SCIENCE

Science

Curriculum Intent

Our Science Curriculum aims to develop a sense of excitement and curiosity about natural phenomena and an understanding of how the scientific community contributes to our past, present and future.

We want pupils to develop a complex knowledge of Biology, Chemistry and Physics, but also adopt a broad range of skills in working scientifically and beyond. Our Science Curriculum is inclusive and meaningful, so all pupils may experience the joy of science and make associations between their science learning and their lives outside the classroom. Studying science allows children to appreciate how new knowledge and skills can be fundamental to solving arising global challenges.

Our curriculum aims to encourage critical thinking and empower pupils to question the 'hows' and 'whys' of the world around them. Our curriculum ensures:

- A strong focus on developing knowledge *alongside* scientific skills across Biology, Chemistry and Physics.
- Curiosity and excitement about familiar and unknown observations.
- Challenging misconceptions and demystifying truths.
- Continuous progression by building on practical and investigative skills across all units.
- Critical thinking, with the ability to ask perceptive questions and explain and analyse evidence.
- Development of scientific literacy using wide-ranging, specialist vocabulary.
- Pupils are enabled to meet the end of Key Stage Attainment Targets in the National Curriculum and the aims also align with those set out in the National Curriculum.

Science

Curriculum Implementation

At Tattershall Primary School we have used the curriculum design model from 'Kapow Primary'.

In order to meet the aims of the National curriculum for Science and in response to the Ofsted Research review into Science, we have identified the following key strands:

- **Scientific knowledge and understanding** of:
  - Biology - living organisms and vital processes.
  - Chemistry - matter and its properties.
  - Physics - how the world we live in 'works'.
- **Working scientifically** - processes and methods of science to answer questions about the world around us.
- **Science in action** - uses and implications of science in the past, present and for the future.

Our Science Curriculum is a spiral curriculum, with essential knowledge and skills revisited with increasing complexity, allowing pupils to revise and build on their previous learning. A range of engaging recall activities promote frequent pupil reflection on prior learning, ensuring new learning is approached with confidence. The **Science in action** strand is interwoven throughout the scheme to make the concepts and skills relevant to pupils and inspiring for future application. Cross-curricular links are included throughout each unit, allowing children to make connections and apply their Science skills to other areas of learning.

Each unit is based upon one of the key science disciplines; Biology, Chemistry and Physics and to show progression throughout the school we have grouped the National Curriculum content into six key areas of science:

Plants
Animals, including humans
Living things and habitats
Materials
Energy
Forces, Earth and space.

Pupils explore knowledge and conceptual understanding through engaging activities and an introduction to relevant specialist vocabulary. As suggested in Ofsted's Science research review (April 2021), the '**working scientifically**' skills are integrated with conceptual understanding

rather than taught discretely. This provides frequent, but relevant, opportunities for developing scientific enquiry skills. Our curriculum utilises practical activities that aid in the progression of individual skills and also provides opportunities for full investigations.

