • Buildings and new developments have destroyed many habitats. This means number and 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  How do developments effect habitats and how can we protect them?  Week 6  Assessment and misconceptions | • 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)  • Fungi are different to plants and animals. They cannot make their own food (like animals) but do not move (like plants) (Y6)  • Micro-organisms are organisms that are so small that we cannot see them with our eyes alone. (Y6 )  • Some fungi are microorganisms (e.g. yeast), but not all are (e.g. mushrooms). (Y6)  • Bacteria are microorganisms, some bacteria can cause disease in other organisms (Y6 )  • Variation occurs within and between species.  • The male part of the plant is called the stamen, made up of the anther and filament, and the anther produces pollen grains (Y5)  • The female parts of the plant are the ovary (which produces the female sex cells which are contained in the ovule) and the stigma which collects pollen (Y5)  • Sexual reproduction is two parents - usually male and female - create a new organism by mixing their gene (Y5). Asexual reproduction does not involve sex cells or fertilisation. Only one parent is needed, and the offspring are (genetically) identical to the parent and each other (Y5) • Potatoes develop tubers and daffodils have bulbs, which will grow to be identical copies of the plant (Y5)    VOCAB  Classification keys, environment,  fish, amphibians, reptiles, birds, mammals, vertebrates, invertebrates, human impact, positive, negative (impact transported, life cycle germination, pollination, fertilisation and seed dispersal |
| **Disciplinary knowledge** | • M&O: Observe using a magnifying glass safely | • A&P: Identify scientific evidence that has been used to support or refute ideas Use a classification key to sort 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  Investigate the impact of light on the growth of plants, drawing a block diagram to illustrate 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 | A&E: Science is never 'complete' and scientists are always working to make models more accurate or to discover new explanations (Y5 |
| **Core threads** | • 8: There is a wide variety of living things, including plants and animals (Y1)  • 4: All living things need food to give them energy (Y2) • 7: Living things grow, need, water, air and food, react to their surroundings, move, get rid of their waste, reproduce (Y2) • 8: Most plants make their own food (Y2 | • 7: Living things – organisms – need water, air, food, a way of getting rid of water and an environment that stays within a particular temperature range • 8: Plants make their own food using sunlight, carbon dioxide and water | 7: Micro-organisms are organisms that are so small that we cannot see them with our eyes alone (Y6) • 8: Animals are ultimately dependent on plants for their survival (Y4 |

**3/4 Spring Term 2 Living things. Animals and Humans**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | • Animals can be placed into groups (carnivores, herbivores and omnivores) based on the foods they eat (Y1)  • Humans are omnivores, but some choose to eat only plants (Y1)  • Humans need to eat a healthy and balanced diet (Y2) • 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, ears, eyes, nose, mouth, arms, legs, hands, feet, toes(Y2)  • Living things grow, need air and nutrients, react to their surroundings, move, get rid of their waste, reproduce (Y2)  • Living things are called organisms (Y2 )  • Animals get their food from plants and other animals, this food provides the energy animals need (Y2)  • Most plants produce their own food and are called producers (Y2)  • In a food chain, the arrows show where the energy is being transferred from and to (Y2)  • Different animals have different nutritional needs (Y3)  • 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) | Week 1   * 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   Can you group foods?  Week 2   * 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 protects the 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   What is our body made up of?  Week 3   * Some organisms have endoskeletons, some have exoskeletons, and some have neither * Endoskeletons grow with the organisms, exoskeletons do not so need to be shed and replaced   Are all skeletons on the inside of organisms?  Week 4   * 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   How do food chains and food webs differ?  Week 5   * There are four main types of teeth: incisors, canines, pre-molars and molars. They each have a different purpose. * Herbivores, carnivores and omnivores have these types of teeth in different proportions   What are the different types of teeth and their purpose?  Week 6  • 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 (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  Investigation - Model digestive system (tights, juice, banana, biscuit)  How do animals and plants digest food?  Assessment and misconceptions | Invertebrates can be placed into groups based on their skeletons; endoskeletons, exoskeletons, or hydrostatic skeletons (Y4)  • There are four main types of teeth: incisors, canines, pre-molars and molars. They each have a different purpose (y4) • Herbivores, carnivores and omnivores have these types of teeth in different proportions (Y4)  • Animals and plants need to digest food to transfer energy from it (Y4)  • The digestive system is the group of organs that help your body digest food (Y4)  • The heart is a muscle that pumps blood around the body through blood vessels (Y6)  Each organ and muscle in the human body needs oxygen and nutrients (from breathing in and eating/digesting) (Y6) • Blood carries oxygen, nutrients and carbon dioxide around the body (Y6 )  • Nutrients are absorbed by the blood along the small intestine, and transported to other organs in the body (Y6) • 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)  • 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)  VOCAB  Digestive system, nutrition, mouth, teeth, canine, incisor, molar, pre-molar, saliva, tongue, rip, tear, chew, grind, cut, oesophagus (gullet), stomach, small intestine, large intestine, rectum, anus, carnivore, herbivore, omnivore, producer, consumer, predator, prey, food chain, skeleton, muscles, support, protection, movement, vertebrate, invertebrate |
| **Disciplinary knowledge** | • R&P: Draw a diagram, a simple scientific drawing that explains or informs | • Science is studied as three disciplines: biology (study of living organisms), chemistry (study of materials) and physics (study of energy)  Label the main bones on a diagram of a human skeleton, give the function of each bone  Explain the digestion process using a prop to others in school or at home  • R&P: Present information orally using a prop or demonstration | 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) (Y5 |
| **Core threads** | 4: All living things need food to give them energy (Y2 | 4: The arrows in a food web show where energy is being transferred from and to • 8: Animals are ultimately dependent on plants for their survival • 8: The relationships among organisms can be represented as food chains and food web | • 4: 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 (Y5) • 8: In any given ecosystem there is competition among species for the energy and materials they need to live (Y6 |

