ST MARY'S, WELHAM GREEN

Science

"Inspired Young Scientists"

Intent

Exploring the wonders of ‘Why?’

Here at St Mary’s, we use Kapow Primary’s Science curriculum. This scheme aims to develop a sense of excitement and curiosity about natural phenomena, and an understanding of how the scientific community contributes to the past, present and future.

The curriculum aims for pupils to develop a complex knowledge of biology, chemistry and physics but also adopt a broad range of skills in working scientifically and beyond. The scheme of work 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 pupils to appreciate how new knowledge and skills can be fundamental to solving arising global challenges.

The curriculum aims to encourage critical thinking and empower pupils to question the hows and whys of the world around them.

The scheme encourages:
- 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.

Kapow Primary’s Science scheme of work supports pupils in meeting the Early Learning Goals for Understanding the World (The Natural World) and the end of key stage attainment targets set out in the National curriculum.

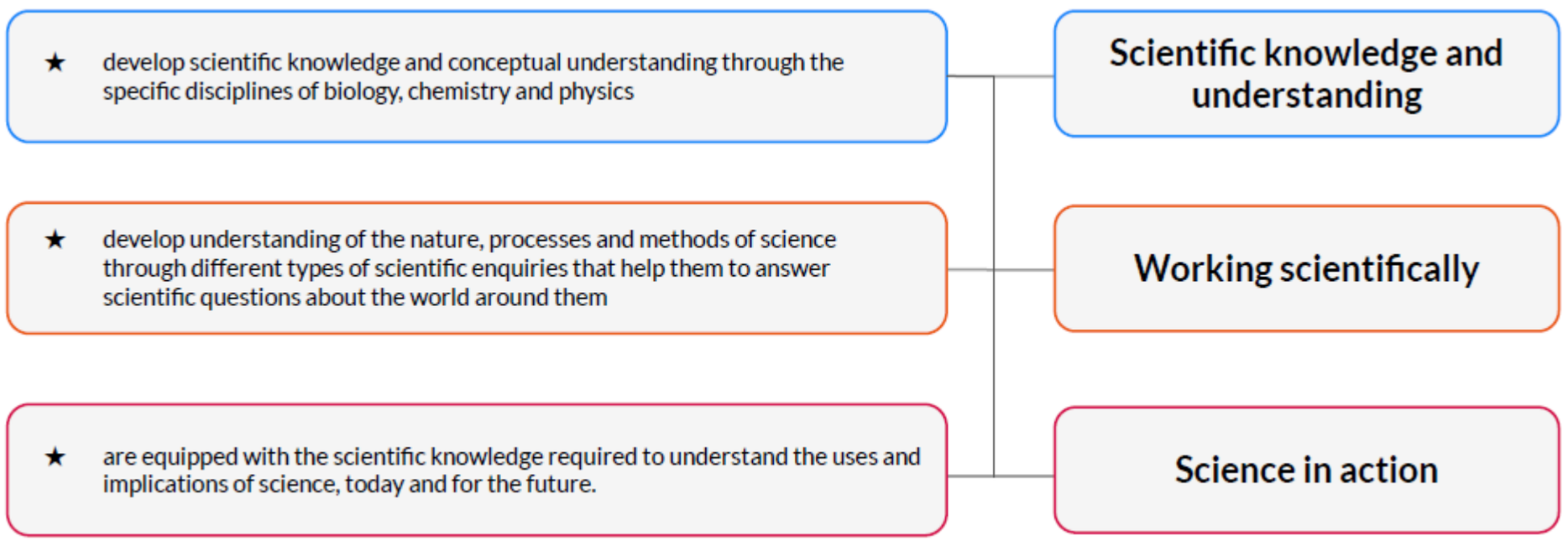
Implementation

To meet the aims of the National curriculum for science and in response to the Ofsted research review: science, Kapow has 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.

Kapow Primary's Science scheme 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 promotes 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 pupils to make connections and apply their science skills to other areas of learning.

