Clarborough Primary School

Science Curriculum

Progression of Substantive & Disciplinary Knowledge

Substantive and Disciplinary Knowledge

Substantive knowledge refers to the subject-specific content and concepts that pupils learn in science, including the content and concepts set out in the National Curriculum,

There are three categories of **Substantive Knowledge**;

- Biology, including the study of plants, animals, habitats and human systems
- Chemistry, including changes in matter, rocks and everyday materials
- Physics, including light, electricity, space, sound, forces and weather

Disciplinary knowledge is understanding how scientific knowledge originates, how scientists think and teaching pupils to 'think like scientists'. In the National Curriculum disciplinary knowledge is taught through Working Scientifically and the key features of scientific enquiry included in the curriculum 'aims'. It is taught and embedded within the teaching of all science units.

Disciplinary Knowledge includes:

- asking questions
- planning enquiries
- observing closely
- taking measurements
- recording and presenting results
- interpreting results
- drawing conclusions
- making predictions

Alongside these go the **scientific enquiry** skills of:

- observing over time
- pattern seeking
- identifying, classifying and grouping
- comparative and fair testing
- researching using secondary sources

Disciplinary Knowledge			
Working Scientifically and Scientific Enquiry			
EYFS	**Key Stage 1**	**Lower Key Stage 2**	**Upper Key Stage 2**
• Use all their senses in hands-on exploration of materials • Explore collections of materials with similar and/or different properties • Talk about what they see using a wide vocabulary • Explore the natural world around them, making observations and drawing pictures of animals and plants • Begin to ask questions about the world around them • Explore how thigs work • Ask questions to find out more and to check what has been said to them. • Articulate their ideas and thoughts in well-formed sentences. • Describe events in some detail. • Use talk to help work out problems and organise thinking and activities, and to explain how things work and why they might happen. • Describe what they see, hear and feel while they are outside • Make comments about what they have heard and ask questions to clarify their understanding.	• Ask simple questions and recognise that they can be answered in different ways • Observe closely, using simple equipment • Perform simple tests • Identify and classify • Use their observations and ideas to suggest answers to questions • Gather and record data to help in to help in answering questions	• Ask relevant questions and use different types of scientific enquiries to answer them • Set up simple, practical enquiries, comparative and fair tests • Make systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers • Gather, record, classify and present data in a variety of ways to help in answering questions • Record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables • Report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions • Use results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions • Identify differences, similarities or changes related to simple scientific ideas and processes • Use straightforward scientific evidence to answer questions or to support their findings	• Plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary • Take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate • Record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs • Use test results to make predictions to set up further comparative and fair tests • Report and present 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 • Identify scientific evidence that has been used to support or refute ideas or arguments

Substantive Knowledge							
Biology							
	EYFS	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
Animals, including humans	Understand the key features of the life cycle of an animal. Know and talk about the different factors that support their overall health and wellbeing: regular physical activity, healthy eating, toothbrushing, having a good sleep routine	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	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	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	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	Describe the changes as humans develop to old age	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
Living things and their habitats	Begin to understand the need to respect and care for the natural environment and all living things. Recognise some environments that are different to the		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		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	Describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird Describe the life process of	Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-

	one in which they live.		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		living things in their local and wider environment Recognise that environments can change and that this can sometimes pose dangers to living things	reproduction in some plants and animals	organisms, plants and animals Give reasons for classifying plants and animals based on specific characteristics
Plants	Plant seeds and care for growing plants Understand the key features of the life cycle of a plant	Identify and name a variety of common and wild and garden plants, including deciduous and evergreen trees Identify and describe the basic structure of a variety of common flowering plants, including trees	Observe and describe how seeds and bulbs into mature plants Find out and describe how plants need water, light and a suitable temperature to grow and stay healthy	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			
Evolution and inheritance							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
Chemistry							
Matter	Understand some important processes and changes in the natural world around them, including			Compare and group together different kinds of rocks on the basis of their appearance and	Compare and group materials together, according to whether they are solids, liquids or gases		

	changing states of matter.			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	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		
Materials	Talk about the differences between materials and changes they notice.	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	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			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	
Physics							
Earth and space						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	
Seasonal changes	Understand the effect of changing seasons on the natural world around them. Understand some important processes and changes in the natural world around them, including the seasons.	Observe changes across the 4 seasons Observe and describe weather associated with the seasons and how day length varies					
Light				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			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

				light source is blocked by an opaque object Find patterns in the way that the size of shadows change			Use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them
Forces	Explore and talk about different forces they can feel.			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		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	

Electricity					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 conductor		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
Sound					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		