**Summer Term 1 Year 3/4 Chemistry: Rocks and properties of materials**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | • Geography: We live on the Earth (Y1)  • Materials have physical properties that make them better or worse for certain uses, such as waterproof, absorbent, windproof, heatproof, malleable (Y2)  • Materials such as wood, metal, plastic, brick, rock, paper and cardboard have these physical properties to different extents (Y2)  • Living things are called organisms (Y2)  • Everything in the world is either living (or used to be living) or not-living (Y2)  • The shape of some solid objects made from some materials can be changed by squashing, bending, twisting, or stretching the material (Y2 )  • Opaque, translucent and transparent materials allow no, some or all light to pass through them (Y3)  • Magnets attract magnetic objects (Y3) | Week 1   * 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   Pzaz investigation Making a Metamorphic Rock  How are rocks formed?  Week 2   * Different rocks have different properties, including permeable/impermeable * Pzaz Investigation Rock Porosity   Can you group rocks by their properties?  Week 3   * 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 of a 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, turning them into sedimentary rock * • 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. Different soils have different properties   How are fossils formed and what evidence can they show us?  Week 4   * 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   What are thermal insulators and conductors?  Week 5   * 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   What are chemical and physical properties?  Week 6  Assessment and misconceptions | • History: Rocks that build historical monuments including Stonehenge and the Great Pyramid in Egypt (Y3) • History: Importance of fossils in archaeology (Y6)  • Geography: Beneath the Earth’s solid crust is a hot layer called the mantle (Yr5)  • Geography: Volcanic eruptions release magma (Y5 )  • Fossils provide evidence for evolution, because they show how organisms have changed over time (Y6 )  • The rock cycle and the formation of igneous, sedimentary and metamorphic rocks (KS3)  • The composition of the Earth (KS3) • The structure of the Earth (KS3) • Earth as a source of limited resources and the efficacy of recycling (KS3)  VOCAB  Rock, stone, sedimentary, igneous, metamorphic, permeable, impermeable, marble, chalk, granite, sandstone, slate, sandy soil, clay soil, chalky soil, peat, sediment, organic matter, fossil |
| **Disciplinary knowledge** | • A&P: A&P: Scientists group objects or living things based on their properties (Y1)  • M&O: Observe using a magnifying glass safely (Y2)  • M&O: Make systematic observations of an object (Y2)  • R&P: Use a pair of axes to classify items based on the extent to which it displays two properties (Y2)  • A&P: Scientists conduct secondary research to learn from what other scientists have already learned (Y1)  • A&P: Scientists identify factors in an investigation that should be controlled, and try to find ways to control them (Y3)  • M&O: Gather information from text/books/images (Y1) and the internet (Y3)  • A&E: Ask further questions that could be explored to extend findings (Y2)  • A&E: Identify scientific evidence that has been used to support or refute ideas (Y4) | * Make observations about rocks using senses and magnifying glass, and classify them in a Carroll diagram/pair of axes * 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 of new materials (e.g. asbestos insulation; lead pencils; plastic bottles |  |
| **Core threads** | • 1: All the ‘stuff’ encountered in everyday life, including air, water and different kinds of solid substances is called matter (Y2)  • 1: Different materials are recognisable by their properties (Y2 | • 5: Much of the solid surface of the Earth is covered in soil, which is a mixture of pieces of rock of various sizes and the remains of organisms. Some soil also contains air, water and some nutrients  • 5: There are many different kinds of rock with different composition and properties.  • 10: Fossils are the preserved remains or traces of living things | • 5: The action of water wears down rock gradually into smaller pieces (see Geography, Year 5 : Investigating water)  • 5: Beneath the Earth’s solid crust is a hot layer called the mantle. The Earth’s crust consists of a number of solid plates which move relative to each other, carried along by movements of the mantle. The formation of mountains, earthquakes and volcanic activity are likely to occur at these cracks (see Geography Year 5  • 1: Materials can be changed by heating and cooling (Y5 |

**Year 3/4 Summer Term 2 Physics: Light and electricity.**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | • Daytime happens when we are facing the sun; nighttime happens we are facing away from the sun (Y1)  • The Moon is more visible at night (Y1)  • Common materials include wood, paper, metal, glass, water, rock (Yr1)  • 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(Yr1)  • Materials can be grouped in a number of ways based on their physical properties(Yr1)  • The material that we choose to make an object from depends on its purpose (e.g. no chocolate kettle) (Yr1) | Week 1   * Opaque, translucent and transparent materials allow no, some or all light to pass through them * Shadows form behind an opaque object when light from a source is blocked * The shape of shadows changes with the angle and the distance of the light source * Pzaz investigation – change shape of shadow   Do all objects cast a shadow? Can you change the shape of a shadow?  Week 2   * Sources of light emit their own light, and others reflect light; both occur in nature as well as man-made objects * Darkness is the absence of light * Some objects are more reflective than others   What are luminous and non-luminous objects?  Week 3   * Light travels in straight lines * We see when light enters our eyes * Light from the sun can be dangerous and there are ways to protect our eye   How does light travel?  Week 4   * 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 accident by connecting just the wire to the cell in a circuit. They can be dangerous * Components include wire, lamp, buzzer, motor or switch   Pzaz investigation – build a circuit  What does a circuit need to be complete?  Week 5   * 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)   Pzaz investigation conductor or insulator?  What materials make a good conductor?    Week 6  Assessment and misconceptions | In ray diagrams, straight lines with arrows show where the energy is being transferred from and to by light (Y6)  • 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 (Y6)  • On a rough surface, light will be reflected in all directions. This is known as diffuse reflection (Y6 )  • Specular reflection between mirrors allow us to see the objects that do not directly reflect light into our eyes (e.g. periscope) (Y6 )  • When light meets an opaque object, some of the light is reflected and some of it is absorbed (Y6)  • White light, which comes from most light sources we use in the classroom, contains all the colours of the visible spectrum (Y6)  • When a light meets a surface, some colours are absorbed and some are reflected. We see the colour(s) that are reflected (Y6)  • 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 (Y6)  • 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)  • There are recognised symbols for cell, lamp, buzzer, motor, and switch. Wires are represented with straight lines (Y6)  • Increasing the voltage in a circuit will increase the brightness of a lamp and increase the volume of a buzzer (Y6)  • The more components in the circuit, the dimmer the lamps in the circuit (Y6)  • 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)  VOCAB  Light, light source, darkness, reflect, reflective, mirror, shadow, block, direction, transparent, opaque, translucent, properties, absence  Electricity, appliance, device, mains, plug, electrical circuit, complete circuit, circuit diagram, circuit symbol, components, cell, battery, positive/negative, connect, connection, short circuit, wire, crocodile clip, bulb, bright/dim, switch, buzzer, motor, conductor, insulator, metal/non metal |
| **Disciplinary knowledge** | • Mathematics: Measure length and height (cm/m) (Y2)  • A&P: There are four main stages of enquiry (A&P, M&O, R&P, A&E) (Y2)  • A&P: Scientists look for patterns in the world around them; they conduct investigations to identify whether a pattern they think they've seen is really there (Y2)  • 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 (Y1)  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)  • A&E: Use findings of investigation to make further predictions (Y3)  • R&P: Design a table to collect data with the appropriate number of rows and columns and correct headings (Y3) | Investigate how the height of a shadow varies as the distance between light source and object changes  • A&P: A dependent variable is what you measure; 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  Investigate which materials are electrical conductors and which are electrical insulators  • A&P: Draw diagram of the investigation • R&P: Present information in a written format | A&P: Scientists must work out if the factor is the cause of the outcome in a correlation (Y5 |
| **Core threads** | • 6: Daytime is when the Earth is facing the Sun; nighttime is when the Earth is facing away from the Sun (Y1  • 4: Things around us can be made to change or happen. We can pull objects behind us or push them across the table (Y1) | • 2: Objects can have an affect on other objects even when they are not in contact with them. Light reaches our eyes, even though the light source may be far away • 6: The Moon reflects light from the Sun  • 4: Things around us can be made to change or happen. We can turn on a light bulb and make it brighter or dimmer. | • 2: The non-contact force of magnetism mean magnets can attract or repel other magnets (Y3)  • 6: Our Sun is one of many stars that make up the Universe (Y5  • 4: Many processes and phenomena are explained in terms of energy exchanges (Y5)  • 4: 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 (Y5) |