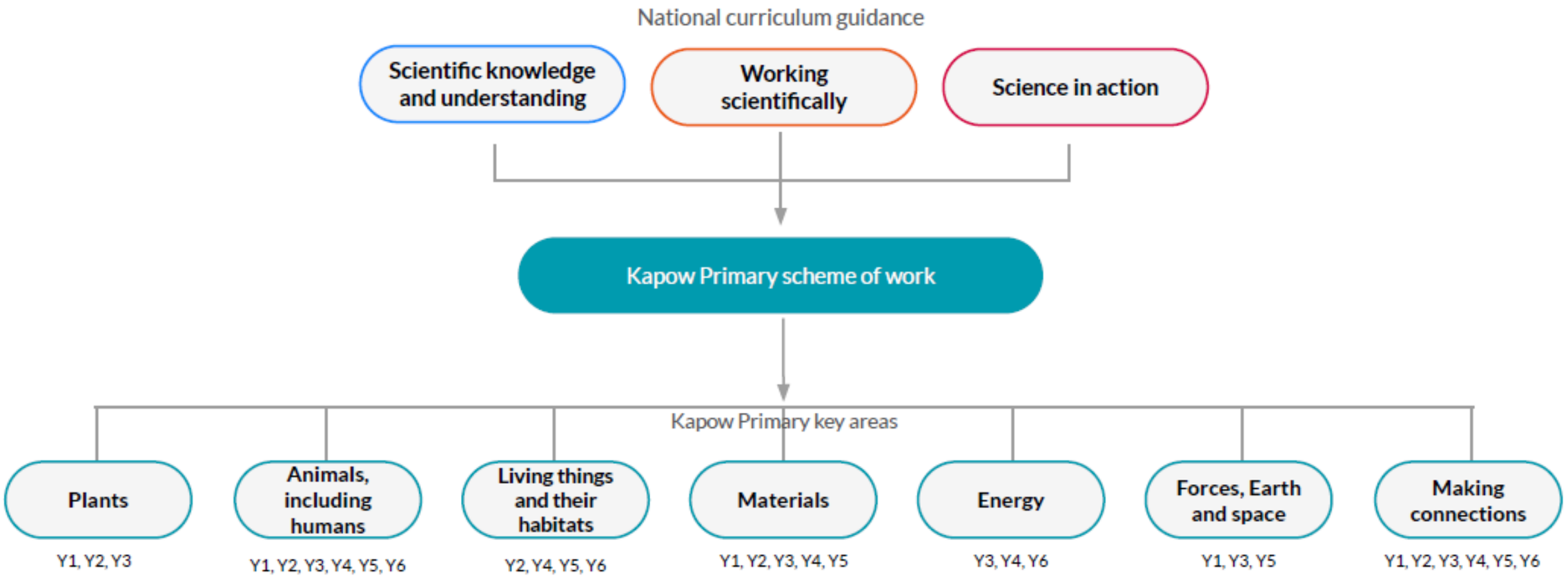


Implementation

Each unit is based on one of the key science disciplines: biology, chemistry and physics. The **National curriculum** content has been grouped into six key areas of science to show progression throughout the school:

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 research review: science** (April 2021), the Working scientifically skills are integrated with conceptual understanding rather than taught discretely to provide frequent but relevant opportunities for developing scientific enquiry skills. The scheme utilises practical activities that aid in the progression of individual skills and provide opportunities for full investigations.



Implementation

In EYFS (Reception), pupils build a **solid foundation for science before transitioning to Key stage 1**. Through hands-on exploration and focused observations, **lessons spark curiosity** and foster an early appreciation for the natural environment, paving the way for more structured scientific learning in Key stage 1.

Each year group has an optional exploratory unit called 'making connections' that delves beyond the statutory curriculum. This **unit assimilates prior knowledge and skills** to evoke excitement and 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.

In Year 1, the transition into the Key stage is eased by providing a selection of activities: some adult-led, some independent tasks and some that can be used during continuous provision to suit your set-up.

Guidance for **adapting the learning** is available for every lesson to ensure that all pupils can access it and opportunities to stretch their learning are available when required. **Knowledge organisers** for each unit help to identify key learning and vocabulary and can be useful as an adaptive teaching tool or to **revise** learning from the unit.

Strong subject knowledge is vital for staff to deliver a highly effective and robust science curriculum. Each unit of lessons includes teacher videos and resources to develop subject knowledge, target fundamental misconceptions effectively and support ongoing CPD. Kapow has been created to build confidence amongst non-specialist primary teachers who are required to deliver and assess the full science curriculum and maximise pupil progression. Videos created by subject specialist feature troubleshooting advice for practical work that does not go to plan, suggested questioning and support for tackling misconceptions and recordings of practical tasks that can be utilised as demonstrations in the classroom or to support pupil reflection on their own observations.

Implementation

'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: Using the Kapow! 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.**

Using the Kapow! Scheme of work, 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 connection 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.

Impact

The impact of Kapow Primary's Science scheme can be constantly monitored through both formative and summative assessment opportunities.
Each lesson includes guidance to support teachers in assessing pupils against the learning objectives and any relevant scientific enquiry skills. Furthermore, each unit has **a unit quiz and a knowledge catcher**, which can be used at the end of the unit to provide a summative assessment. Opportunities for pupils to communicate using scientific vocabulary will also form part of the assessment process in each unit.

