Progression in Science at Whale Hill Primary School

Intent

Our Science curriculum aims to engage and give children an opportunity to experience awe and wonder within science and to want to be curious about the world around them. We want them to make sense of the world by using scientific enquiry skills. Through our progressive, enquiry-based framework, children will develop knowledge of scientists and take part in science events. Concepts taught should be reinforced by focusing on the key features of scientific enquiry, so that pupils learn to use a variety of approaches to answer relevant scientific questions. Alongside developing their scientific skills, pupils will develop a strong sense of how science shapes many everyday things and how Science and STEM will impact on their future.

Disciplinary Skills (Working Scientifically)

'Working scientifically' specifies the understanding of the nature, processes and methods of science for each year group. ***It should not be taught*** as a separate strand. The notes and guidance give examples of how 'working scientifically' might be embedded within the content of biology, chemistry and physics, focusing on the key features of scientific enquiry, so that pupils learn to use a variety of approaches to answer relevant scientific questions. These types of scientific enquiry should include: **observing over time; pattern seeking; identifying, classifying and grouping; comparative and fair testing and researching using secondary sources.** Pupils should seek answers to questions through collecting, analysing and presenting data. 'Working scientifically' will be developed further at key stages 3 and 4, once pupils have built up sufficient understanding of science to engage meaningfully in more sophisticated discussion of experimental design and control.

See Disciplinary Skills Progression document for evidence of how working scientifically is mapped out across each year group.

Progression of Substantive Knowledge

Animals Including Humans (B)

EYFS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
• Make healthy choices about food and drink, and know the effect that exercise has on our bodies. • Begin to make sense of their own life-story and family's history. • Understand the key features of the life cycle of a plant and an animal. • Learn new vocabulary. • Know and talk about the different factors that support their overall health and wellbeing: - regular physical activity - healthy eating - tooth brushing - sensible amounts of 'screen time' - having a good sleep routine - being a safe pedestrian • Show care sand concern for living things. • Identify different parts of their bodies.	• 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. **Key Scientist** Chris Packham - Animal Conservationist Linda Brown Buck – Biologist Mammals	• notice that animals, including humans, have offspring which grow into adults • 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. **Key Scientists** Steve Irwin - Crocodile Hunter Robert Winston - Human Scientist Joe Wicks - Personal Trainer Marie Curie	• 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 • identify that humans and some other animals have skeletons and muscles for support, protection and movement. **Key Scientists** Adelle Davis - 20th Century Nutritionist Marie Curie - Radiation/ X Rays	• 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 • construct and interpret a variety of food chains, identifying producers, predators and prey. **Key Scientists** Ivan Pavlov - Digestive System Mechanism Joseph Lister - Discovered Antiseptics	• describe the changes as humans develop to old age. **Key Scientists** Dr Steve Jones - Geneticist Prof Robert Winston - Human Scientist	• identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood • recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function • describe the ways in which nutrients and water are transported within animals, including humans. **Key Scientists** Justus Von Liebig (Theories of Nutrition and Metabolism) Sir Richard Doll (Linking Smoking and Health Problems) Leonardo Da Vinci (Anatomy) **Progression to KS3** To apply knowledge to look after their bodies to keep themselves healthy In key stage 3 children will learn about The hierarchical organisation of multicellular organisms: from cells to tissues to organs to systems to organisms The tissues and organs of the humans digestive system, including adaptations to function and how the digestive system digests food (enzymes simply as biological catalysts) Calculations of energy

							requirements in a healthy daily diet The consequences of imbalances in the diet, including obesity, starvation and deficiency diseases The structure and functions of the gas exchange system in humans, including adaptions to function The effect of recreational drugs (including substance misuse) on behaviour, health and life processes.
Plants (B)	• Plant seeds and care for growing plants. . Learn new vocabulary. . Make observations of plants. . Know some names of plants, trees and flowers. . May be able to name and describe different plants, trees and flowers. . Children show some care for their world around them. **Key Scientists** Investigate with Kit and Pup - CBeebies	• 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. **Key Scientists** Maria Sibylla Merian – German artist and naturalist Jeanne Baret - Botanist	• observe and describe how seeds and bulbs grow into mature plants; • find out and describe how plants need water, light and a suitable temperature to grow and stay healthy. **Key Scientists** Agnes Arber - Botanist Alan Titchmarsh - Botanist and Gardener Tim Smit – The Eden Project	• identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers; • 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; • explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal. **Key Scientists** Jan Ingenhousz – Photosynthesis Joseph Banks - Botanis	***Revisited through other topics such as Living things and their habitats.*** ***In Year 6 Children will recognise that living things have changed over time and that fossils provide information about living things.*** ***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 can lead to evolution.***		

