Disciplinary knowledge: Working scientifically

Disciplinary knowledge is taught and embedded within the teaching of each unit of substantive knowledge.

• Methods used to answer questions (use of models, classification, correlations and patterns, experimentation, fair testing)

• Using apparatus and techniques (accurate measurement, collecting and recording data, carrying out procedures safely and accurately)

• Data analysis (processing and presenting data, exploring relationships, communicating results in tables / graphs, identifying correlations)

• Using evidence to develop explanations (using evidence / scientific knowledge to draw conclusions, explain laws, models, concepts and findings) As part of working scientifically which is embedded throughout all units, pupils will also learn to use a variety of enquiry strategies to answer scientific questions. Different questions lead to different types of enquiry and are not limited to fair testing. By the end of primary school, children will be able to use these enquiry strategies confidently and know that different strategies may be needed at different times.

• Observing over time: (observing or measuring how one variable changes over time)

• Identifying and classifying: (identifying and naming materials/living things and making observations or carrying out tests to organise them into groups)

• Looking for patterns: (making observations or carrying out surveys of variables that cannot be easily controlled and looking for relationships between two sets of data)

• Comparative and fair testing: (observing or measuring the effect of changing one variable when controlling others)

• Answering questions using secondary sources of evidence: (answering questions using data or information that they have not collected first hand)

Disciplinary Knowledge		
EYFS children can	Year 1 children can	Year 2 children can
• ask simple questions about the world around them • ask teachers or adults within school about things they observe • • make observations about things they see around them • • conduct guided investigations with supervision • make choices when performing simple identifying and classifying • make some comparison between objects or living things • make some predictions about living things based on prior knowledge • make suggestions about how things work based on their own observations • use basic observations to help answer questions with help from the teacher • explore the natural world around me, making observations and drawing pictures of plants and animals. • identify some similarities and differences between the natural world around me and contrasting environments, drawing on their	• ask simple questions and recognise that they can be answered in different ways • fair tests, comparative tests, observation over time, research, pattern seeking) • • observe closely, using simple equipment (hand lenses, egg timers) • perform simple tests to investigate the answer to a given question • perform simple identifying and classifying, grouping task using basic observations • use observations and ideas to suggest answers to questions, using simple sentences to describe the answer • gather and record data to help in answering questions, using given tables or data formats	• ask simple questions and recognise that they can be answered in different ways (fair tests, comparative tests, observation over time, research, pattern seeking) • • research the answers to questions using books, tablets or computers • • observe closely, using simple equipment (hand lenses, egg timers, rulers, stopwatches etc) • perform simple tests to investigate the answer to a given question • begin to design their own tests to investigate the answer to a given question • perform simple identifying and classifying, grouping using basic observations • begin to group using prior knowledge • use observations and ideas to suggest answers to questions, using simple sentences to describe the answer to a question • give basic conclusions with simple reasoning

experiences and what has been read in class		• gather and record data to help in answering questions, using given tables or data formats drawing own tables, deciding how to record

Year 3 children can	Year 4 children can	Year 5 children can	Year 6 children can
• ask relevant questions and use different types of scientific enquiries to answer them (fair tests, comparative tests, observation over time, research, pattern seeking) • begin to select their own methods to find the answer to a scientific question • set up simple practical enquiries, comparative and fair tests • begin to design their own tests and manage variables • make systematic and careful observations and, where appropriate, take accurate measurements using standard units, using a range of equipment, including thermometers, rulers, stopwatches, measuring cylinders and jugs. • gather record, classify and present data in a variety of ways to help in answering questions	• ask relevant questions and use different types of scientific enquiries to answer them (fair tests, comparative tests, observation over time, research, pattern seeking) • select their own methods to find the answer to a scientific question • begin to combine research with their own investigations to confirm conclusions. • set up simple practical enquiries, comparative and fair tests • design their own tests & identify and manage variables. • make systematic and careful observations and, where appropriate, take accurate measurements using standard units, using a range of equipment, including thermometers, rulers, stopwatches, measuring cylinders/jugs and data loggers.	• plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary (fair tests, comparative tests, observation over time, research, pattern seeking) • select and plan the most appropriate type of scientific enquiry to use to answer scientific questions; recognise when and how to set up comparative and fair tests and explain which variables need to be controlled and why. • take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate • make their own decisions about what observations to make, repeat readings and learn about reliability • record data and results of increasing complexity	• plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary (fair tests, comparative tests, observation over time, research, pattern seeking) • select and plan the most appropriate type of scientific enquiry to use to answer scientific questions; recognise when and how to set up comparative and fair tests and explain which variables need to be controlled and why. • plan and execute appropriate investigations based on a given or student-led question • take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate • make their own decisions about what observations to make,

• begin to use simple keys for classification • record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables • report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions • explain findings from investigations to rest of class • use results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions • draw clear conclusions from findings and make predictions based on this, suggest improvements to the investigation • identify differences, similarities or changes related to simple scientific ideas and processes • use straightforward scientific evidence to answer questions or to support their findings	• begin to make decisions about what equipment is appropriate for investigations • gather, record, classify and present data in a variety of ways to help in answering questions • identify criteria for classification and use and create simple keys • record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables • report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions • explain findings from investigations to rest of class • be able to comment on the findings of other investigations compared to their own and how they support or contradict. • use results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions • draw conclusions and support with clear evidence, suggest improvements, raise further	using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs (in line with Year 5 maths curriculum learning) • use test results to make predictions to set up further comparative and fair tests • make predictions and complete further investigation • report 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, including giving an explanation of trust in results, with reasons • identify scientific evidence that has been used to support or refute ideas or arguments, including identifying which evidence they have produced supports or refutes arguments.	repeat readings & learn about reliability, developing an increased level of precision and accuracy • record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs (in line with Year 6 maths curriculum learning) • use test results to make predictions to set up further comparative and fair tests • make predictions and complete further investigation – combine with research • report 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, including giving an explanation of trust in results, with reasons • identify causal relationships in investigations • identify scientific evidence that has been used to support or refute ideas or arguments, including identifying which evidence they

	questions and possible next investigations • identify differences, similarities or changes related to simple scientific ideas and processes • use straightforward scientific evidence to answer questions or to support their findings		have produced supports or refutes ideas or arguments • begin to research evidence to support or refute ideas/arguments & begin to separate opinion from fact