

Science in the OCL Primary Curriculum

Intent

The OCL Curriculum Statement of Intent has been carefully considered for each curriculum area to ensure the content designed meets this at every opportunity.

The context that our children and young people live in:

- Our children live in a world where they require the skills and qualifications, flexibility, emotional intelligence and expertise to be leaders and to thrive as human beings.
- Our children live in world where accepting themselves as individuals and celebrating who they are is key in navigating a complex and ever-changing environment.
- Our children live in a world where they need to feel a sense of ability to change things for the better and have self efficacy.
- Our children live in a world where they need a network of relationships and a network of support to thrive and excel.
- Our children live in a world where early development of vocabulary skills is the single most important factor to get right as early as possible.

We want our children and young people to:

- Be inspired to improve the world around them.
- Have the ambition, skills and expertise to thrive in a fast changing, interconnected and communication rich world, with the confidence and technical expertise to thrive.
- Have a network that supports them.
- Be comfortable in who they are and able to continuously explore who they are becoming.
- Be rich in language with a passion for learning.
- Seek to include others, be other-centred and celebrate difference.
- Have a values approach to life and a sense of what is right and wrong through the lived experience of the 9 habits.

Therefore, we focus on developing character, competence and community. The Science curriculum specifically meets the OCL statement of intent by focussing on character, competence and community in the following areas:

	<p>Character: Children are naturally curious and want to be able to explain the world around them; Science enables them to do this. Through studying Science, children will learn systematic ways to approach answering their own questions, become problem solvers and build resilience when approaching tasks and investigations.</p>
	<p>Competence: Through studying several strands of science: Biology, Chemistry, Physics and Earth Science children will begin to understand the huge role Science has to play in our ever-developing world. The knowledge and skills they will develop over the primary curriculum will inspire them to want to continue their scientific journey and become the change of the future.</p>
	<p>Community: Science enables communities to bring about change; our curriculum shows the children how this can be achieved on a small local scale to a huge global contribution. They will learn that through Science some of the problems we face as a population can be addressed. Our children will feel empowered enough to want to make these changes.</p>

Implementation

To ensure our intent transfers into everyday classroom practice, we use current research in cognitive science to develop pedagogy and specific CPD to ensure subject content is expertly delivered. This is alongside individualised coaching in constantly striving to continually improve practice. Responsive feedback approaches, delivered through out highly effective one-to-one horizons approach, ensure each adult knows the relevant next steps to maximise learning opportunities.

Using research from Dan Williamson’s Models of Memory, Sweller’s Cognitive Load Theory, Rosenshine’s Principles of Instruction and the thinking behind Ebbinghaus’ Forgetting Curve, the curriculum is implemented effectively through a set of core concepts, developed for each curriculum area. This enables children to assimilate new information into growing schema as they move through the academy. By presenting new information to students as another example of these core concepts it allows them to process information in relation to previously learned knowledge and make connections.

The core concepts for science:

Core Concepts in Science	
<p>Physics</p> <p>The universe follows unbreakable rules that are all about forces, matter and energy. P1 Forces are different kinds of pushes and pulls that act on all the matter that is in the universe. Matter is all the stuff, or mass, in the universe. P2 Energy, which cannot be created or destroyed only changed, comes in many different forms and tends to move away from objects that have lots of it. P3</p>	<p>Chemistry</p> <p>All matter in the universe is made up of tiny particles (building blocks). C1</p> <p>The arrangement, movement and type of particles of matter and the forces that hold them together or push them apart explain all the properties of matter. C2 Matter can change if the arrangement of particles changes. C3</p>
<p>Biology</p> <p>Living things are special collections of matter that make copies of themselves and use energy to grow. B1</p> <p>Living things on Earth come in a huge variety of all different forms that are all related because they came from the same starting point 4.5 billion years ago. B2</p> <p>The different kinds of life, animals, plants and microorganisms, have evolved over millions of generations into different forms in order to survive in the environments in which they live. B3</p>	<p>Earth Science</p> <p>The Earth is one of the eight planets that orbit the sun. E1</p> <p>The Earth is tilted and spins on an axis leading to day and night, the seasons and the climate. E2</p> <p>The Earth is made up of several layers, including a relatively thin rocky surface which is divided into tectonic plates, and the movement of these plates leads to many geological events (such as earthquakes and volcanoes) and geographical feature (such as mountains). E3</p>
<p>Scientific Enquiry</p> <p>Science seeks to explain things that we see in the natural world by attempting to understand their causes. S1</p> <p>Scientific theories and explanations of what we see in the natural world that best fit with evidence that has been gathered. Because of this, theories can be changed when new evidence is found. S2</p> <p>The knowledge produced by science leads to new technology that humans find useful. These technologies don’t always make the world better so we have to think carefully about how-and whether-we use them. S3</p>	

The curriculum is mapped using these core concepts. We plan for progression using the key points outlined in the impact section below. Lesson content is planned towards these progression points and follows the model of direct instruction, shared and modelled practice before culminating in independent practice and mastery. Specific knowledge is acquired through the knowledge organisers in each curriculum area and unit of study to ensure broad and balanced coverage and as a tool for children to add to, revise and structure that knowledge.