Pupils should leave our school equipped with the requisite skills and knowledge to **succeed in science at Key stage 3**. They will have the necessary tools to confidently and meaningfully question and explore the world around them and critically and analytically experience and observe phenomena. Pupils will understand the significance and impact of science on society.

The expected impact of following the Kapow Primary Science scheme of work is that pupils will:
- Develop early scientific thinking skills through hands-on exploration and sensory experiences in EYFS.
- Develop a body of foundational knowledge for the biology topics: Plants; Animals, including humans; Living things and their habitats; and Evolution and inheritance.
- Develop a body of foundational knowledge for the chemistry topics: Everyday materials; Uses of everyday materials; Properties and changes of materials; States of matter; and Rocks.
- Develop a body of foundational knowledge for the physics topics: Seasonal changes; Forces and magnets; Sound; Light; Electricity; and Earth and space.
- 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.
- Analyse data 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.

The Non-Negotiables

1. Red exercise book with a name label on the front.

2. Inside cover: stick in the St Mary's Science Enquiry Cycle & Scientific Enquiry poster *[Teacher > Science > KS1 / KS2 enquiry cycle]*

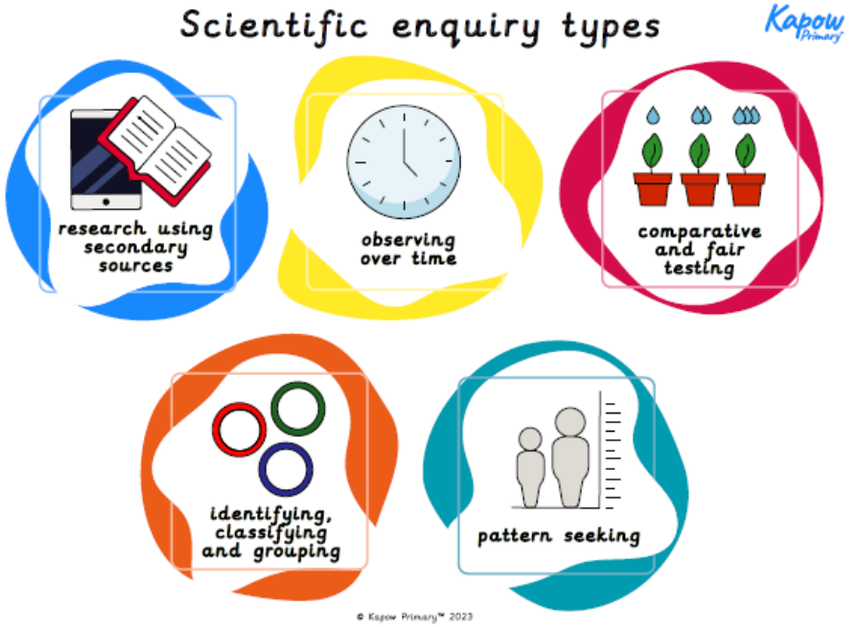
3. Lesson 1: stick in the Knowledge Organiser for the unit you are completing *[Teacher > Science > Knowledge Organisers]*

4. Each lesson should have the long date and a history lesson label with the Kapow! lesson question. *[Teacher > Science >NEW question label template]*

