SCIENCE KNOWLEDGE Progression

This is how our children's SCIENCE knowledge builds from Year 3 to Year 6, taking into account, prior learning (Year 2) and next stage (Year 7).

In order for pupils to become confident scientists, they must learn essential aspects of the knowledge, methods, processes and uses of science. Through building up a body of key foundational knowledge and concepts, pupils are encouraged to recognise the power of rational explanation and develop a sense of excitement, awe, wonder and curiosity about the world around us. They are also encouraged to understand how science can be used to explain how and why things happen. The progression plan will inform planning to ensure that learning is built within the lesson sequence, within the unit, within the year and overtime. We want our children to move from being a novice to becoming an expert scientist.

National Curriculum (KS2)

Working and thinking scientifically' is described separately at the beginning of the knowledge progression document, but must always be taught through and clearly related to substantive science content presented for each concept.
Pupils should read, spell and pronounce scientific vocabulary correctly.

Pillars of our Science Curriculum:

Enquiry skills (that help the children to ask and answer questions about the world around them)	**Awe, wonder and curiosity** (about natural phenomena)	**Future prosperity** (How does science at Westdale lend itself to the future of our pupils and to jobs that do not even exist yet?)

Area of Study	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Working Scientifically						
Question and enquiry **Tools and Techniques** **Presenting findings** **Concluding and reporting**	• Know that questions can be answered in different ways. • Know that the correct technical language should be used orally and in / when writing.	**To build on prior knowledge and:** • Know how to answer **questions** through simple practical enquiries including the introduction of variables. • Know how to take accurate **measurements** using standard units of measure. Measure carefully (taking account of mathematical knowledge up to Year 3) and add to scientific learning. • Know how to **record** and **present** their findings to share with others. • Know that **reports** should be written in simple scientific language using appropriate scientific vocabulary. • Begin to understand that **conclusions** can be drawn from findings. Linked to substantive knowledge (see below)	**To build on prior knowledge and:** • Know how to answer **questions** through different types of scientific enquiry, including knowing which variables remain the same. • Know which **measurements** to use for different aspects of enquiry. Measure carefully (taking account of mathematical knowledge up to Year 4) and add to scientific learning. • Know how to **record,** group and **classify** results; and how to **present** their findings to be easily interpreted by others. • Know how to write a **report** using appropriate scientific vocabulary. • Know that **conclusions** can be drawn from findings and understand about the scientific information that has been learned Linked to substantive knowledge (see below)	**To build on prior knowledge and:** • Know how to plan their own scientific **enquiries** to answer **questions**, including recognising and controlling variables where necessary. • Know how to take accurate **measurements** with accuracy. Measure carefully (taking account of mathematical knowledge up to Year 5) and add to scientific learning. • Know how to **record,** group and **classify** results; and how to **present** their findings accurately. • Know that **reports** should be written formally using appropriate scientific vocabulary. • Know that **conclusions** can be drawn from findings and use test results to make further predictions. Linked to substantive knowledge (see below)	**To build on prior knowledge and:** • Know how to plan a **scientific enquiry**, selecting appropriate controls and resources and independently identifying the variables. • Know which **measurements** are required to 'test' an enquiry and use accurately. Measure carefully (taking account of mathematical knowledge up to Year 6) and add to scientific learning • Use informed decisions to independently **record**, **classify** and **present** their results. • Know how to write an increasingly accurate and evaluative **scientific report.** • Know that **conclusions** can be drawn from findings and know how to evaluate to enable further predictions. Linked to substantive knowledge (see below)	• Know how to evaluate data, with reference to potential sources of random and systematic error. • Know how to work as a group to design, build and test a product, including making a poster to market said product. • Know how to interpret observations and data to identify more complex patterns of correlation. • Know how to draw more complex conclusions from the interpretation of data. • Know how to draw a scatter or bar graph without guidance. • Know how to solve unfamiliar situations by applying existing knowledge to new situations. • Know why controls are necessary for a valid experiment. • Know how scientific methods and theories develop to take into account new evidence and ideas.
Chemistry						
Properties and changes of materials ***How and why can you group given materials?***	• Know that the shape of some solid objects can be changed. • Know how different materials are suitable for different uses.			• Know how to compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity and response to magnets. • Know how to separate some materials based upon their properties, including through sieving, filtering and evaporating. • Know that dissolving, mixing and changes of state are reversible changes.		• Know the difference between a mixture, an element and a compound using examples. • Know how temperature affects solubility. • Know how to use a particle model to explain the difference between elements, compounds, mixtures and apply it to producing clean water. • Know the techniques needed to separate a mixture of soluble and insoluble substances in water.