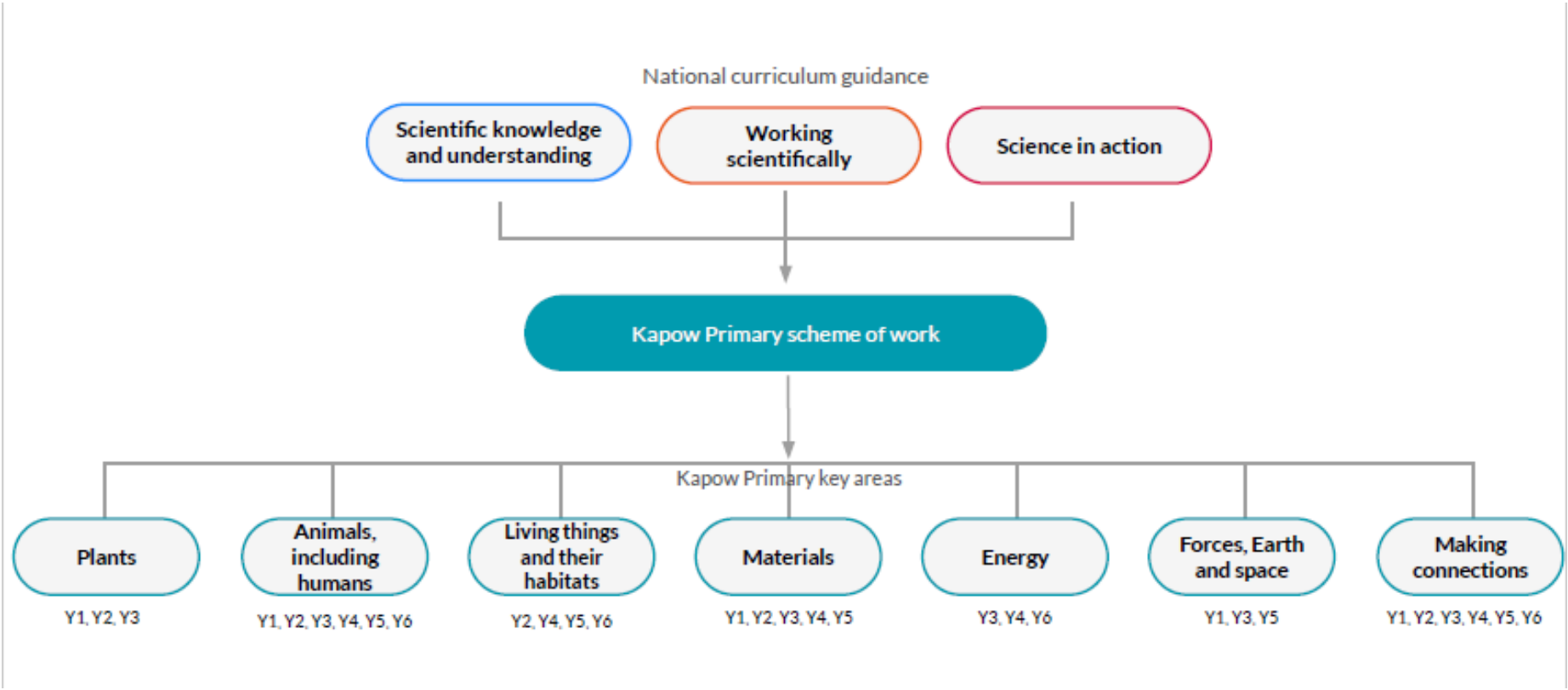
Each year group has an optional exploratory 'Making connections' unit that delves beyond the essential curriculum, assimilating prior knowledge and skills to evoke excitement and to provide an additional method of assessing scientific attainment.

Lessons incorporate various teaching strategies from independent tasks to paired and group work, including practical, creative, computer-based and collaborative tasks. This variety means that lessons are engaging and appeal to those with different learning styles. Guidance for adapting the learning is available for every lesson to ensure that all pupils can access learning, and opportunities to stretch pupils' learning are available when required. Knowledge organisers for each unit help to identify prior and future curriculum links to make the scheme as meaningful as possible and reinforce key technical terms.

At Tattershall Primary School Science is taught discreetly from Year 1 to Year 6, mostly through a weekly lesson. Each year group is taught independently, despite our two mixed age classes, due to the nature of the progression of skills and knowledge within the Science curriculum. To enable us to do this, we utilise an additional teacher so that Alpaca Class (Years 3 and 4) and Lion Class (Years 4 and 5) can be taught in year groups rather than mixed age classes.

Science

Curriculum Organisation



Key areas in Science

Pupils will develop **Scientific knowledge and understanding** in seven key areas. The learning in each area is summarised below:

Animals, including humans

Identifying animals, their basic structure and their eating habits, as well as their basic needs for survival. Children learn about the life cycles of animals and their place in food chains.

Naming parts of the human body and recognising the function of skeletons, muscles, teeth and the digestive and circulatory systems. Learning about the importance of hygiene and of the right type and amount of nutrition. Children learn about the impact of diet, drugs and exercise on the body and study the life cycles of humans.

This key area covers the Year 1, Year 2, Year 3, Year 4, Year 5 and Year 6 subject content titled 'Animals, including humans' from the National curriculum.

Living things and their habitats

Identifying something as living and how it is grouped based on its characteristics, similarities and differences.

Naming different types of habitats, learning what they provide for life and the impact of habitats changing. Children learn about the life cycles and reproduction of animals and plants, and how this affects the variation of living things around us, past and present.

This key area covers the Year 2, Year 4, Year 5 and Year 6 subject content titled 'Living things and their habitats' and 'Evolution and inheritance' from the National curriculum.

Plants

Identifying different plants and their key structures, growing seeds and plants and understanding their requirements for growth. Recognising the function of different plant structures and understanding how plants reproduce.