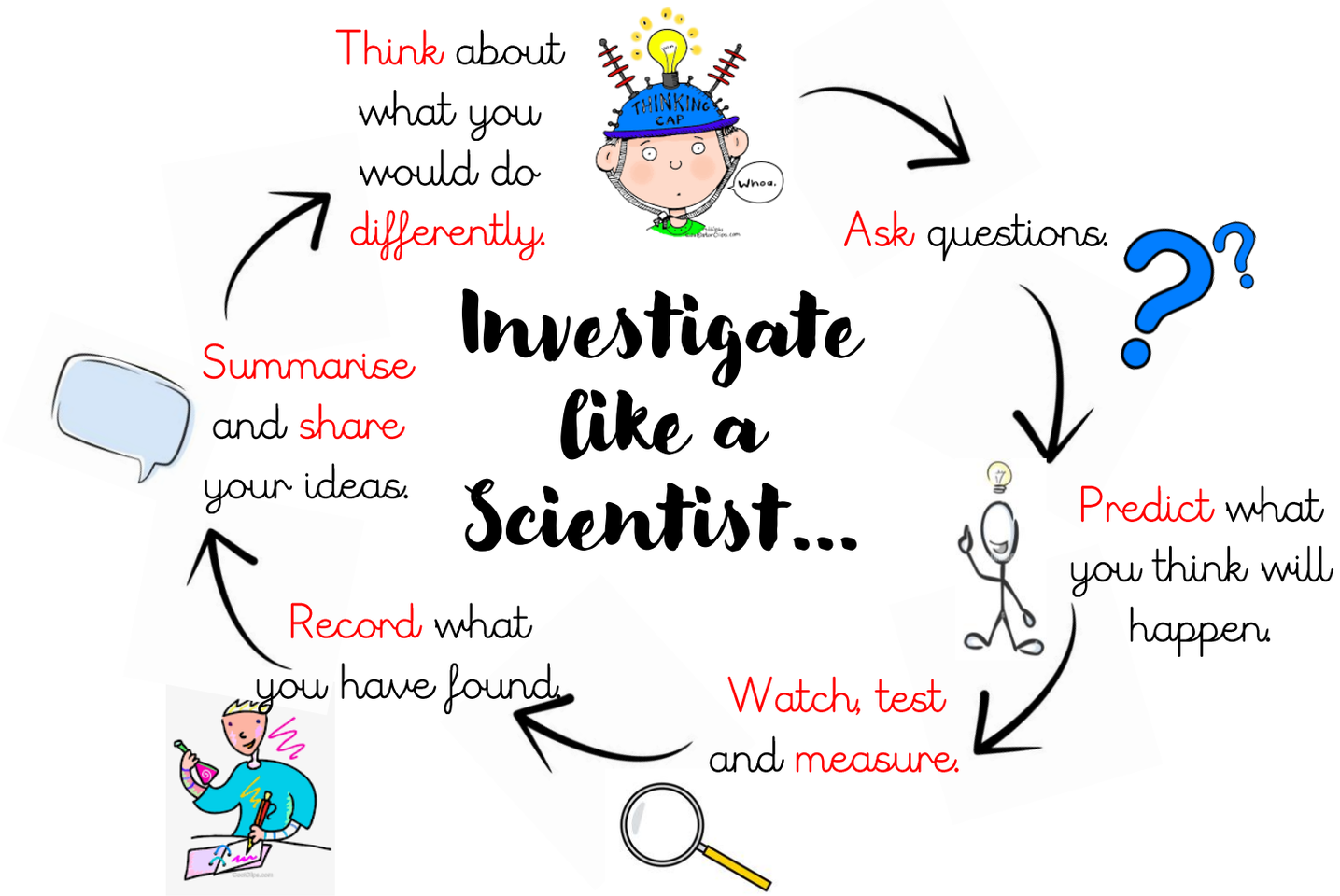
5. Assessment: at the end of each unit, children are to complete the **'Knowledge Catcher'** assessment. This will be stuck in their books to assess how well they can recall what they have learnt.

6. At the end of **each lesson**, teachers *must* refer to the enquiry cycle and discuss with children how they have been a scientist today (asked questions? Recorded data? Shared ideas?). Discuss what enquiry they carried out during investigation lessons.

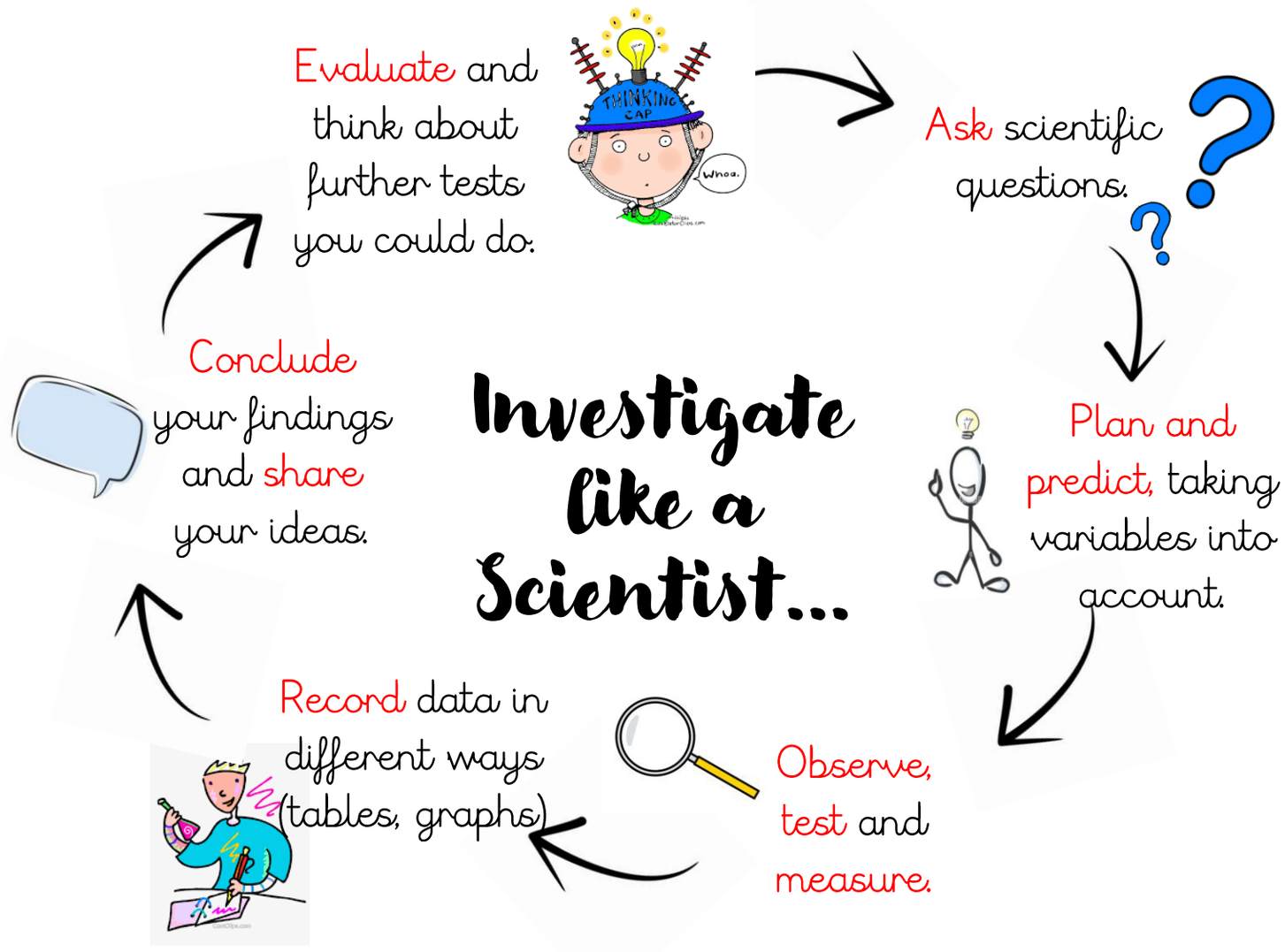
*Note: worksheets are only to be used when necessary. Use Kapow! adapted resources for SEND learners to ensure work is suitable.