				• Know that changes to a material can result in new materials, which may or may not be reversible, including changes associated with burning. • Know that some materials will dissolve to form a solution and know how to recover a substance from a solution. **Scientists:** **Spencer Silver & Arthur Fry** Chemical Engineer & Chemist respectively who invented the post-it note **Ruth Benerito** Chemist who developed wrinkle-free cotton fabric **Jamie Garcia** Chemist who discovered a fully recyclable plastic **Raquel Prado** Chemist who develops a sustainable fabric that looks like leather but comes from pineapple leaves that would otherwise be burnt		
Rocks ***How and why can you group given rocks?***		Know how to compare and group together different kinds of rocks on the basis of their appearance and simple physical properties. Know (in simple terms) how fossils are formed when things that have lived are trapped in rock. Know that soil is made from rocks and organic matter. **Scientists:** **William Smith** (Engineer & Geologist who developed the science of rock strata) **James Hutton** (Scientist who studied rocks and the effects of natural processes on them, such as rain, running water, tides, and volcanoes, on the development of the Earth)				
States of Matter ***How does heat change the state of given materials?***			Know how to compare and group materials together, according to whether they are solids, liquids or gases. Know that some materials change state when they are heated or cooled, and know how to measure or research the temperature at which this happens in degrees Celsius (°C). Know the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature. Scientist: **Daniel Fahrenheit** (Physicist who invented the Fahrenheit temperature scale and the thermometer) **Anders Celsius** (Astronomer who invented the degrees Celsius temperature scale)			• Know how to explain changes of states of matter with reference to energy levels of particles. • Know how pressure occurs in gases. • Know how to explain the properties of the three states of matter with reference to the particle model. • Know how pressure in gases may change and can apply ideas about energy and the particle model in unfamiliar situations.
Biology						
Living things and their habitats	• Know the difference between things that are living, dead and those that have never been alive. • Know the names of a variety of animals and plants in their habitats, including microhabitats.		Know that living things can be grouped in a variety of ways. Know how to use classification keys to help group, identify and name a variety of living things in their local and wider environment.	Know the similarities and differences in the life-cycles of a mammal, an amphibian, an insect and a bird.	Know 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.	

