Diocese of Salisbury Academy Trust
'Beyond expectations for all of God's children'

DSAT Science Curriculum Progression and Guidance Document

Science is a body of knowledge and a process that allows us to explain and understand the world around us.

- The national curriculum for science aims to ensure that all pupils:
  -  develop scientific knowledge and conceptual understanding through the specific disciplines of biology, chemistry and physics
  -  develop understanding of the nature, processes and methods of science through different types of science enquiries that help them to answer scientific questions about the world around them
  -  are equipped with the scientific knowledge required to understand the uses and implications of science, today and for the future

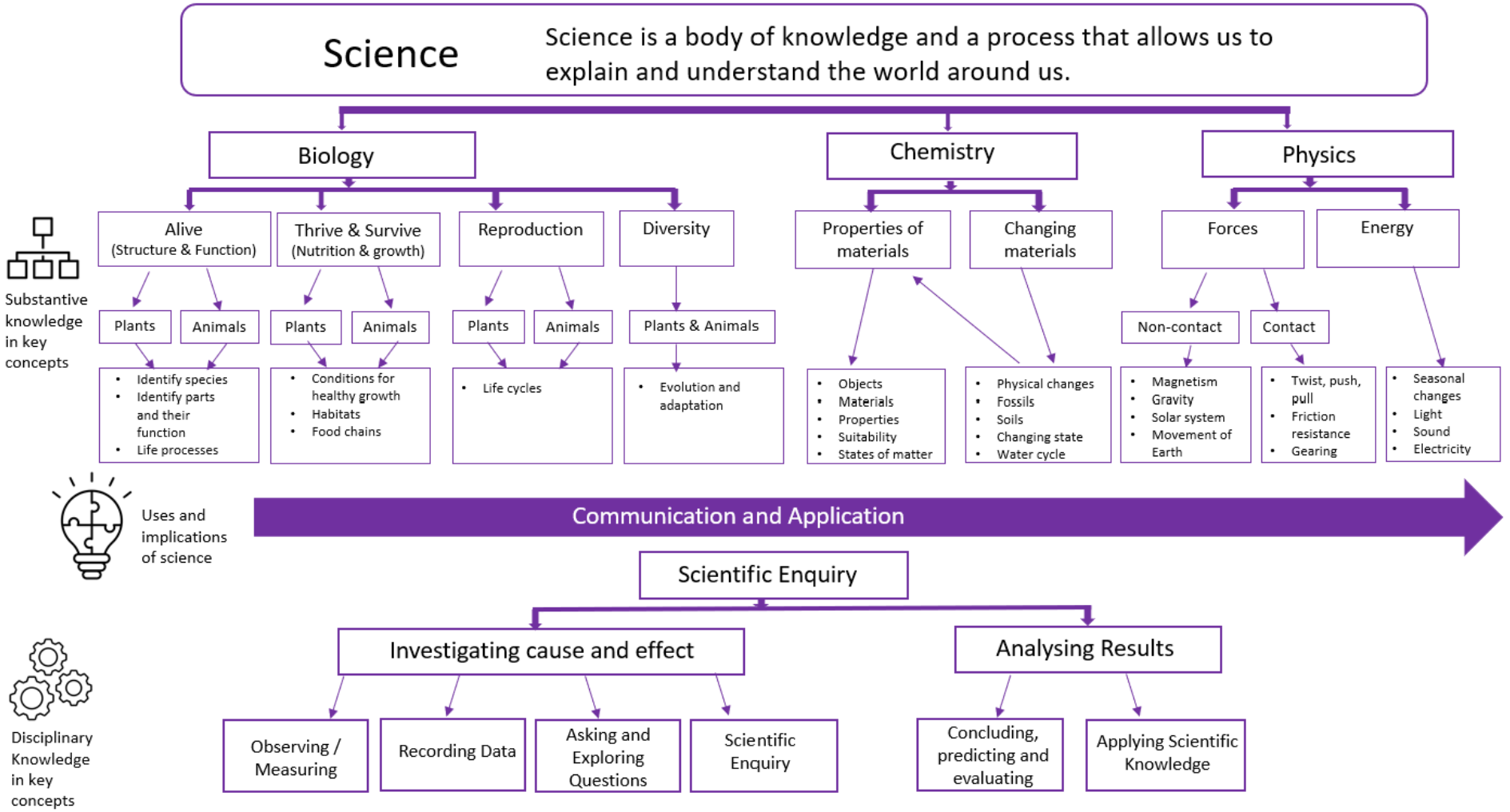
Cohesive

In science, pupils need their knowledge to be organised around the most important scientific concepts, which predict and explain the largest number of phenomena. This curriculum is organised under the concepts of the 'Big ideas of Science Education' which were published by Wynne Harlen and others in 2010. These ideas distil down scientific knowledge into ten guiding principles that we can use to explain a diversity of scientific phenomena. The big ideas are lenses by which we can make sense of the world and build a rich-related schema. It is the intention of this curriculum to support pupils to:

- Develop an extensive and connected knowledge base. When pupils learn new knowledge, it should become integrated with the knowledge they already have. This ensures that learning is meaningful.
- Break down complex concepts and procedures into meaningful 'chunks' of content. These 'chunks', or components, can then be sequenced in the curriculum over time. This allows pupils to successfully build knowledge of science concepts and their relationships over multiple years, without working memory being overloaded.
- Nurture and build motivation and interest in science through developing a connected schema on which to draw, building children's confidence in science.

The explicit connections between spines and units of knowledge can be tracked through the *'Science Big Ideas NC concept map'* here.

The concepts and their links are broadly summarised in the diagram below:



Focused, Ambitious and rigorous

This curriculum document sets out what it means 'to get better' at science. Children are progressing in science if they are building their substantive and disciplinary knowledge. The essential knowledge required for children to meet the end goals of the national curriculum has been identified and organised into key concepts.

- Substantive is knowledge of the products of science, such as models, laws and theories. This is referred to as scientific knowledge and conceptual understanding in the national curriculum

- Disciplinary knowledge is knowledge of the practices of science. This teaches pupils how scientific knowledge becomes established and gets revised. This involves pupils learning about the many different types of scientific enquiry and should not be reduced to learning a single scientific method. This is specified in the 'working scientifically' sections of the national curriculum and it includes knowing how to carry out practical procedures.

The curriculum is deigned to be rigorous through embedding the disciplinary knowledge within the substantive knowledge content. This enables pupils to use disciplinary knowledge together with substantive knowledge to ask and answer scientific questions by carrying out different types of scientific enquiry.