KS1 Enquiry Wheel



KS2 Enquiry Wheel



Curriculum Overview

Science

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2	
Reception	Animal adventures		I am a Scientist		Our beautiful planet		
	Changing seasons						
Year 1	Seasonal changes	Everyday materials	Sensitive bodies	Comparing animals	Introduction to plants	Science through stories	
Year 2	Habitats	Microhabitats	Uses of everyday materials	Life cycles and health	Plant growth	Plant-based materials	
Year 3	Movement and nutrition	Forces and magnets	Rocks and soil	Light and shadows	Plant reproduction	Does hand span affect grip strength?	
Year 4	Digestion and food (Including teeth)	Electricity and circuits	States of matter	Sound and vibrations	Classification and changing habitats	How does the flow of liquids compare?	
Year 5	Earth and space	Life cycles and reproduction	Mixtures and separation	Properties and changes	Unbalanced forces	Human timeline	Does the size of an asteroid affect its impact strength.
Year 6	Classifying big and small	Light and reflection	Evolution and inheritance	Circuits, batteries and switches	Circulation and health	Are some sunglasses safer than others?	

Supporting the EYFS Statutory Framework

Our Science Early Years Foundation Stage (Reception) units are designed to target Development matters 'Understanding the world' statements and also fully integrated with the Kapow Primary Key stage 1 and 2 curriculum for Science, offering a unified approach to teaching Science in EYFS.

Clear progression between EYFS and Key stage 1 content can be seen by looking at our Progression of knowledge and skills document, where component knowledge and skills are outlined across our strands **Scientific knowledge and understanding, Working scientifically** and **Science in action)** from EYFS (Reception) through to Year 6.

Each unit includes **an explanatory video** that aids teachers in planning and implementation highlighting how the activities **contribute to developing foundational skills** and knowledge for later Science education in Key Stages 1 and 2.

Lessons aim to spark curiosity about the world, encouraging focused observation and questioning about the environment around them. Pupils explore, test and observe changes, laying the groundwork for developing essential scientific skills and preparing pupils for Key stage 1.