**Year 5 : Autumn Chemistry: Separating materials**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | • All materials are made of a single substance or a mixture of substances (Y2 Sum)  • Each substance in its state of matter is made up of parts that are too small to see without magnification (Y2 Sum)  • Magnets attract magnetic objects (Y3 Sum)  • Some metals are magnetic but not all are. Plastics, wood, fabric, glass are all nonmagnetic materials (Y3 Sum)  • Materials are different states at room temperature (Y4 Spr)  • Physical properties include electrical conductivity; melting and boiling points; thermal conductivity; being malleable; windproof; hard/soft; and magnetic (Y4 Sum | Week 1:   * Compare and group materials together according to whether they’re solids, liquids and gases. * A pure substance is one that contains only one substance and only type of particle, e.g. oxygen, iron, pure water   How can materials be classified?  Week 2:   * 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)  -Pzaz - Making a solution – Dissolving mixtures and changes   What is dissolving?  Week 3:   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) * Two solids can be separated by using magnets or filters (e.g. sieve)   How can mixtures be separated?  Week 4:   * A solid and a liquid can be separated by using filtration (if the solid is insoluble) or evaporation (if the solid is soluble)  - Identify the part played by evaporation in condensation in the water cycle; associate the temperature which this happens. * -observe that some materials change state when heated or cooled – measure the temperature at which this happens in degrees C. s   Are all changes reversible?  Week 5:   * 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   Can materials be separated by heating? | • Physical and chemical changes (Y6 Sum)  • The concept of a pure substance (KS3)  • Diffusion in terms of the particle model (KS3)  • Simple techniques for separating mixtures: distillation and chromatography (KS3)  • The identification of pure substances (KS3  VOCAB  electrical/thermal conductivity, melting, dissolve, solution, insoluble, solute, solvent, particle, mixture, filtering, sieving, residue, reversible/non reversible changes, new material, burning, rusting |
| **Disciplinary knowledge** | • A&P: Write an appropriate method (Y2 Aut)  • A&P: Scientists identify potential hazards in their experiments and plan ways to reduce them (Y2 Aut)  • A&E: Make a prediction based on substantive knowledge (Y2 Aut)  • A&E: Use findings of investigation to make further predictions (Y3 Sum | Week 6:   * Separate a mixture including coarse sand, water, salt and lumps of a magnetic material. – Investigation   Can I identify how to separate materials?  Week 7 – assessment and misconception |  |
| **Core threads** | • 1: The amount of material does not change when a solid melts or a liquid evaporates (Y4)  • 1: If a material could be divided into smaller and smaller pieces it would be found to be made of pieces, particles, smaller than can be seen even with a microscope. These particles are not in a material; they are the material (Y4 | * 1: When some materials combine, they do not change permanently and can be separated again * 1: Materials can be changed by heating and cooling | • 1: When some materials are combined, they form a new material with different properties to the original materials (Y6) |

**Autumn Term 2: Year 5 Physics, chemistry and biology: Energy**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | Biology:  • In a food chain, the arrows show where the energy is being transferred from and to (Y2)  • Leaves use sunlight, carbon dioxide from the air, and water to make their own food (Y3). They are called producers (Y2)  • A food web shows the transfer of energy between different organisms (Y4)  • Animals and plants need to digest food to transfer energy from it (Y4)  Physics:  • 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 (Y4)  • Appliances use electricity to serve a purpose (e.g. toaster, kettle etc.) (Y4)  • 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 (Y4)  Chemistry:  • All substances in their different forms (solids, liquids and gases) are made of particles (Y4)  • Melting happens when a solid is heated. Different substances melt at different temperatures. This is called the melting point (Y4) | Week 1:   * 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 goes up   What is an energy store?  Week 2:   * In a food chain an amount of energy from the Sun (a chemical store) is transferred to the plant by light. The energy is then transferred along the food chain as the different organisms are eaten. • Energy is not used up it is just moved around from store to store . When energy is transferred from one store to another it can be transferred by light, or electrically.   Can you show the transfer of energy in a food chain?  Week 3:   * 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 goes up. The particles in the solid therefore move more   How is energy transferred in a circuit?  Week 4:   * 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.   Can I demonstrate the transfer of kinetic energy?  Week 5:   * Renewable energy   How is renewable energy generated?  Week 6:  Assessment and misconceptions | • Thermal conductors allow energy to be transferred through it easily when it is heated (Y4)  • 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 (Y6)  • Energy can be stored and transferred; it cannot be created or destroyed (KS3)  • A battery is a store of chemical energy (KS3)  • Energy can be transferred electrically using an electric current (KS3)  • Energy can be transferred electrically from the battery using an electric current to a device like a lamp or a buzzer.(KS3)  • Devices such as bulbs do not store the energy. During this process the energy is transferred to a different store.(KS3)  • Appliances are items that transfer electrical energy to a different store, e.g. light to the surroundings.(KS3  VOCAB  Energy, transference, chemical energy store, kinetic, renewable, circuit, device |
| **Disciplinary knowledge** | A&P: Science is studied as three disciplines: biology (study of living organisms), chemistry (study of materials) and physics (study of energy) (Y3)  A&E: Scientists use models to help explain their ideas (Y4 Spr | 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 |  |
| **Core threads** | 4: Things around us can be made to change or happen. We can pull objects behind us or push them across the table (Y1)  • 4: All living things need food to give them energy (Y2)  • 4: The arrows in food chains (Y2) and food webs (Y4) show where the energy is being transferred from/to | • 4: Many processes and phenomena are explained in terms of energy exchanges • 4: 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 | • 4: Across the world, the demand for energy increases as human populations grow and modern lifestyles require more energy, particularly electrical energy (Y6) |