This key area covers the Year 1, Year 2 and Year 3 subject content titled 'Plants' from the National curriculum.

Materials

Naming materials, describing their properties and understanding why materials have specific uses. Identifying how materials may change and the factors that may contribute to this, including changes of state within the water cycle. Children learn about different mixtures and how they can be separated based on their properties.

Identifying different types of rocks and their physical properties, and understanding how fossils and soil are formed.

This key area covers the Year 1, Year 2, Year 3, Year 4 and Year 5 subject content titled 'Everyday materials', 'Uses of everyday materials', 'Rocks', 'States of matter' and 'Properties and changes of materials' from the National curriculum.

Energy

Learning about light and its properties, how it enables us to see and how shadows are formed. Identifying the relationship between sounds, volume, pitch and vibrations, and how sound travels to the ear.

Recognising electrical appliances and the components that make up different circuits. Building electrical circuits and identifying factors that affect the output.

This key area covers the Year 3, Year 4 and Year 6 subject content titled 'Light', 'Electricity' and 'Sound' from the National curriculum.

Forces, Earth and space

Identifying changes across the seasons, and the weather and day length associated with each.

Recognising different types of forces and understanding their effect on objects, including the role of pulleys, levers and gears. Children learn about magnetic materials and that magnets attract and repel.

Learning about the movements of planets and moons within the solar system and how this relates to our day and night.

This key area covers the Year 1, Year 3 and Year 5 subject content titled 'Seasonal changes', 'Forces and magnets', 'Earth and space' and 'Forces' from the National curriculum.

Making connections

Finding the optimum: the science subject report (Ofsted, 2023) states that schools should ensure that teachers

'regularly connect new learning to what pupils have already learned. This includes showing pupils how knowledge from different areas of the curriculum connects.'

One of the ways in which we do this is through our Making connections units, which give pupils opportunities, beyond the National curriculum programme of study, to make connections between their science learning.

Different types of knowledge in Science

'Pupils need to develop an extensive and connected knowledge-base. When pupils learn new knowledge it should be integrated with the knowledge they already have. This ensures that learning is meaningful'. (Ofsted research review series: Science, 2021)

Substantive knowledge

Referred to as Scientific knowledge and conceptual understanding in the National curriculum and Scientific knowledge and understanding in our scheme of work, this is knowledge of the products of science: concepts, laws, theories and models.

In our *Science: Progression of skills and knowledge* we have broken down the National curriculum attainment targets into knowledge 'chunks' or 'components' and shown how they build over time to develop pupils' understanding of key concepts in Biology, Chemistry and Physics.

Through following our scheme pupils will build their substantive knowledge base by:

- Knowing more facts.
- Giving further examples of the same concept.
- Understanding and using a wider range of vocabulary.
- Using models or concepts that cannot be seen to explain ideas.
- Making and explaining links across areas of science.

Over time, that knowledge will become increasingly organised and connected. The *Recap and recall* section of the lesson helps pupils to activate their prior knowledge and encourages them to make connections between units.