EYFS Overview

Reception Skills Development Progression

Understanding the world									
	Subject	**Year one progression link**	**Autumn one**	**Autumn two**	**Spring one**	**Spring two**	**Summer one**	**Summer two**	**ELG**
The Natural Word	**Science**	Identify and describe plants and animals, including humans. Working scientifically. Exploring materials.	**Seasonal Weather** I can talk about Autumn. I know what the signs of Autumn are and how is it different to Spring, Summer and Winter. **Animals including Humans** I can describe what I can feel, touch, see, hear and smell.	**Animals including Humans** I can identify and learn about the habitats of minibeasts **Plants** I can explore my local environment and explore nature around me including weather. (Autumn nature welly walk to the woods)	**Animals including Humans** I can identify and learn about mini-beasts and their habitats I can talk about similarities and differences between animals, where they live and what they need to survive. **School Trip** The children go on a school trip to visit a wildlife park/zoo. **States of Matter** I can begin to explore changing states of matter through mixing paint and adding water to flour to make playdough.	**Animals including Humans** I know about the butterfly life cycle and can observe changes from a caterpillar to butterfly (Live Butterfly Garden in classroom) **Plants** I can plant my own sunflower seed and know hat it needs to grow.	**Animals including Humans** I can understand the Life Cycle of a chick (Egg hatching in classroom) **Seasonal Weather** I can understand the effect of changing seasons on the natural world around us **Living Things and Their Habitats** I can recognise some environments that are different to one in which we live- through stories and non-fiction texts.	**Everyday materials** I can explore different materials and work scientifically making observations E.g. floating and sinking investigation.) **States of Matter** I can explore changes in matter- freezing and melting.	Explore the natural world around them, making observations and drawing pictures of animals and plants. Know some similarities and differences between the natural world around them and contrasting environments, drawing on their experiences and what has been read in class. Understand some important processes and changes in the natural world around them, including the seasons and changing states of matter.
Key Vocabulary	Animals, body parts, food, flower, push, pull, twist, squash, stretch, electricity, switch, see, hear, feel, touch, smell, healthy, unhealthy, life cycle, exploring, seasons, weather, different, natural world, change, mix, freezing, melting, liquid								

Progression of Skills

Progression of knowledge

Living things and their habitats

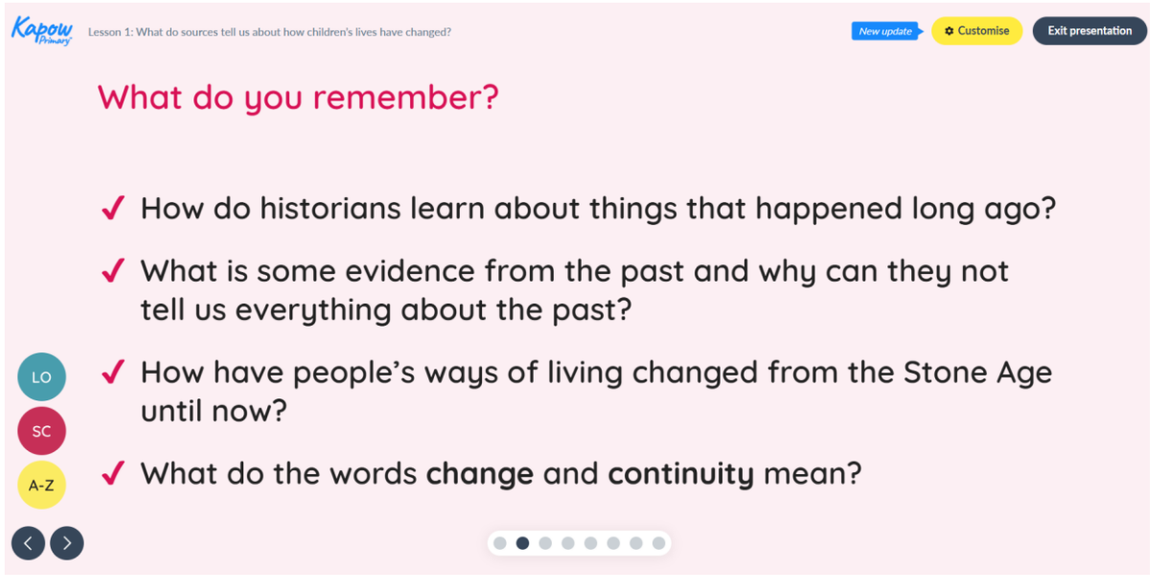
		EYFS: Reception Animal adventures	Year 2 Habitats Microhabitats	Year 4 Classification and changing habitats
Scientific knowledge and understanding	Characteristics of living things	To know that animals and plants move, grow and feed. To know the difference between things that are living and things that are non-living. To know that some animals hibernate or store food in winter.*	To begin to understand some of the life processes, including movement, reproduction, sensitivity, growth, excretion and nutrition. To know the difference between things that are living, dead, and things that have never been alive, using some of the life processes.	To know that living things can be grouped in different ways. To know that a classification key can be used to group and identify plants and animals. To know that vertebrates are animals which have a backbone and invertebrates are animals which do not have a backbone. To know that plants can be grouped into flowering or non-flowering varieties. To know that flowering plants include grasses and non-flowering plants includes ferns and mosses. To know that there are five main vertebrate groups: birds, mammals, reptiles, amphibians and fish. To know that invertebrate groups include snails, slugs, worms, spiders and insects.
	Variation and inheritance	To know the names of familiar animals (e.g. farm animals, pets and animals seen in storybooks.)* To know the names of some familiar flowering plants (e.g. daisy, rose, sunflower, daffodil).*	To know a variety of plants and animals and describe some differences.	
	Habitats and interdependence	To know that plants and animals live in a range of different places. To name some different places where animals live on the school site.	To name a variety of habitats, including woodland, ocean, rainforest and seashore. To know that a habitat is the environment where an animal or plant lives/ grows, because it provides what they need to survive. To know that a micro-habitat is a very small habitat (e.g. stones, logs and leaf litter). To know that living things depend upon each other (e.g. for food, shelter.) To understand that a food chain can be used to show how animals obtain food from eating either plants and/or other animals.	To know that habitats can change throughout the year and this can be dangerous for living things. To know that humans can have both a positive and negative impact on the environment.