**Year 5 Spring Term 1 Biology- Life cycles.**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | • Germination is the development of a plant from a seed. During germination roots and shoots emerge and grow (Y2)  • Some plants grow from bulbs (Y2)  • A seed is the embryonic stage of the plant life cycle (Y2  • Animals, including humans, reproduce. This means they have offspring that grow into adults (Y2)  • As animals grow they get bigger, some animals change during their life cycle as the mature (e.g. tadpole to frog) (Y2)  • The four main stages of the plant's life cycle include germination, pollination, fertilisation and seed dispersal (Y3)  • 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 (Y3)  • 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 breed (Y4)  • Fish, amphibians, reptiles, birds and mammals are all vertebrates (Y4)  • Invertebrates can be grouped based on their characteristics as snails and slugs; worms; spiders and insects (Y4) | Week 1:   * 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   What is sexual reproduction?  Week 2:   * 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   What is an embryo and how does it develop?  Week 3:   * 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   Are all animals born in the same way?  Week 4:   * 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   Can you describe the differences in life cycles between a mammal, an insect, an amphibian, and a bird?  Week 5:   * The male part of the plant is called the stamen, made up of the anther and filament, and the anther produces pollen grains. * The female parts of the plant are the ovary (which produces the female sex cells which are contained in the ovule) and the stigma which collects pollen   Can you identify the male and female parts of a plant?  Week 6:   * Asexual reproduction does not involve sex cells or fertilisation. Only one parent is needed and offspring are (genetically) identical to the parent and each other. * Potatoes develop tubers and daffodils have bulbs, which will grow to be identical copies of the plan -Pzaz – Asexual reproduction in plants 1 and 2   Can I explain the differences between sexual and asexual reproduction?  Assessment and misconceptions | • The human life cycle goes through the same stages as those for other animals: fertilisation, gestation, growth (Y5) • Humans 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 (Y5)  • The gestation period for humans is 40 weeks • The bigger the animal, the longer the gestation period (Y5)  • A foetus is considered a baby when it is born (Y5)  • Fertilisation in most humans is internal, but it can happen externally (in vitro fertilisation - IVF - which means ‘in glass’ fertilisation) (Y5)  VOCAB  Reproduction, sexual, asexual, germination, pollination, pollen, stamen, stigma,, eggs, live young, genome, embryo, oviparous, anther, filament, ovary, ovule, fertilisation |
| **Disciplinary knowledge** | • A&P: Scientists conduct secondary research to learn from what other scientists have already learned (Y1) 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) (Y5)  • M&O: Gather information from text/books/images (Y1) and the internet (Y3) | Using images, text and the internet to research internal and external fertilisation, and viviparous and oviparous organisms |  |
| **Core threads** | • 9: Plants and animals reproduce (have offspring) (Y1 | • 9: Organisms produce offspring of the same kind, but in many cases offspring are not identical with each other or with their parents.  • 9: Plants and animals, including humans, resemble their parents in many features because information is passed from one generation to the next.  • 9: Not all information is passed on from one generation to the other in the same way; some skills and behaviour have to be learned  • 10: Although organisms of the same species are very similar, they vary a little | 9: In a human body, most cells contain 23 pairs of chromosomes. These provide information that is needed to make more cells in growth and reproduction (KS3 |

**Year 5 Spring Term 2- Biology Human development.**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | 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, ears, eyes, nose, mouth, arms, legs, hands, feet, toes (Y1)  • 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 (Y5)  • Sexual reproduction is two parents - usually male and female - create a new organism by mixing their genomes (Y5)  • Sexual reproduction begins with fertilisation of an egg, which mixes the genomes from two parents (Y5)  • Fertilisation can be internal or external (Y5)  • After an egg is fertilised, an embryo will develop (Y5) • Almost all mammals are viviparous (Y5)  • Embryos develop inside the body in the gestation period for viviparous animals. (Y5)  • Viviparous animals are born, oviparous animals hatch from eggs, plant seeds germinate (Y5) | Week 1:   * 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   Can I compare the stages of human and animals life cycle?  Week 2:   * 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   Are all humans and animals gestation periods the same?  Week 3:   * Cognitive, physical and social and emotional development takes place at the greatest rate during infancy * 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) - Pzaz – How bones change with age? (animals inc. humans/human life cycle.) * There are ages where humans at their peak for different things (e.g. reproduction, running etc.)   How do are bodies change with age?  Week 4:   * Secondary ageing relates to environmental factors, like poor diet, not enough exercise, smoking etc.   What factors affect our development?  Week 5:   * Different cultures around the world have different perceptions around the life cycle and ageing   Do all cultures view ageing in the same way?  Week 6:  Assessment and misconceptions (re look at tubers planted) | • The structure and function of the male and female reproductive systems (KS3)  • The female menstrual cycle (KS3)  • The male and female gametes, as specialised cells (KS3)  • Fertilisation, gestation and birth (KS3)  • The effect of maternal lifestyle on the foetus (through the placenta) (KS3  VOCAB  fertilisation, gestation, growth, embryo, foetus, infant, child, adolescent, adult, senior, viviparous |
| **Disciplinary knowledge** | • Mathematics: Use coordinates in the first quadrant (Y4); Interpret and construct line graphs (Y4)  • A&P: Scientists look for patterns in the world around them (Y1)  • A&P: Set a hypothesis to test (Y4)  • A&E: Draw conclusions (e.g. 'the greater the…, the greater the…') (Y4 )  • Geography: Recognise that people have differing opinions about environmental issues (Y4) | Draw a scatter graph to suggest whether there is a relationship between animal size 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 relationship between two variables Discuss one aspect of IVF that is appropriate to your class (e.g. who in the world has access; post code lottery within the UK)  • A&E: Some people may agree or disagree with the use of some scientific discoveries |  |
| **Core threads** | 9: Plants and animals reproduce (have offspring) (Y1) • 9: Organisms produce offspring of the same kind, but in many cases offspring are not identical with each other or with their parents (Y5)  • 9: Plants and animals, including humans, resemble their parents in many features because information is passed from one generation to the next (Y5)  • 9: Not all information is passed on from one generation to the other in the same way; some skills and behaviour have to be learned (Y5) |  | • 9: In a human body, most cells contain 23 pairs of chromosomes. These provide information that is needed to make more cells in growth and reproduction (KS3) |