	EYFS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Living Things and Their Habitats (B)	• Begin to understand the need to respect and care for the natural environment and all living things. • Explore the natural world around them, making observations and drawing pictures of animals and plants. • Know some similarities and differences between the natural world around them and contrasting environments, drawing on their experiences and what has been read in class. • Make comments and questions about the place they live or the natural world • Can talk about things they have observed such as plants and animals and notices features of objects in their environment		• explore and compare the differences between things that are living, dead, and things that have never been alive • 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. **Key Scientists** Terry Nutkins - TV presenter Liz Bonnin - Conservationist)		• 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; • recognise that environments can change and that this can sometimes pose dangers to living things **Key Scientists** Cindy Looy - Environmental Change and Extinction Jacques Cousteau - Marine Biologist Joy Adamson –Born Free Foundation .	• 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 plants and animals. **Key Scientists** James Brodie of Brodie - Reproduction of Plants by Spores David Attenborough - Naturalist and Nature Documentary Broadcaster	• 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. **Key Scientists** Carl Linnaeus - Identifying, Naming and Classifying Organisms Charles Darwin Alfred Russel Wallace **Progression to KS3** The dependence of almost all life on Earth on the ability of photosynthetic organisms, such as plants and algae, to use sunlight in photosynthesis to build organic molecules that are an essential energy store and to maintain levels of oxygen and carbon dioxide in the atmosphere The adaption of leaves for photosynthesis The interdependence of organisms in an ecosystem, including food webs and insect pollinated crops The importance of plant reproduction through insect pollination in human food security How organisms affect and are affected by, their environment, including the accumulation of toxic materials#

Evolution and Inheritance (B)				*Links to the learning of rocks in Y3 – fossils. How living things on earth have changed over time.*			• 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 **Key Scientists** Charles Darwin and Alfred Russel Wallace (Theory of Evolution by Natural Selection) Jane Goodall (Chimpanzees) Professor Nazneen Rahman (Human geneticist) **Progression to KS3** Heredity as the process by which genetic information is transmitted from one generation to the next. Differences between species the variation between individuals within a species being continuous or discontinuous, to include measurement and graphical representation of variation the variation between species and between individuals of the same species meaning some organisms compete more successfully, which can drive natural selection Changes in the environment which may leave individuals within a species, and some entire species, less well adapted to compete successfully and reproduce, which in turn may lead to extinction The importance of maintaining biodiversity and the use of gene banks to preserve hereditary material.

	EYFS	Year 1 (Everyday materials)	Year 2 (Use of everyday materials)	Year 3 (Rocks)	Year 4 (States of Matter)	Year 5 (Properties and changes of materials)	Year 6
Materials (C)	• Use all their senses in hands-on exploration of natural materials. • Explore collections of materials with similar and/or different properties. • Talk about the differences between materials and changes they notice, choosing an appropriate material for a task. • Understand some important processes and changes in the natural world around them. • To name some materials and relate them to the world around them.	• 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. **Key Scientists** William Addis - Toothbrush Inventor Charles Mackintosh - Waterproof coat John Macadam - roads	• 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. **Key Scientists** LEGO – Kirk Christansen Stephanie Kwolek – Kevlar Patsy Sherman- Scotchguard	• 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. **Key Scientists** Mary Anning- contribution to palaeontology William Smith – displayed Yorkshire fossils	• 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. **Key Scientists** Anders Celsius - Celsius Temperature Scale Daniel Fahrenheit - Fahrenheit Temperature Scale/Invention of the Thermometer)	• compare and group together everyday materials on the basis of their properties, including their hardness, solubility transparency, conductivity (electrical and thermal), and response to magnets; • 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. **Key Scientists** Spencer Silver, Arthur Fry and Alan Amron - post it	

						notes Ruth Benerito - Wrinkle free cotton Progression to KS3 (This will also link to forces) Children will learn about: The concept of a pure substance mixtures including dissolving Diffusion in terms of the particle model Simple techniques for separating mixtures: filtration, evaporation, distillation and chromatography The identification of pure substances	
Seasonal Changes (C)	• Explore the natural world around them. What is light and dark? What are shadows? • Describe what they see, hear and feel while they are outside. • Recognise some environments that are different to the one in which they live. • Understand the effect of changing seasons on the natural world around them.	• observe changes across the 4 seasons; • observe and describe weather associated with the seasons and how day length varies. **Key Scientists** Dr Steve Lyons (Extreme Weather) Holly Green (Meteorologist)		***Links to Light in Y3 – (Shadows, light/dark, the sun)***	***Links to Electricity topic in Y4 – Objects need electricity to work, switches.***	***Links through Earth and Space***	***Links to Electricity topic in Y6 – Objects need electricity to work, switches.***