Disciplinary knowledge

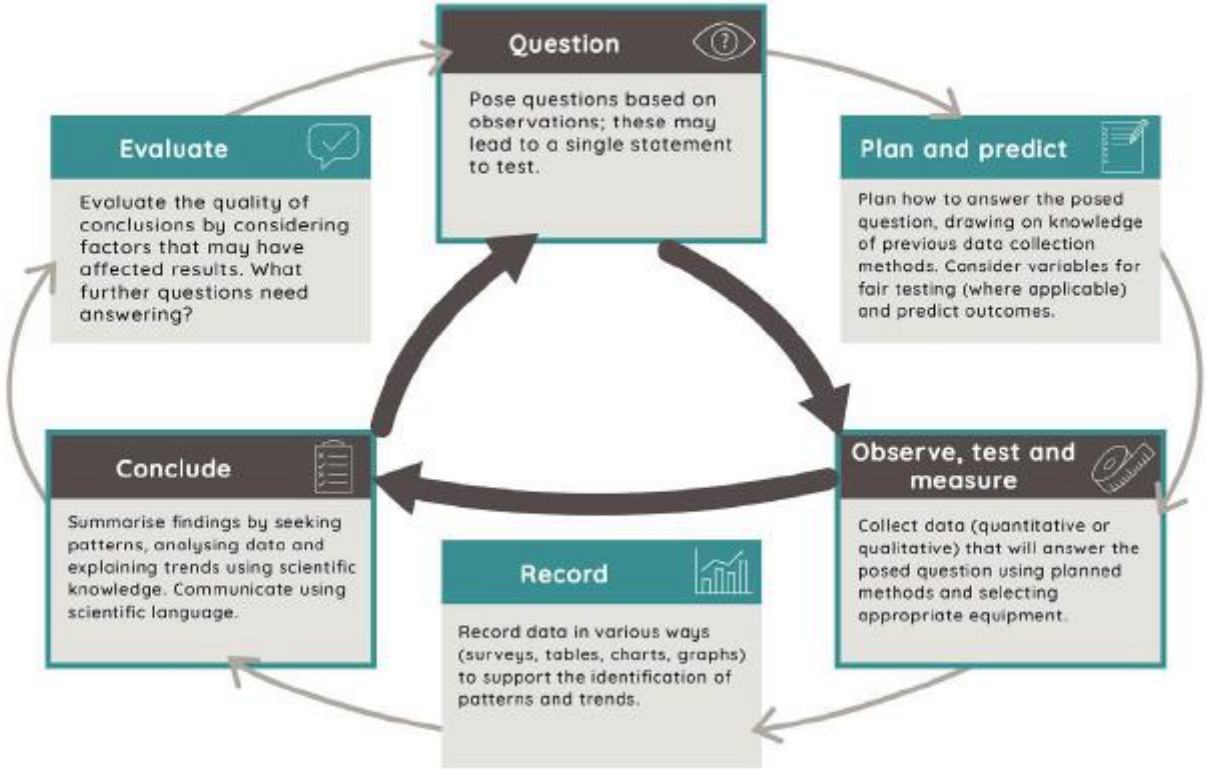
Working scientifically specifies the understanding of the nature, processes and methods of science for each year group and is covered alongside our Scientific knowledge and understanding strand in each and every unit, never in isolation.

We have broken down the Working scientifically statements from the National curriculum further to ensure gradual progression and focused teaching of the working scientifically skills. This also allows teaching to focus on the component disciplinary knowledge required to enable pupils to carry out the skills competently.

Pupils should be able to see the interplay between the two types of knowledge and our Science in action strand gives pupils this opportunity through seeing how scientists have worked in the past and continue to work in the present day. This furthers pupils' understanding of how some of the substantive knowledge they learn came to be established.

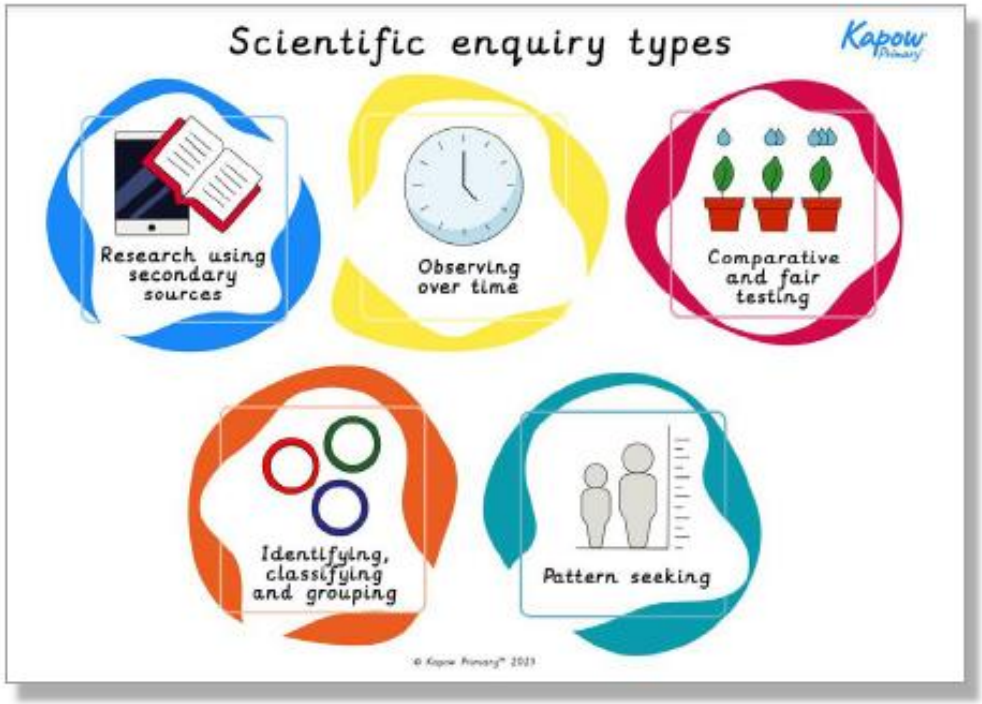
Working scientifically - Enquiry cycle

Kapow Primary has created the working scientifically enquiry cycle below, demonstrating aspirational steps for scientific enquiry. Short enquiry opportunities will focus on a particular working scientifically skill, while ensuring the essential Question - Observe - Conclude cycle is met. Full investigation opportunities will provide an appreciation of how the steps interconnect to form a complete enquiry.