Subject Delivery

Lesson Timings	Type of delivery
<p>Science is taught weekly for an hour per lesson. In addition to this, there are links within PE and PSHE and more practically in the STEAM theme.</p>	<p>The Science lessons are predominantly discrete to enable focus on the knowledge for each area and concept, although vocabulary is continually developed using sentence stems and tiers universally across the subject areas.</p> <p>An additional Science focus in the STEAM Theme makes rich and meaningful links to learning.</p>

Annual Organisation per year group

Term	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Autumn 1	Animals including humans (human body & senses) B1 B2	Animals including humans (Growing a healthy lifestyle) B1	Animals including humans (Skeleton & Muscles) B1 B2 B3	Animals including humans (digestion & teeth) B3	Living things B1	Animals including humans (circulatory system) B1
Autumn 2	Animals including humans (animal naming, classifying) B1 B2	Recycle & Reuse	Rocks & Soils C1 C2 C3	States of Matter C1 C2 C3	Earth & Space E1 E2	Living things B2
Spring 1	Space E1 E2	Use of everyday materials C1 C2	Super Scientists S1,2 & 3	Sustainability C1 C2 & C3	Healthy Me B1 & B3	Evolution & Inheritance B3
Spring 2	Everyday Materials C1 C2	Building things C1 C2	Forces & Magnets P2	Sounds P1 P3	Forces P1 P2	Electricity P1 P3

Summer 1	Plants B2	Plants B1	Plants B1 B2	Living things B2 B3	Animals including humans B1	Practical Skills W.S
Summer 2	Seasonal change S2	Living things & habitats B1 B3	Light P1 P3	Electricity P1 P3 C2	Material changes C2 C3	Light P1 P3

Impact

The ultimate test of the impact of the curriculum is in whether the students know what you want them to know, and what you think they should know. This has been carefully mapped against the core concepts for Science in the tables on the following pages.

To determine this, we check and monitor children's learning, providing teachers and students with information about progress and analysis of deliberate retrieval practice. We need to be able to fluidly use 'checking for understanding' techniques in the moment as well as being able to know what has been learnt and retained over time and the depth of that learning:

- We use checking for understanding techniques through **Socratic** quizzes and hinge questions to ensure we are aware of all students learning during the lesson and adapt the pace as necessary.
- Retrieval practice is built in where most impactful to interrupt the forgetting curve and secure constructs in long term memory.
- Depth of knowledge is then assessed through spaced quizzing, **end of unit assessment quizzes** and Student Portfolios in Showbie.

Science Specific Impact Measures

In Science quizzing is used as a method of assessing pupils understanding at the end of a core concept to analyse the extent to which knowledge has been consolidated into long-term memory. Retrieval practice tasks throughout the lessons also interrupt the forgetting curve to enable faster access to prior learning. Pop tasks at the end of the year pull together the learning for the subject under the core concept areas to consolidate learning and to prepare children to make links to the future learning in subsequent years.

Progression Points against the Core Concepts

Core Concepts	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Physics			<ul style="list-style-type: none"> ▪ P2 ▪ Understand a force can be thought of as either a push or pull ▪ Understand that some forces need contact between two objects (impact forces {when two objects collide}, frictional forces {when two surfaces are already in contact} and strain forces {when an elastic material is squashed or stretched}) but magnetic forces can act at a distance ▪ Understand that unsupported objects fall towards the Earth because of the force of gravity ▪ Compare how different objects move on different surfaces ▪ Describe magnets having two poles ▪ Observe how magnets can attract or repel each other and attract some materials and not others ▪ Identify and investigate magnetic materials ▪ P1 & P3 ▪ Recognise we need light in order to see things and dark is the absence of light ▪ Understand light is a form of energy ▪ Understand light travels in straight lines and is reflected from surfaces ▪ Recognise that shadows form when the light from the light source is blocked by an opaque object but light will pass through a transparent object ▪ Find patterns in the way shadows change ▪ data loggers can be used to track light levels • Understand looking directly at the sun with our without sunglasses is damaging to our eyes. 	<ul style="list-style-type: none"> ▪ P1 & P3 ▪ Know sound is made when an object vibrates ▪ Recognise vibrations travel through vibrating air particles in a longitudinal waves to the ear drum ▪ Know that pitch is a high or low sound and this can be determined by how many vibrations per second ▪ Know that volume is quiet or loud and created by the strength of the vibration ▪ Volume will become fainter the further you travel away from the vibrating object ▪ P1 & P3 ▪ 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 a part of a complete loop with a battery ▪ Recognise that a switch opens and closes a circuit and associate this whether or not a lamp lights in a simple series circuit • Recognise some common conductors and insulators, and associate metals with being good conductors 	<ul style="list-style-type: none"> ▪ P1 & P2 ▪ 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 greater effect 	<ul style="list-style-type: none"> ▪ P1 & P3 ▪ 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 the light source to our eyes or from the 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 • P1 & P3 • Associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in a 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 diagram