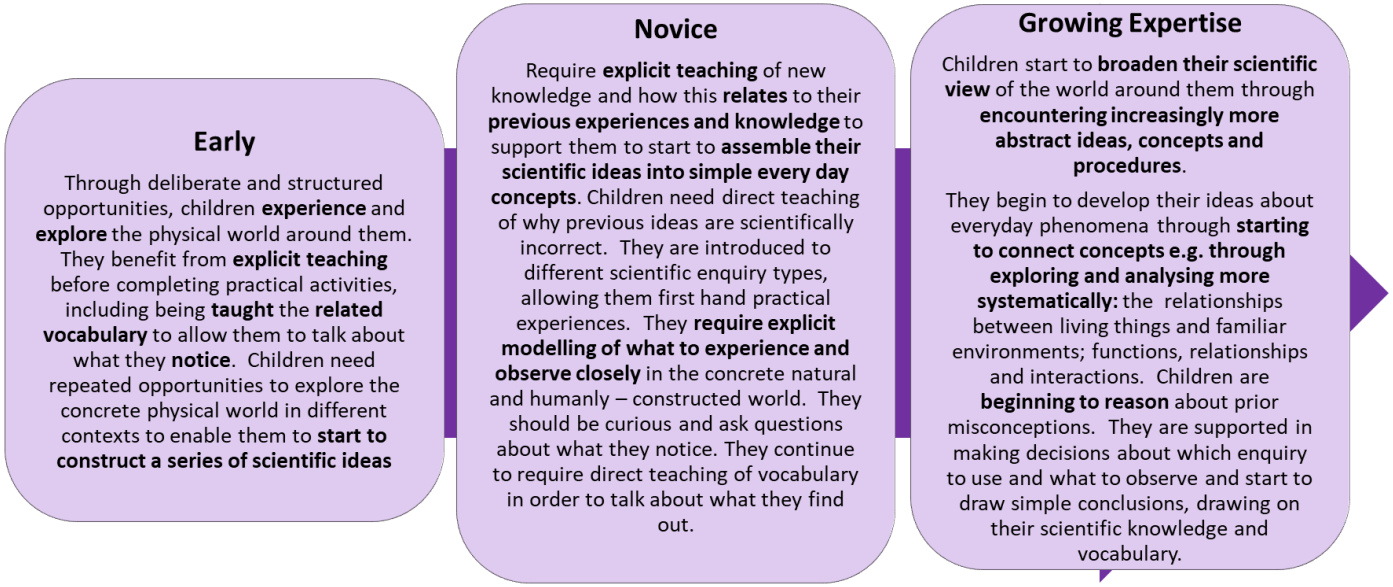
The focused identified knowledge can be found in the progression tables below, set against the national curriculum end goals for each year.

Relevant

This curriculum has been personalised by individual schools through identifying the specificity in the knowledge that is pertinent to their context. It has been relevant to their context through the reflection of their choices of examples detailed in the application and uses of choice section, driven by their vision and values curriculum.

Appropriate

Our curriculum aims to create a pathway for our children to assemble small ideas together, building into concepts which link and connect creating a powerful mental framework of the 10 big ideas of science that explains and helps us appreciate lots of wonderful things resulting in motivated scientists of the future. It aims to expose how prior knowledge is built upon and grown leading to growing expertise over time leading to more complex abstract ideas and concepts.



Sequenced and Progressive

Through the careful consideration of the sequencing of the curriculum, ensuring that knowledge build on and grows from previous knowledge, the curriculum has become the progression model. The sequences of knowledge are exposed in the pathways for single and mixed age below. The rationale for these is summarised in the flow charts that follow. There had been careful consideration to the cohesion between the science and the maths curriculum to ensure that children are applying previously maths knowledge to the disciplinary skills.

Progression Tables – Substantive Knowledge

Biology Key Concept: Alive (structure) Organisms are organised on a cellular basis and have a finite life span	
• All organisms comprise one or more cells. • Multi-cellular organisms have cells that are differentiated according to their function.	• All the basic functions of life are the result of what happens inside the cells that make up an organism. • Growth is the result of multiple cell divisions.

National Curriculum	Plants Knowledge Progression	Animals Knowledge Progression	Plants and Animals Knowledge Progression	Essential Vocabulary	
EY	• Know that a plant is a living thing and can grow. • Know that picking a flower / pulling a plant out of the ground will cause it to die • Know that chopping a tree down means it is no longer living • Know that a seed grows into a plant • Know that leaves from different plants and trees look different • Know that a woodland is made up of trees.	• Know that a body is made up of different parts. • Notice animals move, eat, sleep, drink, reproduce • Know that some animals have different body parts to humans • Notice and comment some of the similarities and differences between animals • Know that people live in family groups. • Know that farms produce food for us to eat.	*Examples of provision:* • *Visit a woodland* • *Seasonal walks* • *Know that they can use different parts of their bodies to explore* • *Sensory opportunities linked to plants (herbs etc)*	• Alive • dead • Plant • flower • seed • tree • grow • leaf/leaves • woodland • Fruit • Vegetable • Animal • Body	• Hands • Shoulders • Knees • Toes • Head • Back • Arms • Feet • Same • Different • Family • Farms • Teeth
Year 1 NC • identify and name a variety of common wild and garden plants, including deciduous and evergreen trees • identify and describe the basic structure of a variety of common flowering plants, including trees • identify and name a variety of common animals including fish, amphibians, reptiles, birds and mammals • identify and name a variety of common animals that are carnivores, herbivores and omnivores • describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals including pets) • identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense	• Know difference between a plant and a tree • Know the difference between common and wild plants • Know the difference between evergreen and Deciduous • Know and identify leaf, stem, root, flower, petal, branch, trunk, blossom • Know the names of wild and garden plants. • Know the names or deciduous and evergreen trees.	• Know that a fish lives in the water and fins and name some examples. • Know that a bird has feathers and lays eggs and name some examples. • Know that a reptile has scaly skin and name some examples • Know that amphibians can live in water and on land and name some examples. • Know that mammals give birth to live young that look like them and name some examples. • Know that carnivores eat only meat and name some examples • Know that omnivore eat meat and vegetations and name some examples. • Know that herbivores only eat vegetation and name some examples. • Know that humans have eyes so they can see • Know that humans have ears to hear • Know that humans have a tongue to taste • Know that humans have skin to feel • Know that humans have a nose to smell • Know that humans use their sense to learn about the world.		• Common plants • Wild plants • Evergreen • Deciduous • Stem • Root • Petal • Branch • Trunk • Blossom • Bark • Neck • Elbows • Face • Ears • Eyes • Mouth • Feet	• Fingers • Nose • Skin • Tongue • Stomach • Senses – taste, touch, smell, see, hear • Fish • Fin • Bird • Feathers • Eggs • Reptile • Scaly • Amphibians • Mammals • Carnivore • Omnivore • Herbivore