We aim for children to be able to talk confidently about scientific enquiry skills so we have created icons which are visible alongside relevant instructions and activities to help children recognise and become familiar with the stages of the enquiry process.

Working scientifically - Different types of enquiry



The National curriculum states that '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' but the Ofsted science subject report notes that 'Overall, in primary schools, inspectors found very few examples of pupils gaining knowledge of pattern seeking or learning about secondary sources.'

The Kapow Primary curriculum aims to familiarise pupils with all these types of enquiry so that by the end of Key stage 2 they are able to choose the most suitable enquiry type to answer questions. In Key stage 1, pupils are introduced to enquiry types as 'Super science skills' and are encouraged to reflect on which skills they have used to answer questions.

Science

Long Term Plan

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Forces, Earth and Space	**'Seasonal Changes'** Reflecting on their own experiences, children learn about the four seasons and the weather associated with each. Pupils explore how seasonal changes affect trees, daylight hours and our choices about outfits. They plan and carry out their own weather reports, considering the knowledge required for this job.		**'Forces and Magnets'** Investigating the movement of vehicles on different surfaces, children learn about the impact of friction and compare uses and drawbacks. They broaden their experience in writing scientific methods and recording data as they investigate contact and non-contact forces. Pupils explore the properties of different magnets and use this to understand their uses.		**'Earth and Space'** Exploring some of the key celestial bodies in our Solar System, children learn their names and compare their movements. Pupils discover the relationship between the Earth's rotation and daylight, making models to represent their knowledge. They make their own sundials and consider how and why humans' ideas about the universe have changed over time. **'Imbalanced Forces'** Building on their knowledge of contact forces, children explore gravity, air resistance and water resistance in more depth and consider the effect of these forces being imbalanced. They demonstrate key principles in the classroom and plan investigations to further their understanding of the effects of these forces. Pupils test their ideas using models and compete to build the most effective pulley system.	

Materials	**'Everyday Materials'** Identifying the difference between objects and materials, children explore their surroundings to find examples of each. They work scientifically by planning tests, making observations and recording data. Pupils use results to answer questions and sort and group materials based on their properties.	**'Use of Everyday Materials'** Building on their knowledge of everyday materials and their properties, pupils recognise that materials are suited to specific purposes and explore how actions such as stretching and bending affect the shape of solid objects. They compare the suitability of materials; gather and record data in tables and block graphs and use their results to answer questions. Children learn about the harmful effects of plastic and explore eco-friendly alternatives.	**'Rocks and Soil'** Studying rocks and their properties, children learn how to classify rocks and identify how they were formed. They look at the work of palaeontologists to learn about fossil formation and use models to explore how fossils tell us about the past. Pupils investigate the physical properties of rocks and link these to their particular uses. Pupils also explore soil formation, separate soil using a sedimentation jar and test soil drainage.	**'States of Matter'** Investigating the properties of solids, liquids and gases, children learn about the different states of matter. They explore changes of state using relatable examples and use this to explain changes to water through the water cycle. Pupils investigate the relationship between temperature and rate of evaporation while broadening their experience of working scientifically.	**'Mixtures and Separation'** Pupils explore different types of mixtures and the different methods that can be used to separate them. They dissolve a range of substances, identify different solutions and investigate how temperature affects the time taken to dissolve. They design and create a water filter, sieve soil and evaporate solutions. **'Properties and Changes'** Broadening their experience of the properties of materials, children investigate hardness, transparency and conductivity and consider how these properties influence the uses of materials. They explore reversible changes, including dissolving and changes of state. Children compare these to irreversible changes, including rusting, burning and mixing vinegar and bicarbonate of soda.	