**Year 5 Summer Term 1 Physics- Forces**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | •Forces are pushes or pulls that act in particular directions. They can cause a change in speed, direction or shape of an object (Y3)  •Forces that act in opposite directions are called opposing forces (Y3)  •Forces that are equal and act in opposite directions are described as balanced forces. They 'cancel each other out' (Y3) •When forces are balanced, an object will move at a constant speed in the same direction. This includes being stationary (Y3) •Contact forces require contact between two objects (e.g. friction). Non-contact forces can affect an object at a distance (e.g. magnetism) (Y3)  •Friction is a force between two surfaces that are sliding or trying to slide over each other (Y3)  •Friction is a contact force because it requires the two objects to be touching (Y3)  •The bumpier or rougher the surfaces, the more friction there will be (Y3) | Week 1:   * 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 * Pzaz – Do heavier objects fall more quickly?   What stops us from floating away?  Week 2:   * 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.   How does air resistance effect speed?  Week 3:   * Water resistance is a frictional force that acts between water and a moving object to slow it down   What is water resistance?  Week 4:   * 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   Is it possible to increase a force?  Week 5:   * The components of levers can be arranged in different orders: effortfulcrum-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 move the load   Is there a link between components of levers and their order?  Week 6  Assessment and misconceptions | • The Earth’s Moon is smaller than the Earth and has less mass, so its gravitational force is less (Y5)  • Using force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces (KS3)  • Moment as the turning effect of a force (KS3) • Forces associated with deforming object; stretching and squashing- springs (KS3)  • Measurement of stretch or compression as force is changed (KS3)  • Work done and energy changes in deformation (KS3) • Non-contact forces: gravity forces acting at a distance on earth and in space, forces between magnets and forces due to static electricity (KS3)  • Opposing forces and equilibrium; weight held by stretched spring or supported on a compressed surface (KS3)  • Forces being needed to cause objects to stop or start moving, or to change their speed or direction of motion (KS3)  • Change depending on direction of force and its size (KS3)  VOCAB  Fall, Earth, gravity, weight, mass, air resistance, water resistance, friction, moving surfaces, mechanisms, levers, pulleys, gears, force, transfers, fulcrum, |
| **Disciplinary knowledge** | •Mathematics: Round numbers with 1 decimal place to the nearest whole number (Y4); Understand difference between discrete and continuous data (Y4); Interpret and construct bar and line graphs (Y4); Area is the space inside a shape and can be measured by counting squares (Y4)  •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)  •M&O: Anomalous results should be discarded and rerecorded (Y3)  •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 (Y3)  •M&O: Taking multiple readings allows you to see if your data is repeatable, and helps identify outliers (Y3) | Fair test to investigate how the distance between the load and the fulcrum affects the force required to lift it  • A&P: Scientists must work out if the factor is the cause of the outcome in a correlation  • M&O: Measure force using a Newtonmeter  • R&P: Line graphs can be used when data is continuous; bar charts can be used when data is discrete  • A&E: Make judgements on the reliability of the data |  |
| **Core threads** | •2: Objects can have an affect on other objects even when they are not in contact with them: light (Y3), magnetism (Y3), sound (Y4)  •3: Forces can push, pull or twist objects, making them change shape or motion (Y3); Things can only change their motion if there is a net force acting on them (Y3); When forces acting on an object are not equal and opposite in direction, they are unbalanced and will change an object’s speed, direction or shape (Y3) | • 2: The non-contact force of gravity makes things fall to Earth  • 2: There is gravitational force between all objects, but it is only felt when one or more of the objects has a very large mass  • 3: An object on Earth pulls the Earth as much as the Earth pulls the object, but because the Earth’s mass is much bigger, we observe the motion of the object | • There is attraction and repulsion between objects that are electrically charged (KS3); Visible light and other forms of radiation can travel through any empty space (KS3); How quickly an object’s motion is changed depends on the force acting and the object’s mass. The greater the mass of the object, the longer it takes to speed it up or slow it down (inertia) (KS3 |

**Summer Term 2 Physics Earth and space.**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | • Geography: We live on the Earth (Y1)  • Daytime is when the Earth is facing the sun; nighttime is when the Earth is facing away from the sun (Y1)  • The Moon is more visible at night (Y1)  • Animals, including humans, need water, food, air, and the right temperature to survive (Y2)  • Light travels in a straight line (Y3)  • Sources of light emit their own light, and others reflect light; both occur in nature as well as manmade objects (Y3)  • Shadows form behind an opaque object when light from a source is blocked (Y3)  • Sound travels through a medium; it cannot travel in a vacuum (Y4)  • Gravity is a non-contact force that pulls all objects towards each other (Y5)  • The greater the mass of the object, the greater the gravitational pull around it (Y5)  • Air resistance is a frictional force that acts between air and a moving object to slow it down (Y5) | Week 1:   * 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 * Bodies are held in their orbit by gravity   What is the universe made up of?  Week 2:   * 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 is one day longer, this is called a leap year, this year accounts for the four 0.25 days   How did scientists model of the universe change?  Week 3:   * The Earth rotates on its axis once every 24 hours, so only half of the Earth is facing the Sun at 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 across the sky.   How does the Earth’s rotation affect day and night?  Week 4:   * The time taken for the Moon to orbit the Earth is 28 days and, during this time, the sun shines on different parts of the Moon * The phases of the Moon include new moon, crescent, quarter moon, gibbous moon and full moon * The Earth’s Moon is smaller than the Earth and has less mass so its gravitational force is less   Can I describe the orbit of the moon and its phases?  Week 5:   * 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.  -Pzaz – top trumps   Can I identify and compare the eight planets in our solar system?  Week 6:  • Space is a vacuum, which means there are no air particles  Can you hear in space?  Week 7: Assessment and misconceptions | • The Earth’s tilt creates seasons, and different day lengths at different times of the year (KS3)  • Calculating gravity force on different planets and stars (KS3)  • The light year as a unit of astronomical distance (KS3)  • Movement of stars and constellations (KS3)  VOCAB  Earth, planets, sun, solar system, moon, celestial body, spherical, rotation, spin, night and day, dwarf planet, orbit, geocentric model, heliocentric model, axis, satellites, vacuum |
| **Disciplinary knowledge** | • Mathematics: Number of minutes in an hour; hours in a day (Y3); Number of days in a month, year and leap year (Y3)  • A&P: Scientists must work out if the factor is the cause of the outcome in a correlation (Y5)  • A&E: Draw conclusions (e.g. 'the greater the… , the greater the…’) (Y3)  • A&E: Identify scientific evidence that has been used to support or refute ideas (Y4) | Look for patterns between a planet’s distance from the Sun and it’s temperature and size 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 explanation | Scientists seek to understand how accurate their results are, and how confident they can be in their findings (KS3 |
| **Core threads** | • 6: Daytime is when the Earth is facing the Sun; nighttime is when the Earth is facing away from the Sun (Y1)  • 6: The Moon reflects light from the Sun (Y3) | • 3: The downward force of gravity on an object on the Moon is less than that on Earth because the Moon has less mass on Earth  • 6: Our Sun is one of many stars that make up the Universe.  • 6: The distances between us and the bodies in solar system is huge, and even bigger in the Universe | • 6: The tilt of the Earth’s axis gives rise to seasons (KS3) • 6: The movements of galaxies suggest that the Universe is expanding from a past state called the ‘big bang’, towards a future that is still unclear (KS3 |