National Curriculum	Plants Knowledge Progression	Animals Knowledge Progression	Plants and Animals Knowledge Progression	Essential Vocabulary	
Year 2 NC • observe and describe how seeds and bulbs grow into mature plants • explore and compare the differences between things that are living, dead, and things that have never been alive	• Know the difference between a seed and a bulb • Know the difference between a seedling, young plant and mature plant	•	• Know that something that is living has to have 7 life processes (MRS NERG) • Know that a living thing is dead if it no longer has all 7. • Know that it has never been alive If it has never had all 7..	• Seed • Bulb • Seedling • Young • Mature • Living thing • Life processes	• Nutrition • Growth • Reproduction • Respiration • Sensitivity • Excretion • Movement
Year 3 NC • identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers • identify that humans and some other animals have skeletons and muscles for support, protection and movement	• Know that a stem/trunk provides support and transport water • Know that the leaf captures energy from the sun. • Know that flowers attract insects. •	• Know that humans and animals have skeletons to: ○ protect their vital organs ○ support the structure of their body ○ allow movement • Know that humans and animals have muscles which work in pairs to allow movement		• Transport • Support • Function • Energy • Store • Capture • Attract • Insects	• Skeleton • Protect • Organs • Structure • Muscles • Joint • Bones • Human
Year 4 NC					
Year 5 NC • describe the changes as humans develop to old age	•	• Know that babies are dependent upon an adult • Know that a toddler can move around their world. • Know that children grow rapidly • Know that adolescents experience puberty which enables them to reproduce • Know that adults are fully grown human • Know as humans age, their bodies begin to change		• Dependence • Toddler • Adolescent • Puberty • Ageing • Rapid	
Year 6 NC • identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood • describe the ways in which nutrients and water are transported within animals, including humans. • describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals • give reasons for classifying plants and animals based on specific characteristics.	•	• Know that the function of the heart is to pump blood around the body. • Know that the function of the lungs is to bring oxygen into the body and excrete carbon dioxide • Know that carbon dioxide is waste product • Know that blood vessels transport the blood to all areas of the body. • Know that blood carries oxygen, CO2, water and nutrients. •	• Know the difference between a plant, micro-organisms and an animal • Know that a microorganism is a bacteria or a virus that can be helpful or harmful • Know the difference between flowering plants and non-flowering plants • Know the difference between vertebrates and invertebrates • Know the 5 classifications of vertebrates: mammals, bids, fish, amphibians and reptiles. • Know that invertebrates can be worms, insects and spiders • describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals • give reasons for classifying plants and animals based on specific characteristics.	• Heart • Blood • Blood vessels • Arteries • Veins • Pump • Lungs • Oxygen • Carbon dioxide • Toxic / waste product • Nutrients • (Respiration)	• Micro-organism • Bacteria • Virus • Vertebrate • Invertebrate • Classification • Characteristics

Biology Key Concept: Survive and Thrive Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms	
• Food provides materials and energy for organisms to carry out the basic functions of life and to grow. • Green plants and some bacteria are able to use energy from the sun to generate complex food molecules.	• Animals obtain energy by breaking down complex food molecules and ultimately depend on green plants as their source of energy source. • In any ecosystem there is competition among species for the energy resources and materials they need to live and reproduce.

National Curriculum	Plants Knowledge Progression	Animals Knowledge Progression	Plants and Animals Knowledge Progression	Essential Vocabulary	
EY	• To know that plants need water to grow.	• Know why we wash our hands before we eat. • Know why we have to look after our teeth by brushing them every day. • Know that sugar is bad for your teeth. • Know that exercise is healthy for our body. • Know that their heart beats faster after exercise. Know 2-3 healthy food choices.		• Wash • Hands • Eat • Clean	• Sugar • healthy • unhealthy • exercise
Year 1 NC					
Year 2 NC • find out and describe how plants need water, light and a suitable temperature to grow and stay healthy • find out about and describe the basic needs of animals, including humans, for survival (water, food and air) • describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene • identify that most living things live in habitats to which they are suited and describe how different habitats provide for the basic needs of different kinds of animals and plants, and how they depend on each other • identify and name a variety of plants and animals in their habitats, including microhabitats • describe how animals obtain their food from plants and other animals, using the idea of a simple food chain, and identify and name different sources of food	• Know that plants need water and light and the correct temperature to grow and stay healthy. • Know that the absence of one or more of these will affect the health and growth of the plant.	• Know that animals need water, food and air to survive. • Know that humans need exercise to maintain their structure and movement. • Know that humans need a balanced diet of carbohydrate, vegetable and protein • Know the importance of hygiene for good health.	• Know that a habitat is the environment in which an animal or plant usually lives. • Explain why previously studied plants and animals live in their habitats. • Know that a simple food chain starts with a plant and contains one or more animals • Construct a food chain using previously taught animals and plants. • Explain how plants and animals depend on each other.	• Essential • Survive • Balanced • Diet • Carbohydrate • Protein • Hygiene • Habitat • microhabitat • environment	• chain • dependence • healthy • unhealthy •
Year 3 NC • explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow) and how they vary from plant to plant • investigate the way in which water is transported within plants • identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat	• Know that plants need nutrients from the soil and room to grow • Know that different plants need different conditions • Know that water is transported in plants from the roots to the stem and excreted through the leaves.	• Know the role of carbohydrate, protein, fats and vegetables in maintaining a balanced of diet. • Know that nutrition provides the body with energy.		• Soil • Nutrients • Conditions • Transportation •	• Fats and oils • energy

National Curriculum	Plants Knowledge Progression	Animals Knowledge Progression	Plants and Animals Knowledge Progression	Essential Vocabulary	
Year 4 NC • describe the simple functions of the basic parts of the digestive system in humans • identify the different types of teeth in humans and their simple functions • recognise that environments can change and that this can sometimes pose dangers to living things • construct and interpret a variety of food chains, identifying producers, predators and prey	•	• Know that teeth break down food into small swallowable pieces. • Know the function of the molars is to grind food. • Know the function of the canines is to rip food • Know the function of the incisors is to cut food. • Know the oesophagus transports chewed food and liquid to the stomach • Know that the stomach breaks down the chewed food into a liquid • Know that the small intestine allows nutrients to be absorbed into the body. • Know that the function of the large intestine is to absorb water. • Know that the anus allows the body to store and excrete waste	• Know that a food chain starts with a producer • Know that a food chain includes predators who feed on prey. • Construct a food chains containing producers predators and prey • Know that environmental change can endanger living things in a habitat.	• Molar • Grind • Canines • Rip • Incisors • Chew • Small intestine • Absorbed • Large intestine • anus	• producer • predator • pre • endanger • environment threat
Year 5 NC					
Year 6 NC • recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function	•	• Know that an unbalanced diet leads to poor health • Know that exercise leads to greater well-being both physically and mentally • Know that some drugs can be harmful to the human body.		• Well being • Physical health • Emotional health • Drugs • Medicines	

Biology Key Concept: Reproduction Genetic information is passed down from one generation of organisms to another	
• Genetic information in a cell is held in the chemical DNA. • Genes determine the development and structure of organisms.	• In asexual reproduction all the genes in the offspring come from one parent. • In sexual reproduction half of the genes come from each parent.

National Curriculum	Plants Knowledge Progression	Animals Knowledge Progression	Plants and Animals Knowledge Progression	Essential Vocabulary	
EY	• Know that when a seed is planted it will grow into an adult plant. • Know that some plants produce flowers and/or fruit and vegetables.	• Know that animals change as they grow. Humans from baby to adult.		• Seed • Grow • Adult • plant	• Produce • Flower • Fruit • vegetable
Year 1 NC					
Year 2 NC • notice that animals, including humans, have offspring which grow into adults		• Know that animals have offspring • Know offspring grow into adults • Know the names of common animals and their offspring e.g. egg, chick, chicken, spawn, tadpole, froglet, frog, baby, toddler, teenager, adult.		• Offspring • Chick • Spawn • Froglet • lifecycle	• Tadpole • Toddler • Teenager • adult
Year 3 NC • explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal	• Know that plants mature and create flowers and seeds • Know that the flower attracts pollinators. • Know that pollinators carry pollen from one plant to another causing pollination to occur. • Know that a seed forms as a result of pollination • Know that seeds disperse by wind, explosion, animals and water. • Know that seeds disperse to find room to grow new plants. •			• Mature • Pollinators • Attract • Pollen	• Pollination • Disperse • Explosion • reproduce
Year 4 NC					
Year 5 NC • describe the life process of reproduction in some plants • describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird • describe the life process of reproduction in some animals	• Know that plants that reproduce sexually need pollen from a male and female plant. • Know that asexual plants do not require male and female pollen and therefore do not have flowers. • Know that seeds germinate and grow into mature plants	• Know the life cycle of a mammal (human) • Know that mammals require sperm from a male to fertilise an ovary from a female. • Know that a fertilised egg grows in the female's uterus until the offspring is ready to be born. • Know that a bird's embryo is grown outside of the female within a protective egg, until it is ready to be hatched. • Know that an amphibian's embryo is laid as soft spawn in water until they are ready to hatch. • Know that amphibian offspring undergo metamorphosis into a mature adult. • Know that insects have four stages within their life cycles – egg lava, pupa and adult.		• Fertilisation • Fertilise • Male • Female • Germinate • Sperm • Ovary • gestation	• Uterus • Born • Fertilised • Embryo • Metamorphosis • Lava • pupa • Asexual reproduction • Sexual reproduction
Year 6 NC					

