United Curriculum: Science

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Autumn 1	**Biology** Plants *Identifying and naming common plants and describing basic structures*	**Biology** Plant growth *Plants grow from seeds, and require water, light and a suitable temperature*	**Chemistry** Rocks *Comparisons of types of rocks and how fossils are formed*	**Biology** Classifying organisms *Introduction to classifying animals and their environment*	**Chemistry** Separating mixtures *Identifying and separating mixtures; difference between reversible and non-reversible changes*	**Physics** Electricity *Investigating variations in series and parallel circuits, and how electricity is generated*
Autumn 2	**Biology / Physics** Seasonal changes *Observing changes across four seasons and describing associated weather*	**Biology** Needs of animals *Animals need water, food and air to survive and to have offspring*	**Physics** Light *Relationship between light and how we see; the formation of shadows*	**Biology** Food & digestion *The human digestive system and simple food chains*	**Biology, Chemistry, Physics** Energy *Introducing the concept of energy stores and energy transfers, and relating this to prior knowledge*	**Biology** Evolution *Fossils; introduction to the idea that adaptation may lead to evolution*
Spring 1	**Chemistry** Everyday materials *Distinguishing objects from the material it's made from, and describing simple properties*	**Chemistry** Uses of everyday materials *Comparisons of an object's material with its use; impact of bending, twisting on solid objects*	**Biology** Living organisms *The role of muscles and skeletons; the importance of nutrients*	**Chemistry** Particle model and states of matter *States of matter in relation to particle arrangement*	**Biology** Life cycles *Life cycles of a mammal, amphibian, insect and bird, and some reproduction processes*	**Physics** Light *How light travels and is reflected, and how this allows us to see*
Spring 2	**Consolidation and review**	**Biology** Living things & their habitats *Basic introduction to habitats and micro-habitats, and simple food chains*	**Biology** Plants *The key features of flowering plants and what they need to survive*	**Physics** Sounds *Relationship between strength of vibrations and volume of sound*	**Biology** Human development *Human development to old age*	**Biology** Further classification *Further classification of living organisms based on characteristics*
Summer 1	**Biology** Animals *Identifying and naming fish, amphibians, reptiles, birds and mammals; carnivores, herbivores and omnivores*	**Chemistry** Solids, liquids and gases *Understanding how the same substances can exist as solids, liquids and gases*	**Physics** Forces & motion *Introducing pushes and pulls; opposing forces, and balanced forces*	**Physics** Electricity *Simple series circuits*	**Physics** Forces *Gravity, air and water resistance and friction; introduction to pulleys*	**Biology** Functions of the human body *Human circulatory system; transport of nutrients within the body*
Summer 2	**Biology** Humans *Human body parts and senses*	**Consolidation and review**	**Physics** Friction & magnetism *Contact and non-contact forces, including friction and magnetism*	**Chemistry** Properties of materials *Considering physical and chemical properties*	**Physics** Earth and space *Movements of planets and the Moon, and relationship to day and night*	**Chemistry** Physical and chemical changes *Identifying physical and chemical changes*

Vertical concepts

Big ideas <u>of</u> science

	1. All material in the universe is made of very small particles	2. Objects can affect each other at a distance	3. Changing the movement of an object requires a net force to be acting on it
Y1			
Y2	• All the 'stuff' encountered in everyday life, including air, water and different kinds of solid substances is called matter • Different materials are recognisable by their properties		
Y3		• 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 • The non-contact force of magnetism mean magnets can attract or repel other magnets	• Forces can push, pull or twist objects, making them change shape or motion • Things can only change their motion if there is a net force acting on them • 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
Y4	• The amount of material does not change when a solid melts or a liquid evaporates • 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.	• 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	
Y5	• When some materials combine, they do not change permanently and can be separated again • Materials can be changed by heating and cooling	• The non-contact force of gravity makes things fall to Earth • There is gravitational force between all objects, but it is only felt when one or more of the objects has a very large mass	• 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 • 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
Y6	• When some materials are combined, they form a new material with different properties to the original materials		
KS3	• The smallest piece of a material is called an atom. All materials, anywhere in the universe, living and non--‑living, are made of a very large numbers of these basic 'building blocks' of which there are about 100 different kind	• There is attraction and repulsion between objects that are electrically charged • Visible light and other forms of radiation can travel through any empty space	• 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)