A progression of skills document is used from Kapow! These give an indication of how each unit meets the National Curriculum objectives while allowing each year group to see prior knowledge and understanding and their expected next steps.

Living things and their habitats

		Year 6 Classifying big and small Evolution and inheritance
Scientific knowledge and understa	Variation and inheritance	o know that 'organism' is a term used to refer to an individual living thing. o know that micro-organisms are incredibly small and cannot usually be seen by ıe naked eye. o know the characteristics of the different groups of vertebrates and commonly ound invertebrates.
	Habitats and interdependence	To know that a life cycle shows the changes an animal or plant goes through until the reproduction of a new generation when the cycle starts again. To know that all living things must reproduce for the species to survive. To know that sexual reproduction requires two parents, whereas asexual reproduction only requires one parent. To know that there are different processes plants and animals use to reproduce (asexual and sexual reproduction).
		To know that living things have changed over time. To know that fossils provide us with information about living things that inhabited the Earth millions of years ago. To know that characteristics are passed from parents to their offspring, but that all offspring vary from their parents. To know that over time, variation in offspring can affect animals' chances of survival in particular environments. To know that animals and plants have adapted to suit their environment over many millions of years and that this process can be called evolution.

Assessment



<u>Formative assessment:</u>

Every lesson begins with the **'Recap and recall'** section which is intended to allow pupils **retrieval practice** of key knowledge relevant to the upcoming lesson.

This section also provides our teachers with an opportunity to make informal judgements about **whether pupils have retained prior learning and are ready to move on**.

Each lesson contains the **'Assessing progress and understanding' section** which helps teachers to identify those pupils who are **secure in their learning or working at a greater depth** in each lesson.

