Science Working Scientifically Skills Progression

Science Intent Statement: At Milton Ernest C of E Primary School, we recognise the importance of science in our everyday lives. We believe that science teaching is essential for the development of children's curiosity and understanding of the world around them, respect for the living and non-living and how science is used in the real world. Where possible, we aim to provide a practical curriculum that supports the development and progression of scientific skills and enquiry, subject knowledge and vocabulary through the specific disciplines of biology, chemistry and physics. We intend to provide all children, regardless of ethnic origin, gender, class, aptitude or disability, with a broad and balanced curriculum and aim to instil a lifelong love of science learning.

There are **five** areas of scientific enquiry:

- Pattern seeking
- Observation over time
- Comparative and fair testing
- Identifying, classifying and grouping
- Researching secondary sources

Vocabulary

Term	Definition and examples
Types of enquiry	The national curriculum lists five types of enquiry: fair and comparative testing, looking for a pattern, observing over time, identifying and classifying, research
Fair or comparative testing	Changing one variable to observe its effect while controlling all of the other variables. In a comparative test the variable being changed is qualitative e.g. type of material. In a fair test it is quantitative e.g. size of the parachute.
Observing over time	Observing and measuring how something changes over time.
Looking for a pattern	Observing and recording patterns in nature or carrying out a survey where all of the variables cannot be controlled, e.g. where do daisies grow? Do children with the longest arms throw the furthest?
Research	Using secondary sources such as: books, the internet, pictures, visitors and experts as sources of evidence to answer questions.
Identifying and classifying	Arranging and sorting objects, materials and living things into particular sets according to certain characteristics. These can be characteristics and groups designed by the children or recognised groups such as carnivores, omnivores and herbivores.
Accurate	To be accurate, a measurement is close to its true value.
Precise equipment	More precise equipment measures to a smaller increment e.g. a ruler with mm is more precise than a ruler with only cm.
Variable	Variables are the things in an enquiry that can be changed. To establish a causal relationship in a fair test only one variable can be changed. Any others that may affect the results need to be kept the same (controlled). *(Not mentioned in the national curriculum until UKS2)*
Conclusion	A simple summary of what has been found out based on observations and/or measurements.

Footnote: Alternatives to calculating a mean
It may be appropriate for pupils to take repeat readings in comparative and fair tests before they have learnt about calculating the mean average in maths. Rather than asking them to calculate a mean in science before learning how to do this in maths, pupils can instead be encouraged to look closely at their data and identify any readings that do not fit with the others. Once identified, these readings can be crossed out and ignored, or if there is time pupils can repeat the reading again. Pupils can then look at the remaining readings and use these to estimate a 'most likely' answer.

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	KS1 Statutory requirements from NC	Lower KS2 Statutory requirements from NC	Upper KS2 Statutory requirements from NC
	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.	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.	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 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.

Science Working Scientifically Skills Progression

WORKING SCIENTIFICALLY BUILDING BLOCKS EYFS

Shows curiosity and asks questions

Performs simple tests using simple equipment

Uses senses to observe and look closely

Notices changes

Sorts and matches things finding similarities and differences

Makes simple records of what they have done and noticed.

Talks about what they have done and noticed.

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WORKING SCIENTIFICALLY BUILDING BLOCKS KS1

Plan

- Asks simple questions
- Performs simple tests mostly following teacher instructions

Do

- Observes closely using simple equipment
- Makes measurements through comparisons and non-standard units
- Gathers and records data in prepared tables and tally charts
- Identifies and classifies living things and materials
- Uses secondary sources to find answers

Review

- Uses their observations and ideas to answer questions

HFL

Science Working Scientifically Skills Progression

WORKING SCIENTIFICALLY BUILDING BLOCKS LKS2

Plan

- Asks relevant questions using different types of enquiry to answer them
- Sets up simple practical enquiries by beginning to make decisions
- Makes careful observations and accurate measurements using standard units
- With help identifies some things to keep the same in a fair/ comparative test

Do

- Uses classification branching keys
- Records data, starting to add headings to tables
- Uses diagrams, drawings and bar charts to present evidence
- Recognises when and how secondary sources might help answer questions

Review

- Uses results to draw conclusions using evidence to support
- Uses results to suggest improvements
- Uses results to make predictions for new values and raise further questions
- Uses simple scientific vocabulary to discuss and report on findings

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WORKING SCIENTIFICALLY BUILDING BLOCKS UKS2

Plan

- Uses experience to ask questions and chooses the type of enquiry to answer them
- Plans different types of enquiry
- Chooses the most appropriate equipment and uses it accurately
- Recognises and controls variables in fair and comparative tests

Do

- Uses and develops keys to identify and classify
- Decides how to record data and prepares own format
- Uses diagrams, drawings, bar and line and scatter graphs to present evidence
- Recognises which secondary source is most useful, begins to separate opinion from fact

Review

- Uses results to draw conclusions and considers the degree of trust
- Makes suggestions to improve their working method
- Uses results to make predictions and set up further comparative and fair tests
- Use relevant scientific vocabulary, graphs and diagrams to report on findings

Science Working Scientifically Skills Progression

HFL progression in working scientifically skills

This document shows how the working scientifically statements from the science national curriculum for England build through the primary curriculum. The bold statements reflect the working scientifically skills outlined under the statutory requirements. The other bullet points provide additional guidance to support with understanding of progression. For EYFS, relevant Development Matters statements have been used to consider how the foundations for working scientifically can be encouraged and modelled through interactions with children while they are playing and exploring.

In a full enquiry, children will be using and developing a range of the skills listed below. However, to explicitly teach, model and assess each skill it is recommended that teaching narrows the focus so that a fundamental skill or skill area can be focused on in an enquiry. The focus of the learning should also be the focus of any recording children complete e.g. if the focus is on forming a conclusion, this might be the only part of the enquiry recorded by the child in their book. Over the course of an academic year, teachers and science subject leaders should ensure that a range of skills are focused on, so that children are learning the full range of working scientifically skills.