Biology Key Concept: Diversity

The diversity of organisms, living and extinct, is the result of evolution

- All life is directly descended from a universal common ancestor that was a simple one-celled organism.
- Over countless generations changes resulting from natural diversity within a species led to the selection of individuals best suited to survive under certain conditions
- Species not able to respond sufficiently to changes in their environment become extinct.

National Curriculum	Plants Knowledge Progression	Animals Knowledge Progression	Plants and Animals Knowledge Progression	Essential Vocabulary	
EY		• To know that not all birds in our local environment look the same. • To know that not all insects in the garden can fly. • To know that all fish in the sea/ocean do not look the same.		• Local • Environment • Insects • ocean	
Year 1 NC					
Year 2 NC					
Year 3 NC					
Year 4 NC • recognise that living things can be grouped in a variety of ways • explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment	• Classify plants in flowering and non-flowering plants	• Classify vertebrates into fish, amphibians, birds, fish and mammals • Classify non-vertebrates into insects, arachnids, molluscs. • Know invertebrates are animals which do not have a backbone, vertebrates do.	• Know that a classification key is a tool for identifying and grouping based on differences	• Classification • Classification key • Classify • Identify • vertebrates	• non-vertebrates • arachnids • molluscs • insects
Year 5 NC					
Year 6 NC • recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago • recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents • identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.		• Know that animal offspring are similar to, but not identical to their parents.	• Know that fossils are evidence of the plants and animals alive millions of years ago. • Know that characteristics are passed to offspring from their mother and father. • Know that animals and plants have characteristics that are suited to the habitat in which they live. • Know that overtime, animals and plants adapt to suit their environment. • Know that adaptations can be passed from offspring to offspring over many years. • Know that adaptations passed through many offspring result in permanent change which is called evolution.	• Fossils • Evidence • Characteristics • Adaption • Evolution • Inheritance • Breed • variation	

Chemistry Key Concept: Properties of Materials AND Changing Materials

All matter in the Universe is made of very small particles.

- Atoms are the building blocks of all matter, living and non-living.
- The behaviour and arrangement of atoms explains the properties of different materials.
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- In chemical reactions atoms are rearranged to form new substances.
- Each atom has a nucleus containing neutrons and protons, surrounded by electrons.
- The opposite electric charges of protons and electrons attract each other, keeping atoms together and accounting for the formation of some compounds.

National Curriculum	Properties of Materials Knowledge Progression	Changing Materials Knowledge Progression	Essential New Vocabulary	
EY	• Know different words for materials (wood, glass, plastic etc) • Know that some materials float and some sink. • Know when to describe something as hard, soft smooth or rough.	• Know that some materials can change their shape. • Know that cooking something gives an outcome that cannot be reversed.	• Wood • Glass • Plastic • Soft • cook	• hard • smooth • float • sink • rough
Year 1 NC • distinguish between an object and the material from which it is made • identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock • describe the simple physical properties of a variety of everyday materials • compare and group together a variety of everyday materials on the basis of their simple physical properties	• Know that there are different materials which can be identified using observations (including fabric, wood, plastic, glass). • Know that an object is made from / of a material. • Know that properties are the words used to describe what a material is like and what it can do. • Know that different materials have different properties. • Know that a soft material can be twisted and squashed and a hard material cannot. • Know that a stretchy material can be pulled • Know that stiff materials are not easy to bend and flexible materials are. • Know that a shiny material reflects light and a dull material does not. • Know that a rough material has an uneven surface and a smooth material has an even surface. • Know waterproof materials do not let water through and absorbent materials do. • Know that opaque materials do not let light pass through and transparent materials do.		• Materials • Fabric • Elastic • rubber • Object • Properties • Twisted • Squashed • Stretch • Stiff • Flexible •	• Shiny / Dull • Reflect • Uneven /even • Waterproof • Absorbent • Absorption • Absorb • Opaque • Transparent •
Year 2 NC • identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses • find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching	• Know that a material's properties make it suitable for different uses. • Know and apply the properties of plastic to identify objects it is suited and not suited to. • Know and apply the properties of wood to identify objects it is suited and not suited to. • Know and apply the properties of metal to identify objects it is suited and not suited to. • Know and apply the properties of glass to identify objects it is suited and not suited to. • Know and apply the properties of rock to identify objects it is suited and not suited to. • Know and apply the properties of paper to identify objects it is suited and not suited to. • Know and apply the properties of cardboard to identify objects it is suited and not suited to.	• Know that a force is an active power that can change the shape of an object • Know that squashing, bending, twisting and stretching are forces which can be applied to solid objects, causing them to change. • Know that changing the shape of an object can change its suitability for purpose	• Rigid • Strong • Weak • Suitable • Suited • Unsuitable • Purpose • force	•

National Curriculum	Properties of Materials Knowledge Progression	Changing Materials Knowledge Progression	Essential New Vocabulary	
Year 3 NC • compare and group together different kinds of rocks on the basis of their appearance and simple physical properties • describe in simple terms how fossils are formed when things that have lived are trapped within rock • recognise that soils are made from rocks and organic matter	• Know that rocks can be grouped based on what they look like and how they feel. • Know that different rocks have different properties. • Know that fossils are found in sedimentary rocks • Know that sedimentary rocks are formed of layers.	• Know that a fossil is the imprint of something that was once living (plants/animals) • Know that the fossil is the imprint of the hardest material in the living thing • Know that fossils are formed when things that have lived are trapped in layers of rock • Know that organic matter is the remains of something that was once living • When organic matter is squashed it forms a soil	• Rocks • Soils • Sedimentary • Layers • Fossils • Imprint • Organic matter	• Grains • Crystals
Year 4 NC • compare and group materials together, according to whether they are solids, liquids or gases • observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C) • identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature	• Know that materials are made from matter. • Matter is the building blocks of everything. • Know that the three states of matter are solids, liquid and gas. • Know that a solid is a substance that holds its shape. • Know that liquids form a pool not a pile. • Know that gas escape from an unsealed container.	• Know that temperature is a measure of the amount of heat (Celsius) • Know that some materials change state when they are heated or cooled • Know that melting is when a solid changes to a liquid and that freezing is when a liquid changes to a solid • Know that materials all have a melting and freezing point • Know that water freezes at 0 degrees and evaporates at 100 • Know that evaporation is when a liquid changes to a gas and that condensation is when a gas changes to a liquid • Know that the sun's thermal energy evaporates water from the earth's surface. • Know that the water held in clouds cools and condensates back to earth as rain / snow.	• Matter • States of matter • Solid • Liquid • Gas • Temperature • Celsius • Degrees • Melting / melt • Freezing /freeze	• Evaporating / evaporate • Thermal energy • Thermal • Condensation • Water-cycle
Year 5 NC • compare and group materials together, according to whether they are solids, liquids or gases • know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution • use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating • give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic • demonstrate that dissolving, mixing and changes of state are reversible changes • explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda.	• Know that materials that do not easily change when forces are applied are hard. • Know that materials that allow heat in the form of thermal energy or electrical energy to flow through are conductors. • Know that materials that restrict the flow of energy are called insulators. • To know that some materials are magnetic. • To know that the greater the transparency of the material the more light it lets through. •	• Know that soluble materials (substance) are able to be dissolved in a liquid. • Know that a solution contains a liquid and a soluble material. • Know that you can recover a substance from a solution by evaporating off the liquid • Know that some changes are reversible • Know that some changes are irreversible as a new material is formed. • Know that burning a substance is an irreversible change • Know that mixtures can be separated in different ways, including filtering, sieving, and evaporating • Know that chemical changes which involve acids are irreversible	• Conductors • Insulators • Electrical • Thermal • Magnetic • Transparency • Soluble • Dissolve • Solution • Soluble • substance	• revisable • irreversible • burning • mixtures • sieving • filtering • acid • chemical change
Year 6 NC				