How and why can you group given Animals/plants? Y4 – classification key Y5 – group according to lifecycles Y6 – inc microorganisms and broad/narrow groups	• Know that animals obtain their food either through plants, other animals or a combination of the two. • Know different sources of food as shown through a food chain. • Know that organisms live in and are part of an interdependent habitat / microhabitat.		Know that environments can change and that this can sometimes pose dangers to living things. **Scientists:** **Jacques Cousteau** (Oceanographer and co-inventor of the aqualung) **Rachel Carson** (Aquatic Biologist who wrote about environmental pollution) **Kelsey Archer Barnhill** (Deep Sea Ecologist who sends robots to the seafloor to collect samples of different animals to study) **Liz Bonnin** (TV Presenter & Wildlife Conservationist)	Know the gestation period of humans and how this differs to other mammals and other animals. Know the life process of reproduction in some plants and animals **Scientists:** **David Attenborough** Naturalist & TV Presenter **Jane Goodall** (Wildlife Researcher & Conservationist who studied chimpanzees **Roger Arliner Young** Zoologist who studied reproduction in marine organisms	Know reasons for classifying plants and animals based on specific characteristics. **Scientists:** **Carl Linnaeus** (Botanist & Zoologist who developed a taxonomy for classifying organisms) **Agnes Arber** (Botanist and first woman to become a fellow of the Royal Society who studied aquatic flowering plants and monocots, a group of flowering plants)	
Animals including humans ***How is the human body so amazing at keeping us alive?***	• Know the growth process for animals' offspring growing into adults, including caterpillars to butterflies, and babies to humans. • Know that animals (including humans) need water, air, food to survive. • Know that we should eat the right types of food to stay healthy. • Know that hygiene and exercise are important for both mental and physical health.	Know that humans and some animals have skeletons and muscles for support, protection and movement. Know 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. **Scientists:** **Wilhelm Roentgen** (Physicist who discovered x-rays) **Marie Curie** (Physicist who invented the first mobile x-ray machine to treat soldiers wounded on the battlefield in WWI)	Know and be able to construct and interpret a variety of food chains, identifying producers, predators and prey. • Know the simple functions of the basic parts of the digestive system in humans. • Know the different types of teeth in humans and their simple functions. **Scientists:** **William Beaumont** (Surgeon who first observed and studied human digestion as it occurs in the stomach) **Washington & Lucius Sheffield** (Dentists who invented toothpaste in a tube) **Paul Sharpe** (Bioengineer who studies how to regrow teeth if they become damaged)	Know and be able to describe the changes as humans develop from birth to old age. Know that puberty means being able to produce offspring Know the names for the reproductive organs in the human body. **Scientists:** **Virginia Apgar** Doctor & Medical Researcher who developed a method of evaluating the well-being of new-born babies	Know the ways in which nutrients and water are transported within animals, including humans. Know the names of the main parts of the human circulatory system, and be able to explain the functions of the heart, blood vessels and blood Know that diet, exercise, drugs and lifestyle impact upon the way their bodies function. **Scientists:** **William Harvey** (Doctor who discovered the nature of blood circulation and the function of the heart as a pump) **Santorio Santorio** Doctor who invented an instrument to measure pulse accurately using a pendulum and did the first scientific study of the metabolism **Richard Doll** Doctor who proved the link between lung cancer and smoking	
Plants ***How do plants stay alive?***	• Know the function of each basic part of a plant. • Know the life-cycle of a plant – including those from a seed / bulb. • Know what plants need to germinate / grow / survive. • Know the function of roots and stems / trunks. • Know why water, air, light and heat are needed for plants to grow.	Know the functions of different parts of plants; roots, stem, leaves and flowers. Know how plants transport water. Know the requirements of plants for life and growth (air, light, nutrients from soil and room to grow) and how they vary from plant to plant. Know the role of flowers in the life cycle of flowering plants, including pollination, seed formation and seed dispersal. ***Scientists:*** ***Jan Ingenhousz*** *(Doctor & Scientist who discovered the process of photosynthesis)* ***Carl Linnaeus*** *(Botanist who studied the conditions for successfully growing bananas and developed a method to reproduce them in Europe)* **Dr Kelsey Byers** (Biologist who studies flower smells and how they attract insects)				
Evolution and inheritance					Know how living things have changed over time.	

How could humans adapt over time? *With Global Warming, fast food, technology, accessible transport.*					Know that fossils provide information about living things that inhabited the Earth millions of years ago. Know that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents. Know how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution. **Scientists:** **Mary Anning** Fossil hunter who developed the theory that dinosaurs had become extinct a long time ago **Charles Darwin** Natural Historian who developed the theory of evolution by natural selection **Alfred Wallace** Natural Historian who developed the theory of evolution by natural selection	
Physics						
Light ***Y3 – Why is light important but dangerous?*** ***Y6 – How is the way in which light travels important?***		Know that light is emitted from some objects and reflected from others. Know that light from the Sun can damage our eyes – so we must never look at it. Know what we can do to protect our eyes. Know that opaque objects form shadows and why and how the size of shadows can change.			Know that light appears to travel in a straight line. Know that because light travels in straight lines this explains how and why shadows have the same shape as the objects that cast them.	• Know that in a vacuum, light waves have a maximum speed - the speed of light. • Know that white light is a mixture of colours. • Know the primary colours and secondary colours of light. • Know that combinations of the primary colours of light result in the secondary colours of light. • Know that we see different colours due to the different absorption and reflection of light by objects.
		Know that light is needed in order to see objects.			Know that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes.	
		Know that darkness is the absence of light. **Scientists:** **Percy Shaw** (Inventor of the cat's eye)			Know that because light travels in straight lines this explains how objects are seen as they give out or reflect light into the eye **Scientists:** **Euclid** Mathematician who predicted that light travels in straight lines and we only see things that light falls on **Ibn Sahl** Mathematician who observed the paths of rays of light as they reflected off different mirrors **Colin Webb** Professor of Laser Physics	
Forces and Magnets ***How can forces affect the movement of objects?***		Know how things move on different surfaces. Know that some forces need contact between two objects, but magnetic forces can act at a distance.		Know that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object.		
		Know that magnets attract or repel each other and attract some materials and not others. Know how to 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. Know that a magnet has a north and south pole. Know whether two magnets will attract or repel each other, depending on which poles are facing. **Scientists:**		Know that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect. Know the effects of air resistance, water resistance and friction, that act between moving surfaces. **Scientists:** **Archimedes** Mathematician who developed theories about how levers and pulleys can lift and move heavy objects **Galileo Galilei**	

