Curriculum Development Document

Science

Achieve Believe Care

Curriculum Rationale

At Howley Grange we strive to ensure that our curriculum enables all children to gain the wisdom and courage to make positive choices now, and in their futures.

Howley Grange is committed to providing children with an ambitious curriculum that is broad and balanced. We recognise the upmost importance of ensuring children gain fundamental literacy and numeracy skills and that they have opportunities to develop their individual interests and specialisms in a wide variety of subjects.

Staff plan key questions to encourage the use of enquiry, as well as focus on the acquisition and application of key subject knowledge, concepts and vocabulary throughout our school. Our curriculum is designed to help learners to remember the content they are taught in the long term and to integrate new knowledge into larger concepts. Parents, staff and most importantly our children tell us that they enjoy their learning and are eager to find out about the topics and themes, often choosing to take their learning beyond the classroom.

National Curriculum Requirements

Purpose of Study

A high-quality science education provides the foundations for understanding the world through the specific disciplines of biology, chemistry and physics. Science has changed our lives and is vital to the world's future prosperity, and all pupils should be taught essential aspects of the knowledge, methods, processes and uses of science. Through building up a body of key foundational knowledge and concepts, pupils should be encouraged to recognise the power of rational explanation and develop a sense of excitement and curiosity about natural phenomena. They should be encouraged to understand how science can be used to explain what is occurring, predict how things will behave, and analyse causes.

Aims

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

Scientific knowledge and conceptual understanding

The programmes of study describe a sequence of knowledge and concepts. While it is important that pupils make progress, it is also vitally important that they develop secure understanding of each key block of knowledge and concepts in order to progress to the next stage. Insecure, superficial understanding will not allow genuine progression: pupils may struggle at key points of transition (such as between primary and secondary school), build up serious misconceptions, and/or have significant difficulties in understanding higher-order content.

Pupils should be able to describe associated processes and key characteristics in common language, but they should also be familiar with, and use, technical terminology accurately and precisely. They should build up an extended specialist vocabulary. They should also apply their mathematical knowledge to their understanding of science, including collecting, presenting and analysing data. The social and economic implications of science are important but, generally, they are taught most appropriately within the wider school curriculum: teachers will wish to use different contexts to maximise their pupils' engagement with and motivation to study science.

The nature, processes and methods of science

‘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 (controlled investigations); 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.

Spoken Language

The national curriculum for science reflects the importance of spoken language in pupils’ development across the whole curriculum – cognitively, socially and linguistically. The quality and variety of language that pupils hear and speak are key factors in developing their scientific vocabulary and articulating scientific concepts clearly and precisely. They must be assisted in making their thinking clear, both to themselves and others, and teachers should ensure that pupils build secure foundations by using discussion to probe and remedy their misconceptions.

School Curriculum

The programmes of study for science are set out year-by-year for key stages 1 and 2. Schools are, however, only required to teach the relevant programme of study by the end of the key stage. Within each key stage, schools therefore have the flexibility to introduce content earlier or later than set out in the programme of study. In addition, schools can introduce key stage content during an earlier key stage if appropriate. All schools are also required to set out their school curriculum for science on a year-by-year basis and make this information available online.

National Curriculum Attainment Targets

By the end of each key stage, pupils are expected to know, apply and understand the matters, skills and processes specified in the relevant programme of study.

Key Stage One

The principal focus of science teaching in key stage 1 is to enable pupils to experience and observe phenomena, looking more closely at the natural and humanly constructed world around them. They should be encouraged to be curious and ask questions about what they notice. They should be helped to develop their understanding of scientific ideas by using different types of scientific enquiry to answer their own questions, including observing changes over a period of time, noticing patterns, grouping and classifying things, carrying out simple comparative tests, and finding things out using secondary sources of information. They should begin to use simple scientific language to talk about what they have found out and communicate their ideas to a range of audiences in a variety of ways. Most of the learning about science should be done through the use of first-hand practical experiences, but there should also be some use of appropriate secondary sources, such as books, photographs and videos.

'Working scientifically' is described separately in the programme of study, but must always be taught through and clearly related to the teaching of substantive science content in the programme of study. Throughout the notes and guidance, examples show how scientific methods and skills might be linked to specific elements of the content.

Pupils should read and spell scientific vocabulary at a level consistent with their increasing word-reading and spelling knowledge at key stage 1.

Working Scientifically in Key Stage One

During years 1 and 2, pupils should be taught to use the following practical scientific methods, processes and skills through the teaching of the programme of study content:

- 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

Lower Key Stage Two

The principal focus of science teaching in lower key stage 2 is to enable pupils to broaden their scientific view of the world around them. They should do this through exploring, talking about, testing and developing ideas about everyday phenomena and the relationships between living things and familiar environments, and by beginning to develop their ideas about functions, relationships and interactions. They should ask their own questions about what they observe and make some decisions about which types of scientific enquiry are likely to be the best ways of answering them, including observing changes over time, noticing patterns, grouping and classifying things, carrying out simple comparative and fair tests and finding things out using secondary sources of information. They should draw simple conclusions and use some scientific language, first, to talk about and, later, to write about what they have found out.

'Working scientifically' is described separately at the beginning of the programme of study, but must always be taught through and clearly related to substantive science content in the programme of study. Throughout the notes and guidance, examples show how scientific methods and skills might be linked to specific elements of the content.

Pupils should read and spell scientific vocabulary correctly and with confidence, using their growing word-reading and spelling knowledge.

Working Scientifically in Lower Key Stage Two

During years 3 and 4, pupils should be taught to use the following practical scientific methods, processes and skills through the teaching of the programme of study content:

- 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
- reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions
- 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.