Physics Key Concept: Non-Contact Forces Objects can affect other objects at a distance	Physics Key Concept: Contact Forces Changing the movement of an object requires a net force to be acting on it
• All objects have an effect on other objects without being in contact with them. • In some cases the effect travels from the source to the receiver in the form of radiation (e.g. visible light). • In other cases, action at a distance is explained in terms of the existence of a field of influence between objects, such as a magnetic, electric or gravitational field. • Gravity is a universal force of attraction between all objects, however large or small. It keeps the planets in orbit around the sun and causes terrestrial objects to fall towards the centre of the earth.	• A force acting on an object is not seen directly but is detected by its effect on the object's motion or shape. • If an object is not moving, the forces acting on it are equal in size and opposite in direction, balancing each other. • Since gravity affects all objects on earth there is always another force opposing gravity when an object is at rest. • Unbalanced forces cause a change in movement in the direction of the net force. • When opposing forces acting on an object are not in the same line they cause the object to turn or twist. This effect is used in some simple machines

National Curriculum	Non- contact forces Knowledge Progression	Contact Forces Knowledge Progression	Essential New Vocabulary	
EY	• Know that an object will fall when dropped. • Know that an object will not roll in an upwards direction unless a force is applied. • Know that the sun can be seen in the day and the moon and stars at night.	• Know an object moves when you kick it. • Know an object moves if you throw it.	• Object • Sun • moon	• stars
Year 1 NC				
Year 2 NC				
Year 3 NC • notice that some forces need contact between 2 objects, but magnetic forces can act at a distance • observe how magnets attract or repel each other and attract some materials and not others • compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials • describe magnets as having 2 poles • predict whether 2 magnets will attract or repel each other, depending on which poles are facing • notice that some forces need contact between 2 objects • compare how things move on different surfaces	• Know a force is active power • Know that magnetic forces can act at a distance • Know that magnets can attract and repel each other and that these are forces. • Know that some materials are attracted to magnets • Know that metals (except aluminium) are magnetic. • Know that magnets have a north and south pole. • Know that like poles repel and opposite poles attract.	• To know that things move further on smoother surfaces.	• Power • Force • Magnetic • Magnet • Attract • Repel •	• North / south poles
Year 4 NC				
Year 5 NC • explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object • identify the effects of air resistance, water resistance and friction, that act between moving surfaces • recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect. • describe the movement of the Earth, and other planets, relative to the Sun in the solar system • describe the movement of the Moon relative to the Earth • describe the Sun, Earth and Moon as approximately spherical bodies • use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky.	• Know that gravity is an attractive force which causes unsupported objects fall to earth. • Know that sun is the centre of our solar system. • Know that the sun's gravitational force cause the planets to orbit it. • Know that the moon orbits the earth. • Know that the moon appears differently in the night sky at different points in its orbit. • Know that the time between two full moons is an orbit cycle. • Know that sun is a star. • Name the eight planets in the solar system. • Know that the sun, earth and moon are approximately spheres. • Know that earth spins on its axis. • Know that one spin is 24 hours • Know that this causes the surface of the earth to face towards the sun in the day time and away from the sun at night. • Know that the Earth rotation makes it appear as if the sun is moving across the sky.	• To know that friction is a force acting between two surfaces • To know that friction tries to slow things down or halt them. • To know that the same object will move differently on different surfaces. • To know that water resistance is the force acting between an object and body of water. • To know that air-resistance is the force acting between an object and a body of air.	• Gravity • Solar system • Orbit • Orbit cycle • Star • Axis • Rotation • Friction • Resistance • Accelerate • Decelerate •	
Year 6 NC				

Physics Key Concept: Energy

The total amount of energy in the universe is always the same but can be transferred from one energy store to another during an event

- Many processes or events involve changes and require an energy source to make them happen.
- Energy can be transferred from one body or group of bodies to another in various ways. In these processes some energy becomes less easy to use.
- Energy cannot be created or destroyed. Once energy has been released by burning a fossil fuel with oxygen, some of it is no longer available in a form that is as convenient to use.

National Curriculum	Energy Knowledge Progression	Essential New Vocabulary
EY	• To know that Earth is the planet they live on. • Know how to regulate their body temperature using clothing • Know it is colder in winter and warmer in the summer. Know some trees lose their leaves in autumn. • Know that the amount of daylight is less in the winter and more in the summer. • Know there are four seasons	• Planet • Earth • Winter • summer • autumn • spring • season
Year 1 NC • observe changes across the 4 seasons • observe and describe weather associated with the seasons and how day length varies	**Seasonal Changes** • To know that the sun is the main source of light energy and heat energy on earth. • To know that there is more daylight in the summer. • To know that the Earth experience least light and heat energy in winter and most in summer. • To notice the impact of changes in light and heat energy through the seasons. • To notice the impact of changes in light and heat energy on the weather.	• Light energy • Heat energy • Seasonal • Weather • Daylight hours • day • night
Year 2 NC		
Year 3 NC • recognise that they need light in order to see things and that dark is the absence of light • notice that light is reflected from surfaces • recognise that light from the sun can be dangerous and that there are ways to protect their eyes • recognise that shadows are formed when the light from a light source is blocked by an opaque object • find patterns in the way that the size of shadows change	**Light** • Know that light is needed to see things • Know that dark is the absence of light. • Know that light reflected from surfaces. • Know that looking directly at the sun is dangerous. • Know that an opaque object blocks light. • Know that shadows are forms when light is blocked. • Know that translucent materials allow light through. • Know that the close an object to the light source the larger the shadow.	• Light • Dark • Reflection • Opaque • Shadow • Translucent • Absence
Year 4 NC • identify how sounds are made, associating some of them with something vibrating • recognise that vibrations from sounds travel through a medium to the ear • find patterns between the pitch of a sound and features of the object that produced it • find patterns between the volume of a sound and the strength of the vibrations that produced it • recognise that sounds get fainter as the distance from the sound source increases • identify common appliances that run on electricity • construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers • identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery • recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit • recognise some common conductors and insulators, and associate metals with being good conductors	**Sound** • To know that sound is a form of energy. • To know that sound occurs due to an object vibrating. • To know that the vibrations of sound travel through solids, liquids and gases to the ear. • To know that the speed of the vibrations changed the pitch. A high-speed vibration causes a higher pitch. • To know that strength of a vibrations causes a louder volume. • To know that a sound gets fainter as the distance from the sound source increases. • **Electricity** • To know some common appliances that run on electricity. • To know the basic parts of a circuit: bulb, cells, switch wire buzzer. • To Know that a complete circuit is needed to power a component. • To know the impact of a complete and open circuit • To know that a switch completes and opens a circuit. • To know that electrical insulators do not allow electricity to flow through them. • To know that electrical conductors do allow electricity to flow through them. • To know that metal make good conductors. • To know that a series circuit contains elements in a single complete loop.	• Sound energy • Sound • Vibrations • Pitch • Volume • Frequency • Fainter • Louder • Series • Appliances • Electricity • Bulb • Cell • Switch • Wire • Buzzer • Circuit • Power • Component • Insulator • conductor
Year 5 NC		