Vertical concepts

Big ideas of science

	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
Y1	• Things around us can be made to change or happen. We can pull objects behind us or push them across the table	• Plants grow in soil • The weather can change rapidly. Different seasons have different weather patterns
Y2	• All living things need food to give them energy • The arrows in a food chain show where energy is being transferred from and to	• There is air all around us on Earth
Y3		• 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. • There are many different kinds of rock with different composition and properties. • 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 3 Spring: Mountains and Volcanoes and Year 4 Summer: Earthquakes**)
Y4	• The arrows in a food web show where energy is being transferred from and to • Things around us can be made to change or happen. We can turn on a light bulb and make it brighter or dimmer.	
Y5	• Many processes and phenomena are explained in terms of energy exchanges • Energy cannot be created or destroyed. When energy is transferred from one object to others, the total amount of energy in the universe remains the same; the amount that one object loses is the same as the other objects gain	• There is less and less air further away from the Earth's surface; space is a vacuum • The action of water wears down rock gradually into smaller pieces (see **Geography, Year 5 Spring: Investigating water**) • Light from the Sun warms the Earth's surface and the heat is trapped by the Earth's air. This is known as the greenhouse effect (see **Geography, Year 5 Summer: Climate across the world**)
Y6	• Across the world, the demand for energy increases as human populations grow and modern lifestyles require more energy, particularly electrical energy.	
KS3	• 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.	• 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. • Radioactive decay of material inside the Earth since it was formed is its internal source of energy.

Vertical concepts

Big ideas of science

	6. Our solar system is a very small part of one of millions of galaxies in our 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
Y1	• Daytime is when the Earth is facing the Sun; nighttime is when the Earth is facing away from the Sun.	• Living things, including humans, react to their surroundings with their senses	• There is a wide variety of living things, including plants and animals
Y2		• Living things grow, need, water, air and food, react to their surroundings, move, get rid of their waste, reproduce	• All living things need energy for food, as well as air, water and certain temperature conditions. • Most plants make their own food • Animals need food, which comes by eating plants (herbivores) or by eating animals (carnivores), which have eaten plants or other animals. • Plants and animals are dependent on each other. • Organisms are adapted to their environment. If conditions in a habitat change, organisms may not be able to survive.
Y3	• The Moon reflects light from the Sun.	• Living things need water, air, food, a way of getting rid of water and an environment that stays within a particular temperature range.	• Plants make their own food using sunlight, carbon dioxide and water
Y4			• Animals are ultimately dependent on plants for their survival. • The relationships among organisms can be represented as food chains and food webs.
Y5	• Our Sun is one of many stars that make up the Universe. • The distances between us and the bodies in solar system is huge, and even bigger in the Universe		
Y6		• Micro-organisms are organisms that are so small that we cannot see them with our eyes alone	• In any given ecosystem there is competition among species for the energy and materials they need to live.
KS3	• The tilt of the Earth's axis gives rise to seasons. • 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	• All living organisms are made of one or more cells, which can only be seen through a microscope • All the basic functions of life – growth, reproduction, extracting energy from food – are the results of what happens inside cells • Cells are often aggregated into tissues, tissues into organs, and organs into organ systems	• Decomposers are essential (alongside producers and consumers) for a stable ecosystem.

Vertical concepts

Big ideas of science

	9. Genetic information is passed down from one generation of organisms to another	10. Diversity of organisms, living and extinct, is the result of evolution
Y1		• There are many different kinds of plants and animals in the world today.
Y2	• Plants and animals reproduce (have offspring)	
Y3		• Fossils are the preserved remains or traces of living things.
Y4		
Y5	• Organisms produce offspring of the same kind, but in many cases offspring are not identical with each other or with their parents. • Plants and animals, including humans, resemble their parents in many features because information is passed from one generation to the next. • Not all information is passed on from one generation to the other in the same way; some skills and behaviour have to be learned	• Although organisms of the same species are very similar, they vary a little from each other.
Y6		• There are many kinds of organisms that were once alive but are now extinct. • We know about extinct animals from fossils. • 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.
KS3	• 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.	• The natural selection of organisms has been going since the first form of life appeared on Earth 3.5 billion years ago. • Multi-cellular organisms evolved around 2 billion years ago

Disciplinary knowledge (KS1)

The below tables outlines where disciplinary knowledge – the working scientifically elements – is **first taught** and deliberately practised in KS1 or KS2. The curriculum has been sequenced so that the content is also reviewed in subsequent units (and may also be reviewed in other subject areas like geography and history), but to keep the table readable, we have only set out where it is first taught. The Mathematics Programmes of Study have been considered so that pupils never need to apply mathematical skills (e.g. calculating mean, rounding to an appropriate degree, constructing graphs) until they have first been taught in mathematics lessons.