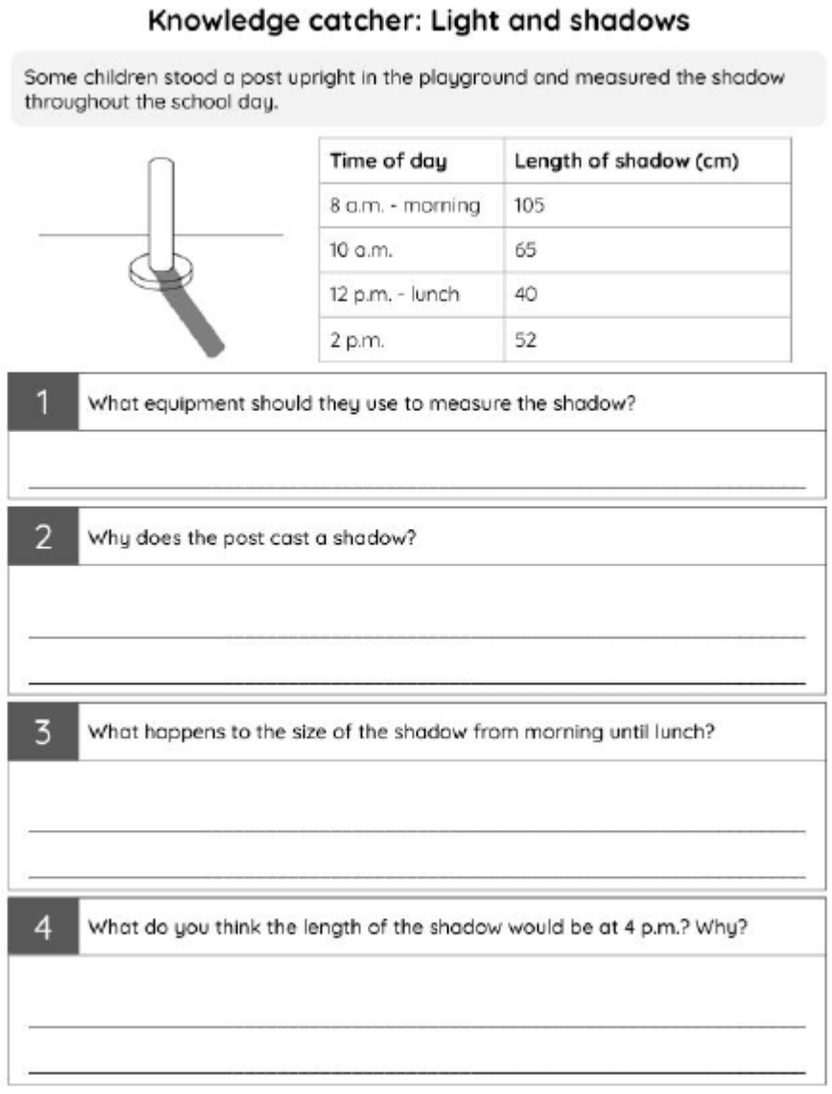
Assessment

Summative assessment:

The disciplinary strands are assessed using a **Knowledge catcher at the end of each unit**. This requires children to draw upon their disciplinary knowledge in order to respond to an outcome task, such as the one shown below.

Each disciplinary concept is assessed at least once by the end of Key stage 1 and once by the end of Key stage 2 using historical enquiry skills. Knowledge catchers provide teachers with a record of summative assessment as evidence of progression from Key stage 1 to Key stage 2.

Substantive concepts and topic knowledge begin being assessed using **an end of unit quiz in Year 2 Spring term** and continue to be assessed throughout Key stage 2 units.



Knowledge catcher: Light and shadows

Some children stood a post upright in the playground and measured the shadow throughout the school day.

Time of day	Length of shadow (cm)
8 a.m. - morning	105
10 a.m.	65
12 p.m. - lunch	40
2 p.m.	52

1 What equipment should they use to measure the shadow?

2 Why does the post cast a shadow?

3 What happens to the size of the shadow from morning until lunch?

4 What do you think the length of the shadow would be at 4 p.m.? Why?

Kapow Primary

Unit title:

Question 1:	A	B	C	D
Question 2:	A	B	C	D
Question 3:	A	B	C	D
Question 4:	A	B	C	D
Question 5:	A	B	C	D
Question 6:	A	B	C	D
Question 7:	A	B	C	D
Question 8:	A	B	C	D
Question 9:	A	B	C	D

Question 10:

Score:

Barriers To and Solutions for Engagement, Progress and Achievement

	Barriers identified by SENCo/Class teacher	Solutions Identified by subject co-ordinator
Hearing Impairment	• Vocabulary • Difficulty in hearing instructions • Managing practical investigations / interactions	• Positioning in classroom • visuals and clarity in step-by-step progress
Visual Impairment	• Difficulty reading • Navigating classroom • Managing resources and equipment	• positioning • colour coding • adapted resources • pre-experience/pre-teach
Dyspraxia (fine/ gross motor)	• Managing physical resources particularly "fiddly bits" such as crocodile clips in circuits • Difficulty recording	• adapted equipment • alternative ways of recording
Memory/ processing	• Recall of instructions • Remembering key facts and vocab • Retaining focus	• task planner • visual representation and recording
ASC	• Noise and movement- over stimulation • sharing equipment • amount of vocab	• Own set of equipment where possible • Sufficient quiet space • Well planned transitions – i.e., between carpet and desk • Visual instruction • Now and next boards/123 boards/sequencing board
ADHD	• Waiting and frustration • Turn taking • Maintain attention • Recording	• Sufficient quiet space • Well planned transitions – i.e., between carpet and desk • Visual instruction • Worked examples • Now and next boards/123 boards/sequencing board
Cognition	• Understanding of process, lang • Retention/ application of substantive / disciplinary knowledge to task • Recording • Vocabulary	• Word/definition bank • Sufficient quiet space • Well planned transitions – i.e., between carpet and desk • Visual instruction • Sentence stems/speaking frames
SEMH	• Attitude towards science • Fear of failure	• Written/visual instructions • Computer/iPad access • Sentence stems/speaking frames • Now and next boards/123 boards/sequencing board

- **Clarity of instruction, explanations and modelling are crucial**
- **Ensure that the most important aspect of learning is made clear – cognitive load theory is relevant for all pupils with SEND both in terms of what pupils see and hear and are expected to learn. Use the teacher guides to see the essential disciplinary and substantive knowledge that all children need.**
- **For many pupils with SEND, it is the recording of the content rather than the content itself which provides the greatest level of challenge in lessons, and this should be addressed in the planning and preparation for lessons**

Exploring the wonders of ‘Why?’

www.stmarys565.herts.sch.uk