Forces (P)	• Explore and talk about different forces they can feel through play-based learning. • Relates their everyday experiences to forces. such as using the words push, pull etc • Know about similarities and differences in relation to places, objects materials and living things • Talk about the features of their own immediate environment and how environments might vary from one to another • Make observations of animals and plants and explain why some things occur, talk about changes.			• compare how things move on different surfaces. • 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. **Key Scientists** William Gilbert - Theories on Magnetism Andre Marie Ampere - Founder of Electro-Magnetism		• 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. **Key Scientists** Galileo Galilei - Gravity and Acceleration Isaac Newton - Gravitation Archimedes of Syracuse - Lever) John Walker - The Match Prof. Brian Cox - air resistance, velocity Progression to KS3 In KS3 children will learn about: Gravity force, weight = mass x gravitational field strength (g), on Earth g=10 N/kg, different on other planets and stars; gravity forces between Earth and Moon, and between Earth and Sun (qualitative only) Our Sun as a star, other stars in our galaxy, other galaxies The seasons and the Earth's tilt, day length at different times of year, in different hemispheres the light year as a unit of astronomical distance	

	EYFS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Light (P)				• 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. **Key Scientists** James Clerk Maxwell - Visible and Invisible Waves of light			• 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. **Key Scientists** Thomas Young - Wave theory of Light Ibn al Haytham Alhazen - Light and our Eyes Percy Shaw - The Cats Eye Progression to KS3 In key Stage 3 children will learn about: The similarities and differences between light waves and waves in matter Light waves travelling through a vacuum, speed of light The transmission of light through materials; absorption, diffuse scattering and specular reflection at a surface Science Use of ray model to explain imaging in mirrors, the pinhole camera, the refraction of light and action of convex lens in focusing (qualitative), the human eye

							Light transferring energy from source to absorber leading to chemical and electrical effects, photo-sensitive material in the retina and in cameras Colours and the different frequencies of light, white light and prisms (qualitative only); differential colour effects in absorption and diffuse reflection
Sound (P)	**EYFS Children** Can you make a loud sound? Can you make a quiet sound? How can we protect our ears? Children to explore through music and practical activities such as plastic tube phones etc.				• 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. **Key Scientists** Aristotle (Sound waves) Gaililieo Galillei (Frequency and Pitch of Sound Waves) Alexander Graham Bell (Invented the Telephone) **Progression to KS3** In KS3 children will learn about: frequencies of sound waves, measured in hertz (Hz); echoes, reflection and absorption of		

					sound Sound needs a medium to travel, the speed of sound in air, in water, in solids Sound produced by vibrations of objects, in loud speakers, detected by their effects on microphone diaphragm and the ear drum,; sound waves are longitudinal Auditory range of humans and animals		

	EYFS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Earth and Space (P)						• 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. **Key Scientists** Helen Sharman- The First Female Astronaut Stephen Hawkin Claudius Ptolemy and Nicolaus Copernicus - Heliocentric vs Geocentric Universe Neil Armstrong - First man on the Moon Helen Sharman - First British astronaut Tim Peake - First British ESA astronaut Progression to KS3 In KS3 children will learn about: Gravity force, weight = mass x gravitational field strength (g), on Earth g=10 N/kg, different on other planets and stars; gravity forces between Earth and Moon, and between Earth and Sun (qualitative only) Our Sun as a star, other stars in our galaxy, other galaxies The seasons and the Earth's tilt, day length at different times of year, in different hemispheres the light year as a unit of astronomical distance	

Electricity (P)					• 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. **Key Scientists** John o' Sullivan - Wifi Thomas Edison - First Working Lightbulb Joseph Swan - Incandescent Light Bulb Michael Faraday – Scientist who studied electricity		• 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. **Key Scientists** Alessandro Volta (Electrical Battery) Nicola Tesla and Thomas Edison (Alternating Currents) Peter Rawlinson (engineer on electrical vehicles) Progression to KS3 In Key Stage 3 children will learn electric current, measured in amperes, in circuits, series and parallel circuits, currents add where branches meet and current as flow of charge Potential difference, measured in volts, battery and bulb ratings; resistance, measured in ohms, as the ratio of potential difference (p.d.) to current Differences in resistance between conducting and insulating components (quantitative) Separation of positive or negative charges when objects are rubbed together: transfer of electrons, forces between charged objects The idea of electric field, forces acting across the space between objects not in contact.