**Year 6 Autumn Term 1 Physics: Electricity.**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | • 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 (Y4)  • A short circuit is the easiest route for electricity to travel and can be created by accident by connecting just the wire to the cell in a circuit. They can be dangerous (Y4)  • Components include wire, lamp, buzzer, motor or switch Materials that allow electricity to flow through them easily are called electrical conductors; materials that do not are called electrical insulators (Yr4)  • Appliances use electricity to serve a purpose (e.g. toaster, kettle etc.) (Y4)  • Energy can be transferred from one store to another store (Y5)  • Fossil fuels, batteries and the Sun are all examples of chemical energy stores (Y5)  • In a circuit that has a battery, the battery is a chemical store of energy. Energy is transferred electrically to the device in the circuit, but the device does not store energy. Instead, it changes the way that it is transferred (Y5)  • Geography: Fossil fuels are materials made from fossils of organisms over millions of years, like coal and oil. Humans use these to run cars/electrical items (Y5) | Week 1:   * 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.   Can I link how components work to the number of cells in a circuit?  Week 2:   * 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. * Use and recognise symbols for cell, lamp, buzzer, motor, and switch. Wires are represented with straight lines   How do series and parallel circuits differ?  Week 3:   * Investigation into Week 2 – planning and investigating series and parallel circuits; Pzazz – Voltage and the functionality of components.   Children to devise own investigation with question  Week 4:   * 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.   How are our homes powered?  Week 5:   * A non-renewable energy source is one where we have a fixed amount of the source, and where it would take too long for more to be formed. Burning fossil fuels to transfer electrical energy is a non-renewable energy source * 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   How do we use non-renewable energy sources in our homes and what are the issues surrounding this?  Week 6:   * 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   Are renewable energy sources the solution to the energy crisis? | • Geography: Improving the environment, and places in the world that have climates or physical features that lend themselves to using renewable sources to generate electricity (Y6 )  • Electric current is measured in amperes using an ammeter. Current is a flow of charge (KS3)  • Current can be measured in parallel and series circuits. The current will be the same at all 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 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)  VOCAB  Series circuit, parallel circuit, components, , terminal, connection, short circuit, conductor, insulator, voltage, current, resistance, non-renewable, renewable |
| **Disciplinary knowledge** | • Mathematics: Interpret and construct bar charts (Y3);: Discrete data is data you count; continuous data is data you can measure (Y4); Interpret and construct bar, line graphs (Y4)  • A&P: dependent, independent and control variables (Y3)  • A&P: Scientists identify factors in an investigation that should be controlled, and find ways to control them  • M&O: Gather information using a data logger (e.g. sound meter app; heart rate app) (Y4)  • R&P: Line graphs can be used when data is continuous; bar charts can be used when data is discrete (Y5)  • A&E: Draw conclusions (e.g. 'the greater the… , the greater the…') (Y4) | 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 | • Planning more complex investigations to answer more challenging questions (KS3) |
| **Core threads** | • 4: Many processes and phenomena are explained in terms of energy exchanges (Y5)  • 4: 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 (Y5) | 4: Across the world, the demand for energy increases as human populations grow and modern lifestyles require more energy, particularly electrical energy | • 4: Objects have energy because of their chemical composition, their movement, their temperature, their position in a gravitational or other field, or because of compression or distortion of an elastic material (KS3 |

**Autumn Term 2 Biology -Evolution.**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | • Living things have adapted to their environment. This means they may not be able to survive in other habitats (Y2)  • 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 (Y3)  • 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 breed. (Y4)  • Geography: Animals and plants have adapted to life in the rainforest (buttress roots, lianas, spider monkey, toucan, fig wasp and fire ants) (Y4)  • Sexual reproduction is two parents - usually male and female - create a new organism by mixing their genomes (Y5)  • History: Homo sapiens first lived in East Africa ~200,000 BC and migrated across the world over 1000s of years (Y5)  • Geography: Flora and fauna that have adapted to life in the tundra (Arctic hare, polar bear) hot desert (cactus, camel, Saharan silver ant, cape ground squirrel) temperate forest (deciduous and coniferous trees, red squirrels, hedgehogs, brown long-eared bats southern wood ants) coral reefs (soft coral, pistol shrimp & goby fish, reef sharks) (Y5 Sum) | Week 1:   * Variation 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. * Pzaz – Children of Mr Men and Little Miss – evolution and inheritance   How does genetic variation occur?  Week 2:   * Some variation is advantageous to the organism in their environment; sometimes it is disadvantageous; and sometimes it gives no advantage/disadvantage   Are all variations advantageous?  Week 3:   * 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 * Pzaz – Darwin’s mocking birds – evolution and inheritance   What makes a species more likely to survive?  Week 4:   * Over many generations, the species will evolve so that all organisms have this adaptation/advantageous trait   How do species evolve over time?  Week 5:   * Homo sapiens evolved in East 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   How have scientists mapped the evolution of Homo sapiens?    Week 6 –  Assessment and misconceptions | • Hereditary is the process by which genetic variation is transmitted from one generation to the next (KS3)  • Chromosomes are made of DNA. Small sections of DNA are called genes. We inherit genes from our 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, this variation means that some individuals will compete more successfully and are more likely to survive, this drives a process known as natural selection. In this process advantageous versions of genes are passed onto offspring (KS3)  • Changes to the environment can lead to individuals of some species or even entire species less well adapted to their environment. This can lead to extinction. Biodiversity is important and we need to maintain it (KS3)  VOCAB  Generation, evolution, inheritance, genetics, variations, adaption, traits, physiological, structural and behavioural |
| **Disciplinary knowledge** | • A&E: Identify scientific evidence that has been used to support or refute ideas (Y4)  • R&P: Use a Venn diagram to classify items into two or three sets based on properties (Y1 )  • A&P: Science is never 'complete' and scientists are always working to make models more accurate or to discover new explanations (Y5) | Sort variations within species in a Venn diagram, based on whether they are genetic, environmental or a mixture of both Identify how evidence of fossils has been used to support the theory of evolution. (Horse fossil record as evidence of the horse developing from a small animal with four toes to a large animal with a hoof).  • A&P: Science is never 'complete' and scientists are always working to make models more accurate or to discover new explanations |  |
| **Core threads** | • 8: Animals are ultimately dependent on plants for their survival (Y4)  • 10: Although organisms of the same species are very similar, they vary a little from each other (Y5 | • 8: In any given ecosystem there is competition among species for the energy and materials they need to live.  • 10: There are many kinds of organisms that were once alive but are now extinct. We know about extinct animals from fossils.  • 10: Living things are found in certain environments because they have the features that enable them to survive there. This adaptation to their environment has come about because of the small differences that occur during reproduction, resulting in some individuals being better suited to the environment than others. In the competition for materials and energy, those that are better adapted will survive and are more likely to pass on their adapted feature to their offspring | • 8: Decomposers are essential (alongside producers and consumers) for a stable ecosystem (KS3)  • 10: The natural selection of organisms has been going since the first form of life appeared on Earth 3.5 billion years ago (KS3)  • 10. Multi-cellular organisms evolved around 2 billion years ago (KS3) |