Energy			**'Light and Shadows'** Identifying examples of light sources, children learn that light is needed to see and how its absence causes darkness. Children investigate reflection and shadow formation, including how different factors change the shadows observed. They explore how shadows can be used to entertain in the arts and create shadow puppets to recount how different people work or experiment with light.	**'Electricity and Circuits'** Exploring appliances that use electricity in their setting, children learn how to work with electricity safely and build circuits. Pupils investigate electrical conductors and insulators and explore the relationship between the number of bulbs and bulb brightness. Real scenarios and historical discoveries inform children about scientific progression and home safety. **'Sound and Vibrations'** Exploring different ways of producing sounds, children learn about the relationship between vibrations and what they hear. They use examples of dolphins and whales to develop their understanding of how sound travels between objects and investigate the role of insulation to protect our ears. Pupils explore how pitch and volume can be altered and make their own musical instruments to demonstrate these principles.		**'Light and Reflection'** Proving that light travels in a straight line, children use this information to explain observations of reflection and shadows. They explore how our eyes allow us to see and how mirrors can be used in a variety of ways. Pupils investigate factors affecting the size of shadows and the laws of reflection. Children apply what they have learned about light by exploring real-life uses of mirrors. **'Circuits, Batteries and Switches'** Using their prior knowledge of electrical circuits, children learn to draw conventional circuit diagrams and use models to explain current and voltage. They make their own batteries, relate this to their knowledge of voltage and explore how battery research has impacted other scientific progress. Pupils investigate the use of switches and fuses and apply their electrical knowledge to design and produce their own electrical device.

Animals including Humans	**'Sensitive Bodies'** Familiarising themselves with the basic parts of the human body, children investigate their senses through stimulating experiences that highlight how we interact with the world around us. They work scientifically, using their senses to make observations, spot patterns and use data to answer questions. They develop an understanding of how science can support those who have lost sensory function and consider how a firefighter uses their senses at work. **'Comparing Animals'** Studying both local and global animals, children recognise common features and use this information to make comparisons and begin to classify animals. Pupils collect data by surveying class pets, to then explore ways in which this information can be recorded. They develop their understanding of classification by comparing the dietary habits of different animals and use their knowledge and imaginations to take on the role of a zookeeper.	**'Life Cycles and Health'** Studying the life cycles of various animals, children learn what animals need to survive and how they change over time. Pupils collect data that allows them to observe changes in their peers, while also developing their ability to take measurements and record data. They consider the role of expert scientific knowledge in careers that inform people to make healthy choices.	**'Movement and Nutrition'** Studying the human skeleton, children identify key bones and compare them to other animals explaining the role within the body. Pupils explore how changes in muscles result in movement and the implications these discoveries have in the scientific development of prosthetic limbs. They study how energy is used by the body, what constitutes a balanced diet in humans and how research contributes to nutritionist expertise.	**'Digestion and Food'** Using models, children describe the function of key organs in the digestive system. Pupils identify the types of human teeth to create their own model and investigate factors that impact our dental health. They compare human teeth to other animals' and consider this in the light of prior knowledge about predators, prey and food chains. Children take on the role of a naturalist investigating animal faeces for clues about diet, digestion and dentition.	**'Human Timeline'** Studying human development and changes, children identify key stages and consider what data may help determine if a child is growing normally. They describe how puberty affects girls and boys and produce graphs to record how gestation periods vary across different animals.	**'Circulation and Exercise'** Studying the human circulatory system, children learn about the role of the heart, blood and blood vessels and use models to demonstrate their function. They play the role of healthcare professionals to diagnose patients and play games to explore how lifestyle choices affect our health. Pupils devise their own investigation to look at the relationship between exercise and heart and breathing rates, applying their knowledge of variables.