	Scientific Attitudes & Planning (A&P)	Measuring & Observing (M&O)	Recording & Presenting (R&P)	Analysing & Evaluating (A&E)
R		• Measure/observe using senses		• Notice patterns in the world me
Y1	• Scientists look for patterns in the world around them • Scientists group objects or living things based on their properties • It is important that we keep as much as we can the same, apart from the one thing we measure and the one thing we change • Scientists conduct secondary research to learn from what other scientists have already learned	• Gather information from text/ books/ images	• Record numerical or descriptive observations in a table • Draw a diagram, a simple scientific drawing that explains or informs • Use a table to classify items based on properties • Use a Carroll diagram to classify items based on properties • Use a Venn diagram to classify items into two or three sets based on properties	• Make simple statements about the results of an enquiry
Y2	• Make a prediction based on substantive knowledge • There are four main stages of enquiry (A&P, M&O, R&P, A&E) • Scientists identify potential hazards in their experiments and plan ways to reduce them • Scientists conduct investigations to identify whether a pattern they think they've seen is really there	• Make systematic observations of an object • Observe using a magnifying glass safely	• Use a pair of axes to classify items based on the extent it displays two properties	• Ask further questions that could be explored to extend findings

Disciplinary knowledge (KS2)

	Scientific Attitudes & Planning (A&P)	Measuring & Observing (M&O)	Recording & Presenting (R&P)	Analysing & Evaluating (A&E)
Y3	• Select most appropriate equipment to measure (the variables) that will give you the best chance of an accurate result • A dependent variable is what you measure; an independent variable is what you change; controlled variables are things that stay the same • Scientists identify factors in an investigation that should be controlled, and try to find ways to control them • Write an appropriate method • Science is studied as three disciplines: biology (study of living organisms), chemistry (study of materials) and physics (study of energy)	• Gather information from the internet • Anomalous results should be discarded and rerecorded • 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 • Taking multiple readings allows you to see if your data is repeatable, and helps identify outliers	• Design a table to collect data with the appropriate number of rows and columns and correct headings	• Draw conclusions (e.g. 'the greater the… , the greater the…') • Use scientific understanding to explain their findings • Suggest ways to improve practical procedures to obtain more accurate measurements • Use findings of investigation to make further predictions
Y4	• Set a hypothesis to test • Draw diagram of the investigation • Scientists use models to help explain their ideas	• Gather information using a data logger (e.g. sound meter app; heart rate app)	• Use a classification key to identify an object • Draw a dichotomous classification key to help others identify an object • Present information orally using a prop or demonstration • Present information in a written format	• Identify scientific evidence that has been used to support or refute ideas
Y5	• 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) • Scientists look for patterns in data to try to identify correlations • Scientists must work out if the factor is the cause of the outcome in a correlation	• Measure force using a Newtonmeter	• Scatter graphs can help you decide if there is a relationship between two variables • Interpret and construct climate graph • Line graphs can be used when data is continuous; bar charts can be used when data is discrete	• Make judgements on the reliability of the data • Some people may agree or disagree with the use of some scientific discoveries • Science is never 'complete' and scientists are always working to make models more accurate or to discover new explanations
Y6		• Taking multiple readings allows you to see if your data is repeatable, helps identify outliers and allows a mean to be calculated	• Decide which graph is most appropriate for the enquiry	• Calculating the mean can be used as a method of analysing data
KS3	• Evaluate risks	• Pay attention to objectivity and concern for accuracy, precision, repeatability and reproducibility • Use a wider range of apparatus and techniques • Apply sampling techniques • Evaluate data, showing awareness of potential sources of random and systematic error	• Use a range of graph types to display data, including pie charts, scatter graphs and line graphs	• The difference between correlation and causation, and suggesting ways to test for both • Understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review