**Year 6 Spring Term 1 Physics and light.**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | • Light travels in straight lines (Y3)  • We see when light enters our eyes (Y3)  • Darkness is the absence of light (Y3)  • Sources of light emit their own light, and others reflect light; both occur in nature as well as man-made objects (Y3)  • Opaque, translucent and transparent materials allow no, some or all light to pass through them (Y3)  • Shadows form behind an opaque object when light from a source is blocked (Y3)  • The shape of shadows changes with the angle and the distance of the light source (Y3)  • Light from the sun can be dangerous and there are ways to protect our eyes (Y3)  • Energy can be transferred from one store to another store (Y5)  • Fossil fuels, batteries and the Sun are all examples of chemical energy stores (Y5)  • When energy is transferred from one store to another, it can be transferred by light or electrically (Y5)  • 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 goes up (Y5)  • Energy is not used up; it is just moved around from store to store (Y5)  • Light travels from the Sun to the Earth (Y5 | Week 1:   * 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 travels from 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.   How does light travel?  Week 2:   * 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 * *Visit from Specsavers?*   How does vision differ?  Week 3:   * 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   What affects shadow shape and size?  Week 4:   * .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 * Specular reflection between mirrors allow us to see the objects that do not directly reflect light into our eyes (e.g. periscope) * When light meets an opaque object, some of the light is reflected and some of it is absorbed * Pzaz – making a periscope   Can I describe the link between the direction of light and its reflection?  Week 5:   * 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. We see 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   How do we see colour?  Week 6 :  Assessment and misconceptions | • The transmission of light through materials, to include absorption, diffuse scattering and specular reflection at a surface (KS3)  • Light waves can travel through a vacuum they do not require a medium (KS3)  • Light waves travel at the speed of light (KS3)  • The similarities and differences between light waves and waves in matter (KS3)  • Use of ray model to explain imaging in mirrors, the pinhole camera, the refraction of light and the action of a convex lens in focusing (KS3)  • The human eye (KS3)  • Light transferring energy from a source to an absorber leading to chemical and electrical effects; photosensitive material in the retina and in cameras (KS3)  • Colours and the different frequencies of light, white light and prisms; differential colour effects in absorption and diffuse reflection (KS3  VOCAB  Emit, ray diagram, diffuse reflection, specular reflection, visible spectrum |
| **Disciplinary knowledge** | • R&P: Draw a diagram, a simple scientific drawing that explains or informs | Draw ray diagrams to show how light travels and how shadows are formed |  |
| **Core threads** | • 2: Objects can have an affect on other objects even when they are not in contact with them. Light reaches our eyes, even though the light source may be far away (Y2 |  | • 2: Visible light and other forms of radiation can travel through any empty space (KS3) |

**Year 6 Spring Term 2 Biology Further classification**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | Coniferous plants keep their leaves all year round; deciduous plants lose their leaves in winter (Y1)  • Animals can be grouped into carnivores, herbivores and omnivores (Yr1  • Animals move from place to place, while plants move on the spot (Y2)  • Classification refers to a method used to place all living things into groups. Organisms can be classified in a number of ways (Y4)  • 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 breed (Y4)  • Fish, amphibians, reptiles, birds and mammals are all vertebrates. Vertebrates have endoskeletons (Y4)  • 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. (Y4)  • Invertebrates can be grouped based on their characteristics as snails and slugs; worms; spiders and insects (Y4 Aut)  • Invertebrates can be grouped based on their skeletons; endoskeletons, exoskeletons, or hydrostatic skeletons (Y4  • Plants can be grouped into flowering and non-flowering plants (Y4)  • Geography: A symbiotic relationship is where plants and animals live along and rely on one another (Y4) | Week 1:   * Invertebrates can be grouped based on their characteristics as poriferans (sponges) cnidarians, echinoderms, molluscs, annelids, platyhelminths and arthropods (spiders, insects, crustaceans and myriapods).   How can invertebrates be classified?  Week 2:   * Plants can be grouped into moss, ferns, conifers and flowering plants   Can I group plants in different ways?  Week 3:   * 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)   How are fungi different to plants and animals?  Week 4:   * Bacteria are microorganisms. Some bacteria can cause disease in other organisms -Pzaz – Microbial growth investigation   What is bacteria?  Week 5:   * 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   Is all bacteria bad?  Week 6 : Assessment and misconceptions | 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 reactants of 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  VOCAB  Organism, micro-organism,  Poriferans, cnidarians, echinoderms, molluscs, annelids, platyhelminths and arthropods  Fungi, bacteria, symbiotic |
| **Disciplinary knowledge** | • Gather information from text/books/images (Y2) and the internet (Y3)  • R&P: Use a classification key to identify an object (Y4  • R&P: Draw a dichotomous classification key to help others identify an object (Y4  • R&P: Present information in a written format (Y4 | Use and draw classification keys 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 a written format |  |
| **Core threads** | • 7: Living things – organisms – need water, air, food, a way of getting rid of water and an environment that stays within a particular temperature range (Y3 | 7: Micro-organisms are organisms that are so small that we cannot see them with our eyes alone | • 7: All living organisms are made of one or more cells, which can only be seen through a microscope (KS3); All the basic functions of life – growth, reproduction, extracting energy from food – are the results of what happens inside cells (KS3 |