		William Gilbert (Doctor who developed the theory of magnetism) **Leonardo Da Vinci** - search document for information (First person to plan and carry out tests on friction) **Eric Laithwaite** (Electrical Engineer who developed the technology behind the Maglev train)		Astronomer, Mathematician & Physicist who was the first person to use the scientific method to test theories about gravity and the Solar System **Isaac Newton** Mathematician & Physicist who developed theories about gravity **George Cayley** Aeronautical Engineer who designed the first successful glider to carry a human being		
Electricity ***How and why can a circuit be designed to ensure all the components work?***			Know 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. Know that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit. Know some common conductors and insulators, and associate metals with being good conductors. Know and be able to name the basic parts of a simple series circuit, including cells, wires, bulbs, switches and buzzers. Know some common appliances which rely on electricity and how integral to our lives electricity has become. Know how to construct a simple series electrical circuit **Scientists:** **Thomas Edison** (Inventor of the lightbulb and power grid) **Joseph Swan** (Physicist & Chemist who developed a primitive electric light 20 years before Thomas Edison) **Lewis Howard Latimer** (Electronic Engineer who improved the design of Edison's light bulb and brought street lighting to the world) **Ronit Kanwar** Businessman who set up company to provide affordable, sustainable solar-powered lights for poor in rural India **William Kamkwamba** Inventor who used wind turbines to bring electricity to his village in Malawi **Zubera Iqbal** Chemist who explores sustainable ways to recycle electric vehicle batteries		Know that the number and voltage of cells affects the brightness of bulbs and loudness of buzzers. Know how to compare and give reasons for variations in how components function, including the brightness of bulbs and the on/off position of switches. Know the symbols when representing a simple circuit diagram. **Scientists:** **Nikola Tesla** Electrical & Mechanical Engineer who developed the AC electrical system and made important advances in technologies such as x-rays, neon lights and robotics **Alessandro Volta** Physicist who developed the electric battery **Mildred S Dresselhaus** Materials Scientist whose research led to the development of the rechargeable batteries in all modern electronic equipment	
Sound ***How does sound travel and what can affect it?***			Know how sounds are made, associating some of them with something vibrating. Know that vibrations from a sound travel through a medium to the ear. Know that there is a link between the volume of a sound and the strength of the vibrations that produced it. Know that there is a link between the pitch of a sound and features of the object that produced it. Know that sounds get fainter as the distance from the sound source increases. Know what pitch and volume mean.			• Know how to recognise a longitudinal wave from a diagram. • Know how to describe longitudinal and traverse waves, with reference to oscillations and energy. • Know that the reflection of a sound wave is an echo. • Know which material sound will travel fastest through, with reference to particle arrangement.

			Scientists: **Aristotle** (Philosopher who developed the concept that sound travels through air due to the movement of air particles) **Isaac Newton** - search document for information (Mathematician & Physicist who measured the speed of sound)			
Earth and Space ***How does the placement, movement and shape of the Earth affect us?***				Know enough about the Earth's rotation to be able to explain day and night and the apparent movement of the Sun across the sky. Know the movement of the Earth, and other planets, relative to the Sun in the solar system. Know the movement of the Moon relative to the Earth. Know that the Earth's tilt and orbit create the seasons. Know that the Sun, Earth and Moon are approximately spherical bodies. **Scientists:** **Galileo Galilei** Astronomer, Mathematician & Physicist who made the first telescope and discovered Neptune and the rings of Saturn **Margaret Hamilton** Computer Scientist who was responsible for the software that allowed astronauts Neil Armstrong and Buzz Aldrin to land on the Moon **Caroline Herschel** Astronomer who was the first woman to discover a comet **Valentina Tereshkova** Astronaut and first woman in space **Mae Jemison** Astronaut and first Black woman in space		• Know that our Sun is a star, and that there are other stars and solar systems in our galaxy and other galaxies in the Universe. • Know that a light year is how far light travels in one year. • Know that the distance from the sun affects the year length and temperature of a planet. • Know why the southern hemisphere experiences seasons differently to that of the northern hemisphere. • Know how the different seasons occur in the northern hemisphere, with reference to the tilt of the Earth and proximity to the Sun.