Upper Key Stage Two

The principal focus of science teaching in upper key stage 2 is to enable pupils to develop a deeper understanding of a wide range of scientific ideas. They should do this through exploring and talking about their ideas; asking their own questions about scientific phenomena; and analysing functions, relationships and interactions more systematically. At upper key stage 2, they should encounter more abstract ideas and begin to recognise how these ideas help them to understand and predict how the world operates. They should also begin to recognise that scientific ideas change and develop over time. They should select the most appropriate ways to answer science questions using different types of scientific enquiry, including observing changes over different periods of time, noticing patterns, grouping and classifying things, carrying out comparative and fair tests and finding things out using a wide range of secondary sources of information. Pupils should draw conclusions based on their data and observations, use evidence to justify their ideas, and use their scientific knowledge and understanding to explain their findings.

'Working and thinking scientifically' is described separately at the beginning of the programme of study, but must always be taught through and clearly related to substantive science content in the programme of study. Throughout the notes and guidance, examples show how scientific methods and skills might be linked to specific elements of the content.

Pupils should read, spell and pronounce scientific vocabulary correctly.

Working Scientifically in Upper Key Stage Two

During years 5 and 6, pupils should be taught to use the following practical scientific methods, processes and skills through the teaching of the programme of study content:

- 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
- reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and a degree of trust in results, in oral and written forms such as displays and other presentations
- identifying scientific evidence that has been used to support or refute ideas or arguments

Programme of Study –Science Curriculum

Key Stage	Year	Enquiry Question	Programme of Study	Knowledge, skills and concept In this unit, pupils will learn to:
Key Stage 1	Year 1	**Who am I?**	Animals, including humans	• Identify, name, draw and label the basic parts of the human body. • Say which part of the body is associated with each sense.
		Monster Materials	Everyday materials	• 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.
		Celebrations	Animals including humans Everyday materials	•Say which part of the body is associated with each sense. •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. •Identify and describe the basic structure of a variety of common plants, including trees.
		Plants and animals where we live	Plants Animals, including humans	•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. Animals (including humans) •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).
		On safari	Plants Animals, including humans	•Identify and name a variety of common wild and garden plants, including deciduous and evergreen 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).
		Holiday	Animals including humans	•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 or omnivores. •Describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals, including pets). •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.

			Everyday materials	• 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.
	Year 2	**Healthy me**	Animals, including humans Everyday materials	•Describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene. •Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses.
		Polar places	Animals, including humans Everyday materials	•Identify and name a variety of animals including fish, amphibians, reptiles, birds and mammals. •Identify and name common animals that are carnivores, herbivores and omnivores. •Describe and compare the structure of a variety of common animals. •Describe the simple properties of a variety of everyday materials. •Compare and group together a variety of everyday materials on the basis of their simple properties.
		Young Gardeners	Plants	•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.
		Our Local Environment	Living things and their habitats	•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 micro-habitats •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
		Squash, bend, twist and stretch	Uses of everyday materials	•Find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching.
		Little masterchefs	Animals, including humans Plants Everyday materials	•Find out about and describe the basic needs of humans for survival (water, food and air). • Describe the importance for humans of eating the right amounts of different types of food, and hygiene. •Observe and describe how seeds and bulbs grow into mature plants. •Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses

Lower Key Stage 2	Year 3	**Rocks, soils and fossils**	Rocks	•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.
		Food and our bodies	Animals, including humans	•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' skeletons and muscles for support, protection and movement.
		Forces and magnets	Forces and magnets	•Compare how things move on different surfaces. •Notice that some forces need contact between two 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 two poles. •Predict whether two magnets will attract or repel each other, depending on which poles are facing.
		Light and shadows	Light	• Recognise that we 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 the eyes. • Recognise that shadows are formed when the light from a light source is blocked by a solid object. • Find patterns in the way that the sizes of shadows change.
		How does your Garden grow?	Plants	•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.
		The nappy challenge	Investigation	•This topic looks at disposable nappies and provides opportunities for children to ask their own questions and make decisions on how to answer their questions using different scientific enquiry activities. <u>Working scientifically skills</u> •Make systematic and careful observations and, where appropriate, take 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. •Ask relevant questions and use different types of scientific enquiries to answer them. •Use results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions. •Set up simple practical enquiries, comparative and fair tests. •Use straightforward scientific evidence to answer questions or to support their findings.
	Year 4	**Living things**	Living things and their habitats	•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
		Looking at states	States of matter	•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.
		Dunking Dilemma!	Investigation	•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, take 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.
		Teeth and eating	Animals, including humans	•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.
		What's that sound?	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.

		Power it up	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 conductors.
Upper Key Stage 2	**Year 5**	**Out of this world**	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.
		Amazing changes	Properties and changes of materials	•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.
		Let's get moving	Forces	•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.
		Material world	Properties and changes of materials	•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.
		Growing up and growing old	Animals, including humans	Describe the changes as humans develop to old age.
		Circle of life	Living things and their habitats	•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.

	Year 6	**Evolution and inheritance**	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.
		Healthy bodies	Animals, including humans	•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.
		Classifying living things	Living things and their habitats	•Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including microorganisms, plants and animals. •Give reasons for classifying plants and animals based on specific characteristics.
		Light	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.
		Electricity	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.
		The Titanic	Investigation	•This topic is based around applying the working scientifically skills that they have learned so far in their science lessons, to explore some of the scientific concepts behind the Titanic, e.g. floating and sinking. <u>Working scientifically skills</u> •Plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary. •Take measurements, use 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. •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.