**Summer Term 1 Year 6 Biology Functions of the human body.**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | • Humans are made of many different body parts (Y1)  • Humans need exercise to stay healthy (Y2)  • Humans need a balanced diet of these food groups (Y3)  • 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. (Y3)  • The skeleton protects organs, e.g. the skull protects the brain; and the ribcage protects the lungs, heart and other important organs (Y3)  • The muscles and skeleton are required to help the body move. When muscles contract they pull the bone (Y3)  • Oxygen and carbon dioxide are found in the air (Y3)  • The digestive system is the group of organs that help your body digest food (Y4)  • Food is further broken down (chemical digestion) in the small intestines where most of the nutrients are absorbed (Y4)  • Water is absorbed in the large intestine, leaving behind the waste products (Y4 | Week 1:   * Each organ and muscle in the human body needs oxygen and nutrients (from breathing in 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   What do muscles and organs in the human body need?  Week 2:   * The heart is a muscle that pumps the blood through the blood vessels. Blood is pumped at a high pressure. * The heart pumps deoxygenated blood to the lungs, where oxygen is transferred to it and it 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 * -Pzaz – Making a heart model   How does blood flow around the body?  Week 3:   * 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 * Veins carry blood back to the heart. They mostly carry deoxygenated blood   How do arteries and veins differ?  Week 4:   * 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 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.   Can I describe ways in which water and nutrients are transported around the body?  Week 5:   * 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 which are also absorbed by the blood and transported around the body. These can causes diseases. Pzaz – heart rate and exercise   What is the relationship between heartrate and exercise?  Week 6 – Assessment and misconceptions | • 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 circulatory system (KS3)  • Gas exchange systems in humans are adapted to their function as they have many alveoli which provides a large surface area for diffusion (KS3)  • The mechanism of breathing moves air in and out of the lungs (KS3)  • The role of diffusion in the movement of materials in and between cells (KS3)  • The impact of smoking on the human gas exchange surface. (KS3)  VOCAB  Circulatory system, heart, blood, blood vessels, pumps, oxygen, carbon dioxide, arteries, veins, nutrients, capillaries, oxygenated, |
| **Disciplinary knowledge** | • Mathematics: Calculate and interpret the mean (Y6) • A&P: Set a hypothesis to test (Y4)  • A&P: Make a prediction based on substantive knowledge (Y2); A&E: Use scientific understanding to explain their findings (Y3 Sum)  • A&P: Scientists must work out if the factor is the cause of the outcome in a correlation (Y5  • A&E: Science is never 'complete' and scientists are always working to make models more accurate or to discover new explanations (Y6  • M&O: Repeatable and reproducible data (Y3  • M&O: Taking multiple readings allows you to see if your data is repeatable and helps identify outliers (Y3 | Investigate the effect of exercise 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 smoking on the human body, and how our scientific understanding has changed over 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 |  |
| **Core threads** |  |  | • 7: All living organisms are made of one or more cells, which can only be seen through a microscope (KS3); Cells are often aggregated into tissues, tissues into organs, and organs into organ systems (KS3 |

**Summer Term 2 - Chemistry Physical and chemical changes.**

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|  | **Required prior knowledge** | **Knowledge to be explicitly taught** | **How knowledge will be built upon** |
| **Substantive knowledge** | • Digestion in the human body can be chemical and mechanical (Y4  • Physical properties are properties that we can measure or observe in the classroom. They include electrical conductivity; melting and boiling points; thermal conductivity; being malleable; windproof; hard/soft; and magnetic (Y4  • Chemical properties are properties that scientists need specialist equipment to measure. They include flammability and toxicity (Y4  • A mixture is two or more substances, e.g. air, steel (Y5  • 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) (Y5  • A solvent is a liquid that is used to dissolve other substances (Y5  • A reversible change is a change that can be undone, where the original substances can be recovered (Y5  • An irreversible change is a change that cannot be undone, where the original substances cannot be recovered (Y5  • When a solid is heated the solid becomes a liquid. Energy from a chemical store is transferred to the solid, the solid becomes hotter and its thermal store of energy goes up. The particles in a solid therefore move more, and arrange to form a liquid (Y5 | Week 1:   * A mixture is two or more substances that are mixed but not chemically joined together   What is a mixture?  Week 2:   * 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   How do you know if a chemical change has occurred?  Week 3:   * A physical change is where the substance changes its properties, but it does not become a different substance   What is a physical change?  Week 4:   * Some chemical changes are irreversible, (e.g. cook an egg, rusting iron), but some can be reversed   Are chemical changes permanent?  Week 5:   * Most physical changes are reversible (e.g. water to ice), but some are not (e.g. crack an egg, turn wood into sawdust)   Are physical changes reversible?  Week 6:   * Reversible and irreversible chemical changes can be written as word equation   Can I record chemical changes as a word equations?  Week 7: Assessment and misconception | 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 produces a salt and hydrogen (KS3)  • Reactions of acids with alkalis produces a salt and water (KS3)  • Reactions can be endothermic or exothermic (KS3  VOCAB  Chemical join, chemical change, equation, substance, reversible, irreversible |
| **Disciplinary knowledge** | • A&P: Scientists group objects or living things based on their properties (Y1)  • A&P: Make a prediction based on substantive knowledge (Y2  • A&P: Scientists identify potential hazards in their experiments and plan ways to reduce them (Y2)  • R&P: Use a Carroll diagram to classify items based on properties (Y1)  • R&P: Use a classification key to identify an object. Draw a dichotomous classification key to help others identify an object (Y4  • R&P: Present information in a written format | 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 is chemical/physical and reversible/irreversible  Carry out changes and identify whether the change created is physical/chemical and reversible/irreversible |  |
| **Core threads** | • 1: All the ‘stuff’ encountered in everyday life, including air, water and different kinds of solid substances is called matter (Y2)  • 1: Different materials are recognisable by their properties (Y2) |  |  |

Core Threads for Science. The Big Ideas of Science.

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**Alignment to the National Curriculum**

**Substantive knowledge** ( knowledge of the 3 subject disciplines that represent Science) have been aligned across year groups to ensure that pupils are exposed to a balance of disciplines and substantive knowledge across Key stages. Additional units have been purposefully added to take pupils beyond the National curriculum. In Year 2: Solids, liquids and gases. This introduces pupils to the idea that familiar substances (like water or chocolate) can exist as solids, liquids or gases. It will support understanding of states of matter and the particle model in Year 4, and pre-empts the misconception that substances only ever exist in one state. Later in Year 5: Energy. This introduces pupils to energy stores and transfers at a very basic level, and has been designed to pre-empt misconceptions that need to be unpicked at secondary. It also allows pupils to review content from previous topics across biology, chemistry and physics (like food webs, electricity, and states of matter), and consider them through the lens of energy. Finally in Year 6: Physical & chemical changes. This unit gives pupils the opportunity to run more sophisticated practical investigations. It provides a good transition to Year 7

**Disciplinary knowledge** (working scientifically) As specified in the National Curriculum, disciplinary knowledge is not taught as a separate strand. Instead, very specific aspects of disciplinary knowledge (for example, recognising and managing risk; or measuring using a Newton meter) are explicitly taught as part of the units set out here. They are deliberately practiced in the context of relevant and appropriate experiments, and then reviewed at regularly intervals across the key stages.

**Assessment**

Assessing impact is assessing how well pupils have learned the required knowledge from the implemented curriculum.

This can be done through:

Formative assessment in lessons

There are formative opportunities for formative assessment in the lesson through questioning, feedback and discussion. Teachers should continually adapt their lesson delivery to address misconceptions and ensure that pupils are keeping up with the content.

Summative assessment

A post-learning quiz/task provided for units. These consist of multiple choice questions, or labelling/ identifying locations on a pre-drawn map, making comparisons using visual maps, photographs. The aim is to assess whether pupils have learned the core knowledge for that unit. These should be used formatively, and teacher should plan to fill gaps and address misconceptions.

Books and pupil conference

Talking to pupils about their books allows you to assess how much of the curriculum content is secure. These conversations are used most effectively to determine whether pupils have a good understanding of the vertical concept, and if they can link recently taught content to learning from previous units. (They should not be used to assess whether pupils can recall information, as low-stake quizzes can gather this information more efficiently)