Core Concepts	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Chemistry	<ul style="list-style-type: none"> ▪ C1 & C2 ▪ Distinguish between an object and 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 every day materials • Compare and group together a variety of everyday materials on the basis of their properties 	<ul style="list-style-type: none"> ▪ C1 & C2 ▪ Identify suitability of everyday materials for a particular use ▪ Find out how the shapes of materials can be changed through squashing, bending, twisting and stretching ▪ Understand the difference between natural and man-made objects (name examples in both) • Begin to test materials against suitability criteria such as waterproof, wind proof 	<ul style="list-style-type: none"> ▪ C1 & C2 & C3 ▪ Compare and group together different kinds of rocks based on and their appearance and some physical properties ▪ Understand what a geologist is ▪ Understand how igneous, sedimentary and metamorphic rocks are formed ▪ Describe in simple terms how fossils are formed when things that have lived have been trapped within sedimentary rock ▪ Understand who Mary Anning is • Recognise that soils are made from rocks and organic matter 	<ul style="list-style-type: none"> ▪ C1 & C2 & C3 ▪ Know that everything is made of tiny particles and these particles are arranged differently depending on the state of matter ▪ Know there are three states of matter: solid, liquid and gas ▪ Understand how the bonds between the particles change upon heating and cooling ▪ Know the melting point of water is 0°C and the boiling point of water is 100°C ▪ Understand process of: sublimation, condensation, evaporation, transpiration, precipitation ▪ Explain the water cycle • ▪ C1 & C2 & C3 ▪ Understand the difference between natural and synthetic ▪ Explain properties of synthetic materials ▪ Explain what happens to these synthetic materials in landfill sites. ▪ Understand the terms fuel and combustion ▪ Can describe the combustion reaction • 	<ul style="list-style-type: none"> ▪ C2 & C3 ▪ 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 ▪ Given 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 tha this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda 	

Biology

- **B2**
- Identify and name common, wild and garden plants
- Identify, name and distinguish between deciduous and evergreen trees
- Identify and describe the structure of common flowering plants, including trees
- **B1 & B2**
- Identify the name of a variety of common animals including, fish, amphibians, reptiles, birds and mammals
- Identify and name of variety of common animals that are carnivores, herbivores & omnivores
- **B1 & B2**
- Identify, name and label basic parts of the human body
- Understand what the 5 senses are
- Identify which part of the body is associated with each sense

- **B1**
- Understand plants can grow from seeds or bulbs
- Understand how seeds and bulbs grow into mature plants
- Find out and describe how plants need water, light and suitable temperature to grow and mature
- Understand how these requirements affect the planting calendar
- **B1 & B3**
- Understand the characteristics of living things
- Explore and compare the differences between things that are living, dead and never lived
- Identify that most living things live in habitats (including microhabitats) to which they are suited and describe how different habitats provide basic needs for different plants and animals
- Describe how animals obtain their food from other plants and animals, understanding simple food chains
- **B1 & B3**
- Notice that all animals including humans have offspring which grow into adults either from eggs or live young
- Understand the basic need of animals in order to grow
- Understand the stages of human development and name some changes that occur through each stage
- Describe the importance for humans to exercise, eat the right amounts of different food and hygiene

- **B1 & B2 & B3**
 - Identify that animals including humans, need the right type of nutrition and they cannot make their own food.
 - They receive nutrition from what they eat.
 - Identify that humans and some other animals have skeletons and muscles for movement, support and protection.
 - Name the major bones in the human body
 - Understand the difference between an endo and exoskeleton
 - **B1 & B2**
 - Identify and describe the functions of different parts of flowering plants
 - Understand water transportation within plants
 - Explore the requirements of plants for life and growth
 - Understand how plants adapt to different environments
- Explore the part that flowers play in the plant life cycle