Living Things and their Habitats		**'Habitats'** Considering the life processes that all living things have in common, pupils classify objects into alive, was once alive or has never been alive. Pupils explore global habitats, naming plants and animals that can be found there. They learn how a range of different living things depend on each other for food or shelter. Pupils explore this further by creating food chains to show the sequence that living things eat each other for energy to grow and stay healthy. **'Microhabitats'** Developing their understanding of scientific enquiry, pupils learn that scientists use a range of skills to answer questions. They discover that microhabitats provide what minibeasts need to survive and carry out a survey to find out where different minibeasts live in the school grounds. They practise asking scientific questions and follow a method to investigate which conditions woodlice prefer. Pupils explore the job role of a botanist by identifying flowering plants.		**'Classification and Changing Habitats'** Identifying different ways living things can be grouped, children make classification keys to explore which grouping methods are most effective. Pupils study ways that habitats may change over time and understand that humans can have both positive and negative effects on their surroundings. They play the role of naturalists and review the impact of conservation programmes.	**'Life Cycles and Reproduction'** Studying different animals' life cycles, children learn about the significance of reproduction for a species' survival. Pupils calculate the probability of male and female turtles hatching and grow plants to compare asexual and sexual reproduction. Pupils compare fertilisation across different animals and explore the needs of a foetus. Children narrate their own documentary in the style of an inspirational naturalist.	**'Classifying Big and Small'** Children broaden their knowledge of how vertebrates, invertebrates, plants and micro-organisms are grouped using shared characteristics. They discover how Carl Linnaeus developed the Linnaean and binomial systems for classifying and naming living things. Pupils use and produce classification keys to sort and identify organisms. **'Evolution and Inheritance'** Studying patterns in humans and other species, children learn about characteristics that are inherited from parents and those that are environmental. Through the eyes of Darwin and Wallace, pupils understand how observations lead to theories and explore natural selection. By modelling the variation and natural selection of Darwin's finches, they begin to explain how species evolve over time and the role of

						fossil evidence that supports this theory.
Plants	**'Introduction to Plants'** Identifying the key features of a plant, children describe important structures and make comparisons between different plants. Pupils use investigative skills to record the growth of a plant over time and begin to reflect on factors that will affect its development. They begin to explore how plants are used by humans and grow their own herb garden.	**'Plant Growth'** Using their prior knowledge of important plant structures, children explain what factors are needed for successful growth and compare how those needs vary across different plants. They grow plants from seeds and bulbs to ascertain the needs for initial development and compare this to the survival needs of plants in later growth phases. Pupils take their own measurements and reflect on historical examples to understand how conclusions can be drawn.	**'Plant Reproduction'** Building on their prior knowledge of plant structures, children describe the functions of named parts and use evidence to explain their significance in plant development. Pupils investigate further factors that may affect the growth of plants and compete with their peers to disperse seeds in a variety of ways. They explore how seeds vary and define the type of plant they are studying, as well as looking at how seed shapes have inspired modern technologies.			
Making Connections						
Bringing together pupils' learning from multiple Science units, helping them to make connections between the key concepts and skills.						

Progression of Knowledge and Skills

Click on the icon below to open our Science Progression of Knowledge and Skills Document

How our School Values are Embedded in Science

HONESTY **FORGIVENESS** **KINDNESS** **TEAMWORK** **RESPECT**

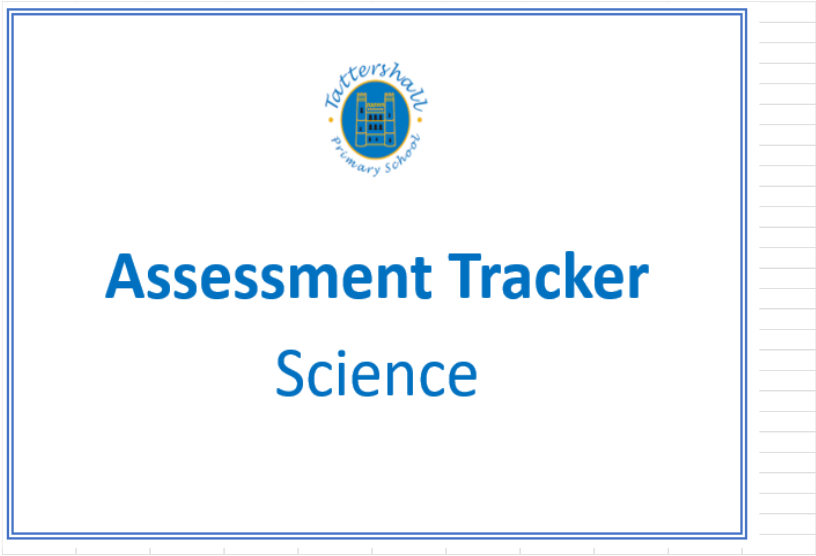
Year R	Key Stage One	Lower Key Stage Two	Upper Key Stage Two
Honesty – Looking after the environment. Forgiveness – Understanding the needs of others. Kindness – Turn taking, sharing, speaking to others kindly, investigating safely Teamwork – working together on activities, playing games together, investigating safely and sharing. Respect – respecting each other as individuals, respecting the use of technology and the world around them.	Honesty – Looking after the environment. Conducting a fair test, providing honest and fair results. Forgiveness – Understanding the needs of others, knowing that investigations might not turn out as expected. Kindness – Turn taking, sharing, speaking to others kindly, investigating safely – understanding what others think might happen and what they have to say. Teamwork – working together on activities, playing games together, investigating safely and sharing. Respect – respecting each other as individuals, respecting the use of technology and the world around them.	Honesty – Looking after the environment. Conducting a fair test, providing honest and fair results, talking about an honest and accurate conclusion Forgiveness – Understanding the needs of others, knowing that investigations might not turn out as expected. Kindness – Turn taking, sharing, speaking to others kindly, investigating safely. Conducting a fair test - understanding what others think might happen through their predictions and what they have to say. Knowing that one person's prediction might be different to another. Listening to other understanding and reasoning. Teamwork – working together on activities, playing games together, investigating safely and sharing. Talking and explaining their reasoning as to why things might happen. Respect – respecting each other as individuals and their reasoning and predictions, respecting the use of technology and the world around them.	Honesty – Looking after the environment. Conducting a fair test, providing honest and fair results, talking about an honest and accurate conclusion. Accepting the conclusion. Forgiveness – Understanding the needs of others, knowing that investigations might not turn out as expected – accepting when your prediction might not be correct. Kindness – Turn taking, sharing, speaking to others kindly, investigating safely. Conducting a fair test - understanding what others think might happen through their predictions and what they have to say. Knowing that one person's prediction might be different to another. Listening to others understanding and reasoning. Sharing out job roles in investigations equally – helping others. Teamwork – working together on activities, playing games together, investigating safely and sharing. Talking and explaining their reasoning as to why things might happen. Sharing out job roles equally and helping others during investigations. Respect – respecting each other as individuals and their reasoning and predictions, respecting the use of technology and the world around them.