National Curriculum	Energy Knowledge Progression		Essential New Vocabulary	
Year 6 NC • recognise that light appears to travel in straight lines • use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye • explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes • use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them. • associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit • compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches • use recognised symbols when representing a simple circuit in a diagram.	**Light** • To know that light appears to travel in straight lines • To know that light can travel directly to the eye. • To know that light can travels from a source to an object and then to the eye. • To know that light can be reflected into the eye. • To know that shadows are the same shape as objects as light travels in straight lines.	**Electricity** • To know that voltage is an electrical force. • To know that the more volts the brighter / louder the component. • To know that a cell is 1.5v • To know that a battery is multiple cells. • To know that in a circuit with a fixed voltage, the more components the quieter, dimmer the component. • To know the recognised circuit symbols for switch, cell, bulb, buzzer and switch.	• Source • Voltage • Battery • Components	

Progression Tables – Disciplinary Knowledge

Key Concept: Investigating Cause and Effect	Key Concept: Analysing
Science is about finding the cause or causes of phenomena in the natural world • Science is a search to explain and understand phenomena in the natural world. • There is no single scientific method for doing this; the diversity of natural phenomena requires a diversity of methods and instruments to generate and test scientific explanations. • Often an explanation derives from the factors that must be present for an event to take place, as shown by evidence from observations and experiments. • In other cases, supporting evidence is based on correlations revealed by patterns in systematic observation.	Scientific explanations, theories and models are those that best fit the evidence available at a particular time • A scientific theory or model representing relationships between variables of a natural phenomenon must fit the observations available at the time, and lead to predictions that can be tested. • Any theory or model is provisional and subject to revision in the light of new data, even though it may have led to predictions that accord with data in the past.

National Curriculum	Observing and measuring	Recording Data	Asking and exploring questions	Performing Tests	Concluding, prediction, evaluating
EY					
KS1 NC • asking simple questions and recognising that they can be answered in different ways • observing closely, using simple equipment • performing simple tests • identifying and classifying • using their observations and ideas to suggest answers to questions • gathering and recording data to help in answering questions.	• I know that to observe means to look closely and notice similarities and differences related to my enquiry question • I know that measuring tells the size of something. • I know how to use a hand lens • I know that a hand lens makes small objects appear bigger • I know how to use same sized objects to make measure comparison • I know observation can be instant or take place over time.	• I know where to place my data on a given simple table • I know where to place my data on a given bar chart / pictogram/ Venn diagram • I can group things based on given criteria	• I can sort and classify using given criteria • I know that groups and sorting helps us observe similarities and differences. • I know that variables change over time.	• I can follow a modelled investigation in small parts	• I know that my observations and recordings enable me to answer my question

National Curriculum	Observing and measuring	Recording Data	Asking and exploring questions	Performing Tests	Concluding, prediction, evaluating
	•				
LKS2 NC • asking relevant questions and using different types of scientific enquiries to answer them • setting up simple practical enquiries, comparative and fair tests • making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers • gathering, recording, classifying and presenting data in a variety of ways to help in answering questions • recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables • using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions • identifying differences, similarities or changes related to simple scientific ideas and processes • using straightforward scientific evidence to answer questions or to support their findings.	• I know that I observe / measure the dependent variable. • I know that a dependent variable is the variable that is changing • I know that systematic observation is one that is controlled. • I know that temperature is measured in 0C using alcohol and digital thermometers. • I know that force is measures in N using a Newton meter • I know that sound is measure in decibels using dataloggers. *(KS1 Maths Curriculum)* • *I know that length in measured in m and cm using a ruler, tape measure* • *I know that capacity is measured in ml and L using measuring cylinders* • *I know that time is measured in mins and sec using a stopwatch* • *I know that mass is measured in g and Kg using balanced and digital scales* • *I can read scales in divisions of 1,2,5 and 10.*	• I know that the control variable builds the table • I know that the dependent variable data is organised in a table. • I know that the control variable builds the x axis • I know that the dependent variable data is organised on the y axis • I can label and identify features I have observed • I know that a diagram is simplified and contains key features. • I know how to use my careful observations in a given simple key to identify	• I know there are different types of scientific enquires. • I know that comparative and fair testing involves exploring cause and effect. • I know that classifying involves sorting and grouping according to similarities and differences. • I know that researching involves using secondary sources to find answers to questions • I know that 'observations over time' focus on similarities and differences, patterns and change at regular intervals. • I know and give reasons for my choice of enquiry • I know that my question is based on my variables • I can identify the control and dependent variables • I can recognise a fair test	• I can make suggestions as to how to investigate	• I know how to describe the similarities and differences or changes in my data • I know how to use tables and bar charts to look for patterns and relationships (cause and effect) and describe these in words. • I know how to use the relationship (cause and effect) or pattern to predict a future change • I can use my scientific knowledge to explain my findings.
UKS2 NC • planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary • taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate • recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs • using test results to make predictions to set up further comparative and fair tests • identifying scientific evidence that has been used to support or refute ideas or arguments.	• I use my knowledge of variables and measures to make decisions about which to observe and measures and equipment to use. • I know that systematic observation is based on the control variable *(LKS2 Maths Curriculum)* • I can read scales that involve decimal numbers and negative numbers.	• I know how to organise data using my knowledge of control and dependent variables in tables, charts and diagrams. • I know that a line graph represents changes over time. • I know that the x axis is the control variable • I know that the y axis is the dependent variable • (line graphs are taught in maths in year 6)	• I can identify how to control variables in different enquiry types • I know how to use variable to generate an enquiry question for different enquiry types. • I can explain my choice of enquiry choice • I can design a fair test •	• I can plan and perform part of an investigation independently	• I can use my scientific knowledge to question my findings and decide when further testing is required. • I know that all results allow me to question and predict, however, not all results are reliable

Key Concept: Communication	Key Concept: Application
The knowledge produced by science is used in engineering and technologies to create products to serve human ends • The use of scientific ideas in engineering and technologies has made considerable changes in many aspects of human activity. • Advances in technologies enable further scientific activity; in turn this increases understanding of the natural world. • In some areas of human activity, technology is ahead of scientific ideas. • In other areas, scientific ideas precede technology.	Applications of science often have ethical, social, economic, and political implications • The use of scientific knowledge in technologies makes many innovations possible. • Whether or not particular applications of science are desirable is a matter that cannot be addressed using scientific knowledge alone. • Ethical and moral judgments may be needed, based on such considerations as justice or equity, human safety, and impacts on people and the environment.