- **B3**
 - Understand that the mouth tongue and teeth are the first part of the digestive system
 - Identify different types of teeth and their functions
 - Identify and understand the role of each organ within the digestive system
 - Know that animals and humans ultimately receive their energy from the sun
 - Construct and interpret a variety of food chains
 - **B2 & B3**
 - 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 local and wider environments
- Recognise that environments can change and that this can sometimes pose dangers to living things

- **B1**
 - Describe the changes as humans develop to old age.
 - **B1 & B3**
 - Recognise the impact of diet, exercise, drugs and lifestyle on the way our bodies function
 - **B1**
 - 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

- **B1**
- Identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood
- Describe the ways in which nutrients and water are transported within animals, including humans
- Understand the term nutritional deficiency
- **B2**
- Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including microorganisms and plants
- Give reasons for classifying plants and animals based on specific characteristics
- **B3**
- 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 the parent
- Identify how plants and animals are adapted to suit their environment in different ways and that adaptation may lead to evolution

<p style="text-align: center;">Earth Science</p>	<ul style="list-style-type: none"> ▪ E1 & E2 ▪ Understand what the term 'space' means ▪ Understand objects found in space ▪ Name the planets of our solar system ▪ Understand Earth's tilt and orbit ▪ When and how space was discovered ▪ Name some famous astronauts • Understand jobs linked to space 		<ul style="list-style-type: none"> ▪ E3 ▪ Understand how igneous, sedimentary and metamorphic rocks are formed 		<ul style="list-style-type: none"> ▪ E1 & E2 ▪ 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. 	
<p style="text-align: center;">Scientific Enquiry</p>	<ul style="list-style-type: none"> ▪ S2 ▪ Observe changes across the four seasons including trees and flowers ▪ Observe and describe weather associated with the seasons and how day length varies ▪ Understand how to make a rain gauge and what it is used for • Understand what is hibernation 		<ul style="list-style-type: none"> ▪ S1 & S2 & S3 ▪ Name some influential scientist of our time ▪ Understand how their discoveries and achievements paved the way for future theory and innovation in Science <ul style="list-style-type: none"> ○ Mae Jamieson ○ Watson & Crick ○ Rachel Carson ○ Tim Berners Lee ○ Mah-Hussain Gambles 	<ul style="list-style-type: none"> ▪ S2 ▪ Describe what global warming & climate change are ▪ Describe common evidence that global warming exists ▪ Understand common causes of global warming ▪ Explain the effects of global warming & climate change on the Earth ▪ S3 ▪ Understand the definition of recycling ▪ Understand and identify the difference between recyclable and non-recyclable plastics ▪ Explain why recycling plastic is important for the environment • Describe the impact of burning fuels on the environment 		

			<ul style="list-style-type: none"> ▪ P2 ▪ Understand a force can be thought of as either a push or pull ▪ Understand that some forces need contact between two objects (impact forces {when two objects collide}, frictional forces {when two surfaces are already in contact} and strain forces {when an elastic material is squashed or stretched}) but magnetic forces can act at a distance ▪ Understand that unsupported objects fall towards the Earth because of the force of gravity ▪ Compare how different objects move on different surfaces ▪ Describe magnets having two poles ▪ Observe how magnets can attract or repel each other and attract some materials and not others ▪ Identify and investigate magnetic materials ▪ P1 & P3 ▪ Recognise we need light in order to see things and dark is the absence of light ▪ Understand light is a form of energy ▪ Understand light travels in straight lines and is reflected from surfaces ▪ Recognise that shadows form when the light from the light source is blocked by an opaque object but light will pass through a transparent object ▪ Find patterns in the way shadows change ▪ data loggers can be used to track light levels • Understand looking directly at the sun with our without sunglasses is damaging to our eyes. 	<ul style="list-style-type: none"> ▪ P1 & P3 ▪ Know sound is made when an object vibrates ▪ Recognise vibrations travel through vibrating air particles in a longitudinal waves to the ear drum ▪ Know that pitch is a high or low sound and this can be determined by how many vibrations per second ▪ Know that volume is quiet or loud and created by the strength of the vibration ▪ Volume will become fainter the further you travel away from the vibrating object ▪ P1 & P3 ▪ 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 r not the lamp is a part of a complete loop with a battery ▪ Recognise that a switch opens and closes a circuit and associate this whether or not a lamp lights in a simple series circuit • Recognise some common conductors and insulators, and associate metals with being good conductors 	<ul style="list-style-type: none"> ▪ P1 & P2 ▪ 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 greater effect 	<ul style="list-style-type: none"> ▪ P1 & P3 ▪ 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 the light source to ur eyes or from the 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 • P1 & P3 • Associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in a 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 diagram
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