ASSESSMENT IN SCIENCE

Teachers use formative assessment within and across lessons to be able to feedback to pupils about their learning in Science in the moment. Each lesson includes guidance to support teachers in assessing pupils against the learning objectives. Planning will be adapted to meet the needs of the children based on ongoing teacher assessment and adaptations will be designed to ensure pupil progress is maximised.

Each lesson will begin with an element of learning review and the key learning outcomes for each lesson are clearly identified Furthermore, each unit has a unit quiz and a knowledge and skills catcher, which can be used at the beginning and/or end of the unit to provide a summative assessment. Opportunities for children to communicate using scientific vocabulary will also form part of the assessment process in each unit. At the end of each unit, teachers will use the Assessment Tracker grid to make a summative judgement of each pupil's achievements. This information supports not only our assessment of achievement at an individual lesson but an overview of the class's achievement and is used to inform next steps. This information 'follows' the class year on year so that each teacher has a thorough and in depth understanding of the outcomes for each pupil and the class as a whole.

An example of the Assessment Tracker for Science can be viewed by clicking on the icon below:



Science

Curriculum Impact

After implementing our Science Curriculum, pupils will leave school equipped with the requisite skills and knowledge to succeed in Key Stage 3 Science. They will have the necessary tools to confidently and meaningfully question and explore the world around them as well as critically and analytically experiencing and observing phenomena. Pupils will understand the significance and impact of Science on society.

The expected impact is that children will:

- Develop a body of foundational knowledge for the Biology topics in the National Curriculum: Plants; Animals, Including Humans; Living Things and Their Habitats; Evolution and Inheritance.
- Develop a body of foundational knowledge for the Chemistry topics in the National curriculum: Everyday Materials; Uses of Everyday Materials; Properties and Changes of Materials; States of Matter; Rocks.
- Develop a body of foundational knowledge for the Physics topics in the National curriculum: Seasonal Changes; Forces and Magnets; Sound; Light; Electricity; Earth and Space.
- Be able to evaluate and identify the methods that 'real world' scientists use to develop and answer scientific questions.
- Identify and use equipment effectively to accurately gather, measure and record data.
- Be able to display and convey data in a variety of ways, including graphs.
- Analyse data in order to identify, classify, group, and find patterns.
- Use evidence to formulate explanations and conclusions.
- Demonstrate scientific literacy through presenting concepts and communicating ideas using scientific vocabulary.
- Understand the importance of resilience and a growth mindset, particularly in reference to scientific enquiry.
- Meet the end of Key Stage expectations outlined in the National Curriculum for Science.