	Skill	EYFS	Key stage 1	Lower key stage 2	Upper key stage 2
Planning- exploring and planning	Ideas and questions 	• shows curiosity and starts to ask questions	• **asks simple questions and recognises that they can be answered in different ways**	• **asks relevant questions and uses different types of scientific enquiries to answer them**	• uses their scientific experiences to explore ideas and raise different types of questions. • chooses the type of enquiry to answer a question and justifies their choice.
	Planning or following an approach 	• performs simple tests using some simple equipment	• **performs simple tests** or follows teachers' instructions, including tests to classify, comparative tests, pattern seeking and observations over time. • with guidance, suggests what they will do • with guidance, identifies things to measure or observe that are relevant to the question	• **sets up simple practical enquiries, comparative and fair tests** • begins to make decisions about what observations to make and how long to make them for • begins to choose the type of simple equipment that might be used from a reasonable range	• **plans different types of scientific enquiries to answer questions** • makes decisions about what observations or measurements to make, how long to make them for and whether to repeat them • chooses the most appropriate equipment to make measurements (accuracy and precision)
	Variables 		• suggests why a comparative test is unfair	• with help, decides how to set up a fair test and identifies some things that need to be kept the same.	• recognises when and how to set up comparative and fair tests • **recognises and controls variables where necessary** • explains which variables need to be controlled and why

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Doing – collecting and presenting evidence	Observing and measuring 	• uses senses to observe and look closely • notice changes	• **observes closely using simple equipment** • makes measurements through comparisons and using non-standard units.	• **makes systematic and careful observations where appropriate** **taking accurate measurements using standard units using a range of equipment, e.g. data loggers and thermometers**	• **takes measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate** • calculates mean value where appropriate (after taught in maths see footnote)
	Secondary sources 		• uses simple secondary sources to find answers, e.g. books, videos, photographs, people, identification sheets	• recognises when and how secondary source might help answer questions that cannot be answered through practical investigations	• recognises which secondary sources will be most useful to research their ideas • begins to separate opinion from fact • **identifies scientific evidence that has been used to support or refute ideas or arguments**
	Identify and classify 	• finds things that are similar or different • sorts and matches things	• **identifying and classifying** • uses observations and testing to identify similarities and differences in materials and living things • sorts and groups based on own criteria and criteria given into tables and sorting rings	• **identifies differences, similarities related to simple scientific ideas and processes** • **records findings using keys** • uses classification branching keys • records classification using Venn and Carroll diagrams	• **records and presents findings using classification keys** • uses and develops keys to identify, classify and describe living things and materials
	Recording information and data 	• makes simple records (drawings, photographs etc.) to show observations including simple tick sheets (reception)	• **gathers and records data to help in answering questions** • records observations e.g. using photos, video, labelled diagrams and in writing • records measurements in prepared tally charts, tables, block graphs or pictograms	• **gathers and records data in a variety of ways to help in answering questions** • starts to decide how to record data in simple contexts. • uses given templates and adds own headings to tables	• **records data and results of increasing complexity** • decides how to record data and prepares own format.
	Presenting evidence 		• with help, records their findings in a range of ways, e.g. simple tables, diagrams, pictograms, block graphs and sorting circles	• **recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables**	• **records and presents findings using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs**

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Reviewing –analysing results concluding and evaluating	Answering questions and concluding 	• talks about what they have done and what they have noticed	• talks about what they have found out and, with support, how they found it out • **use their observations and ideas to suggest answers to questions**	• **uses results to draw simple conclusions** • **uses straightforward scientific evidence to answer questions or to support their findings** • **identifying differences, similarities or changes related to simple scientific ideas and processes**	• **reporting and presenting 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** • draws valid conclusions, explains and interprets the results (**including the degree of trust)** using scientific knowledge and understanding (e.g. recognises limitations of data)
	Sharing findings 		• talks about what they, their group or class have found out	• **reports on findings from enquiries, in simple scientific language, using oral and written explanations, displays or presentations of results and conclusions** • communicates findings to an audience	• communicates findings to an audience in oral and written forms using relevant scientific language, graphs and diagrams to communicate and justify scientific ideas
	Evaluating 		• with support, suggests whether what happened was what they expected • with support, suggests different ways they could have done things	• **uses results to suggest improvements, make predictions for new values and raise further questions** • with support, suggests simple improvements to a method • use evidence to suggest value for different items e.g. distance travelled by car on other surfaces. • with support, ask questions related to the enquiry or arising from the data	• makes practical suggestions about how their working method could be improved (e.g. surveying more people, repeat to check accuracy of results, better control of variables etc.) • identify limitations that reduce the trust they have in data. • uses results to identify when further tests and observations might be needed • **uses test results to make predictions and to set up further comparative and fair tests**

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Working Scientifically – Key Vocabulary		
Key Stage 1	**Lower Key Stage 2**	**Upper Key Stage 2**
	All KS1 plus:	All previous Vocabulary plus:
		Variables
		Controlled variable
observe	enquiry	evidence
changes	practical enquiry	justify
patterns	fair test	accuracy
grouping	comparative test	precision
sorting		scatter graphs
	conclusion	bar graphs
compare	accurate	line graphs
identify (name)	thermometer	argument (science)
results	data logger	causal relationship
measure	estimate	
record	data	
equipment	diagram	
questions	key (identifying)	
test	table	
investigate	chart	
explore	bar chart	
predict	results	
same	prediction	
different	method	
	reason	
	similarity	
	difference	
	question	
	properties	
	characteristics	