	Communicating	Applications
EY		
KS1 NC	• I know that science has been used and is used to provide solutions	• I can recognise an application of science.
LKS2 NC • reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions	• I know relevant scientific language and can use that language to discuss and present my ideas	• I can name an application of science and an associated scientist
UKS2 NC • reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations	• I know that relevant scientific language and illustrations can be used to communicate and justify my ideas • I know how scientific ideas have developed over time.	• I can use my knowledge of science to understand its uses and implication

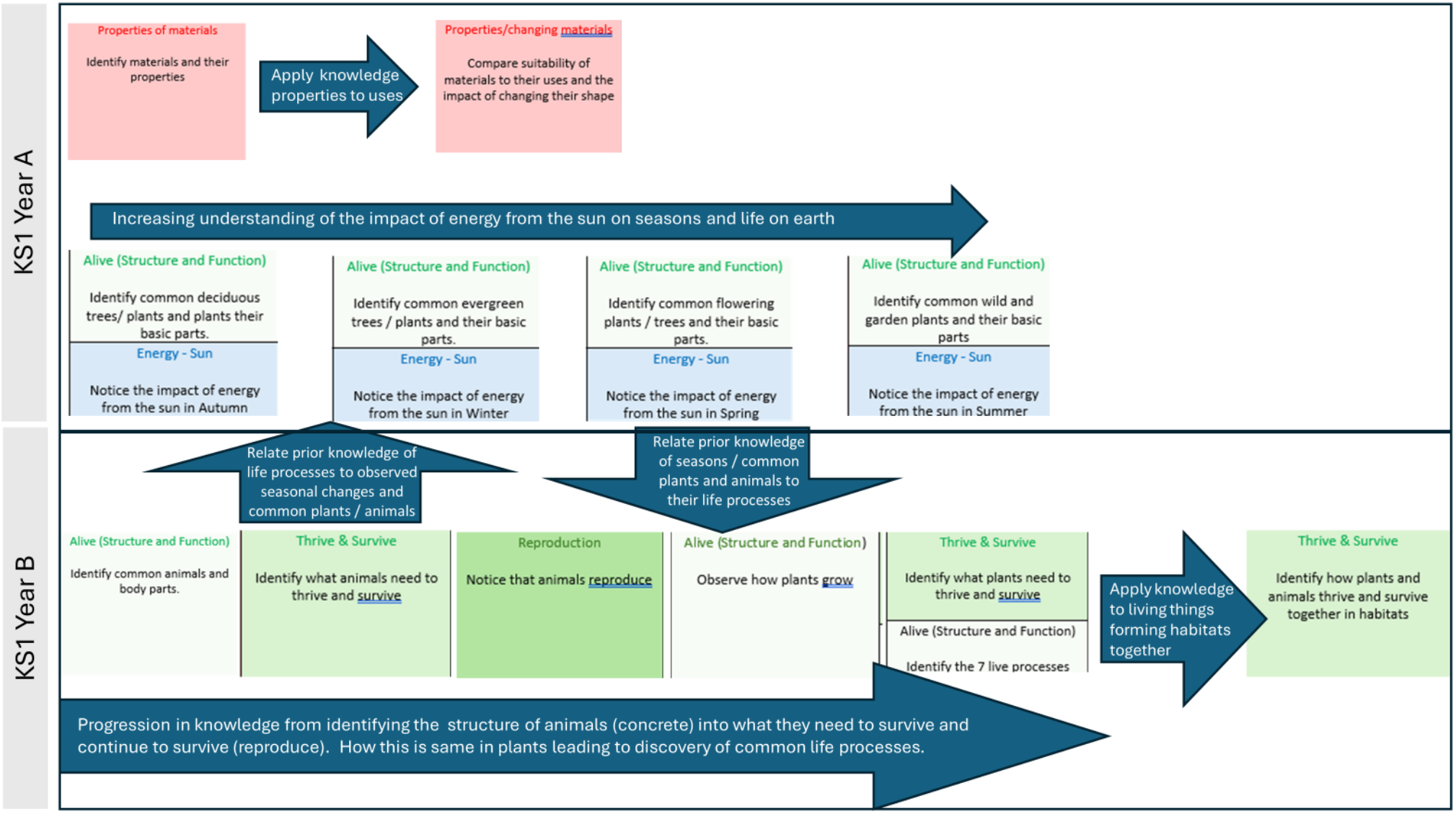
Sequencing Pathways – Single Age

		Autumn		Spring		Summer	
Early	Year 1	Alive (Structure and Function) Identify common animals and body parts.	Alive (Structure and Function) Identify common deciduous trees/ plants and plants their basic parts. Energy - Sun Notice the impact of energy from the sun in Autumn	Alive (Structure and Function) Identify common evergreen trees / plants and their basic parts. Energy - Sun Notice the impact of energy from the sun in Winter	Alive (Structure and Function) Identify common flowering plants / trees and their basic parts. Energy - Sun Notice the impact of energy from the sun in Spring	Properties of materials Identify materials and their properties	Alive (Structure and Function) Identify common wild and garden plants and their basic parts Energy – Sun Notice the impact of energy from the sun in Summer
Novice	Year 2	Properties/changing materials Compare suitability of materials to their uses and the impact of changing their shape	Thrive & Survive Identify what animals need to thrive and survive	Reproduction Notice that animals reproduce	Alive (Structure and Function) Observe how plants grow	Thrive & Survive Identify what plants need to thrive and survive Alive (Structure and Function) Identify the 7 live processes	Thrive & Survive Identify how plants and animals thrive and survive together in habitats
Growing Expertise	Year 3	Energy - Light Notice light and dark including shadows	Forces: contact & non-contact Notice and compare simple contact and non-contact forces through friction and magnets	Alive (Structure and Function) Identify the structure and function of human skeleton and muscles and parts of a flowering plant.	Thrive and Survive Explore and investigate nutrition in plants and animals	Reproduction Explore the function of the flower in pollination and seed dispersal	Properties/changing materials Compare rocks and soils and describe fossil formation
	Year 4	Properties/changing materials Observe and measure changes of state	Energy – Sound Explore how sound energy travels in vibration waves	Alive (Structure and Function) Identify the structure and function of different parts of the digestive system (including teeth)	Diversity Use knowledge of structure of plants and animals to group them	Thrive and Survive Construct food chains and reason about the impact of environmental change on thrive and survive	Energy – Electricity Explore the impact of an open and closed circuit on electrical energy?
	Year 5	Properties/changing materials Explain the processes and outcomes of some reversible and irreversible changes which include changes of state.	Forces: contact & non-contact Identify and explain the effects of unbalanced forces	Forces: contact & non-contact Describe the orbits of the earth and moon	Alive (Structure and Function) Describe how human structure and function changes as they age.	Reproduction Describe and compare the process of sexual reproduction in some animals	Reproduction Describe and compare the process of sexual and asexual reproduction in some plants.
	Year 6	Alive (Structure and Function) Identify the structure and function of main different parts of the human circulatory system	Alive (Structure and Function) Use knowledge of structure and function of plants and animals to classify them in broad groups	Thrive and Survive Recognise ways in which humans can support or hinder their ability to thrive.	Diversity Identify adaptions and its role in evolution	Energy - Light Explore how light energy travels in straight lines.	Energy – Electricity Explore the impact of varying voltage in a circuit

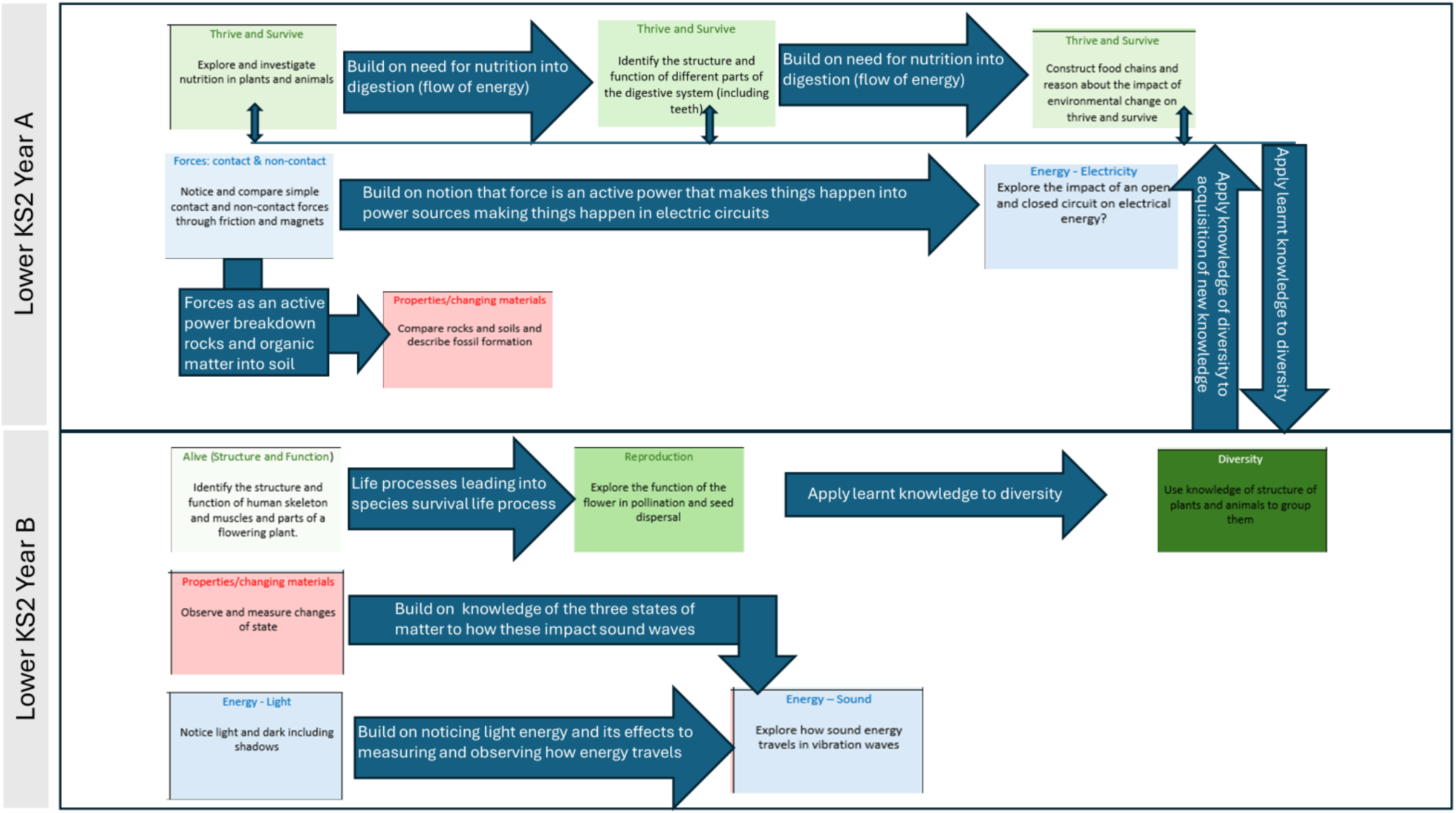
Sequencing Pathways – Mixed Age

		Autumn		Spring		Summer	
Early	KS1 Year A	Properties/changing materials Compare suitability of materials to their uses and the impact of changing their shape	Alive (Structure and Function) Identify common deciduous trees/ plants and plants their basic parts. Energy - Sun Notice the impact of energy from the sun in Autumn	Alive (Structure and Function) Identify common evergreen trees / plants and their basic parts. Energy - Sun Notice the impact of energy from the sun in Winter	Alive (Structure and Function) Identify common flowering plants / trees and their basic parts. Energy - Sun Notice the impact of energy from the sun in Spring	Properties of materials Identify materials and their properties	Alive (Structure and Function) Identify common wild and garden plants and their basic parts Energy - Sun Notice the impact of energy from the sun in Summer
Novice	KS1 Year B	Alive (Structure and Function) Identify common animals and body parts.	Thrive & Survive Identify what animals need to thrive and survive	Reproduction Notice that animals reproduce	Alive (Structure and Function) Observe how plants grow	Thrive & Survive Identify what plants need to thrive and survive Alive (Structure and Function) Identify the 7 live processes	Thrive & Survive Identify how plants and animals thrive and survive together in habitats
Growing Expertise	Year 3	Forces: contact & non-contact Notice and compare simple contact and non-contact forces through friction and magnets	Thrive and Survive Explore and investigate nutrition in plants and animals	Thrive and Survive Identify the structure and function of different parts of the digestive system (including teeth)	Thrive and Survive Construct food chains and reason about the impact of environmental change on thrive and survive	Energy - Electricity Explore the impact of an open and closed circuit on electrical energy?	Properties/changing materials Compare rocks and soils and describe fossil formation
	Year 4	Properties/changing materials Observe and measure changes of state	Alive (Structure and Function) Identify the structure and function of human skeleton and muscles and parts of a flowering plant.	Energy - Light Notice light and dark including shadows	Reproduction Explore the function of the flower in pollination and seed dispersal	Diversity Use knowledge of structure of plants and animals to group them	Energy – Sound Explore how sound energy travels in vibration waves
	Year 5	Alive (Structure and Function) Describe how human structure and function changes as they age.	Alive (Structure and Function) Identify the structure and function of main different parts of the human circulatory system	Thrive and Survive Recognise ways in which humans can support or hinder their ability to thrive.	Properties/changing materials Explain the processes and outcomes of some reversible and irreversible changes which include changes of state.	Reproduction Describe and compare the process of sexual reproduction in some animals	Reproduction Describe and compare the process of sexual and asexual reproduction in some plants.
	Year 6	Forces: contact & non-contact Identify and explain the effects of unbalanced forces	Forces: contact & non-contact Describe the orbits of the earth and moon	Alive (Structure and Function) Use knowledge of structure and function of plants and animals to classify them in broad groups	Diversity Identify adaptions and its role in evolution	Energy - Light Explore how light energy travels in straight lines.	Energy – Electricity Explore the impact of varying voltage in a circuit

Sequencing Pathway – Rationale KS1



Sequencing Pathway – Rationale LKS2



Sequencing Pathway – Rationale UKS2