Grange Primary Academy
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Part of United Learning

Science End of Year Expectations

Overview: Whole School

	EYFS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Autumn	Children know about similarities and differences in relation to places, objects, materials and living things. They talk about the features of their own immediate environment and how environments might vary from one another. They make observations of animals and plants and explain why some things occur, and talk about changes Opportunities for scientific development are provided through adult-focused activities as well as in the classroom continuous provision.	**Biology/Physics** **Seasonal Changes** Observing changes across the four seasons and describing associated weather. **Biology** **Animals Including Humans** Identifying and naming parts of the human body; recognising and understanding the different senses **Chemistry** **Everyday Materials** Distinguishing objects from the material it's made from, and describing simple properties.	**General Science** **Observational Skills** Observing features to compare objects, materials and living things and, with help, decide how to sort and group them, observe changes over time. **Chemistry** **Everyday Materials** Comparisons of an object's material with it's use; impact of bending, twisting etc on solid objects	**Physics** **Light** Relationships between light and how we see; the formation of shadows. **Chemistry** **Rocks** Comparisons of types of rocks and how fossils are formed.	**Physics** **Electricity** Simple series circuits **Physics** **Sound** Relationships between strength of vibrations and volume of sound	**Physics** **Earth & Space** Movements of planets and the moon, and relationships to day and night. **Physics** **Forces** Gravity, air and water, resistance and friction; introduction to pulleys.	**Physics** **Electricity** Investigating variations in series circuits **Physics** **Light** How light travels and is reflected, and how this allows us to see.
Spring		**Biology/Physics** **Seasonal Changes** Observing changes across the four seasons and describing associated weather.	**Biology** **Plants** Plants grow from seeds, and require water, light and a suitable temperature.	**Biology** **Plants** The key features of flowering plants and what they need to survive	**Chemistry** **States of matter** Relationships Solids, liquids and gases and the role of vibrations and volume of sound	**Chemistry** **Properties of materials** Simple Relationships between materials and their uses; difference between	**Biology** **Evolution and inheritance** Fossils; introduction to the idea that adaptation may lead to evolution.

		Biology **Animals** Identifying and naming fish , amphibians, reptiles, birds and mammals; recognising carnivores, herbivores and omnivores	**Biology** **Living things and their habitats** Basic introduction to habitats and micro-habitats, and simple food chains.		**Biology** **Living things and their habitats** Introduction to classifying animals and their environment	reversible and non reversible changes.	**Biology** **Living things and their habitats** Classification of living organisms based on characteristics.
Summer		**Biology/Physics** **Seasonal Changes** Observing changes across the four seasons and describing associated weather. **Biology** **Plants** Identifying and naming common plants and describing basic structures **Chemistry** **Everyday Materials** Distinguishing objects from the material it's made from, and describing simple properties. **General Science** **Scientific Skills** Experience and observe the natural and humanly constructed world around them, developing scientific curiosity and language.	**Biology** **Plants** Plants grow from seeds, and require water, light and a suitable temperature. **Biology** **Animals Including humans** Animals need water, food and air to survive and to have off spring.	**Physics** **Forces and magnets** Magnets have poles which attract and repel **Biology** **Animals Including Humans** Identifying The role of muscles and skeletons; the importance of nutrients.	**Biology** **Animals Including humans** Understanding of digestive system, teeth and food chains	**Biology** **Living things and their habitats** Life cycles of a mammal, amphibian, insect and bird, and some reproduction processes **Biology** **Animals Including humans** Human development to old age	**Biology** **Animals Including humans** Functions of the human body, human circulatory system; transport of nutrients within the body. How to keep the body healthy.

KS1 will receive 1.30 hours per week

KS2 will receive 2 hours per week

Science National Curriculum Expectations

A high-quality science education provides the foundations for understanding the world through the specific disciplines of biology, chemistry and physics. Science has changed our lives and is vital to the world's future prosperity, and all pupils should be taught essential aspects of the knowledge, methods, processes and uses of science. Through building up a body of key foundational knowledge and concepts, pupils should be encouraged to recognise the power of rational explanation and develop a sense of excitement and curiosity about natural phenomena. They should be encouraged to understand how science can be used to explain what is occurring, predict how things will behave, and analyse causes

EYFS	Children know about similarities and differences in relation to places, objects, materials and living things. They talk about the features of their own immediate environment and how environments might vary from one another. They make observations of animals and plants and explain why some things occur, and talk about changes.
KS1	The principal focus of science teaching in key stage 1 is to enable pupils to experience and observe phenomena, looking more closely at the natural and humanly constructed world around them. They should be encouraged to be curious and ask questions about what they notice. They should be helped to develop their understanding of scientific ideas by using different types of scientific enquiry to answer their own questions, including observing changes over a period of time, noticing patterns, grouping and classifying things, carrying out simple comparative tests, and finding things out using secondary sources of information. They should begin to use simple scientific language to talk about what they have found out and communicate their ideas to a range of audiences in a variety of ways. Most of the learning about science should be done through the use of first-hand practical experiences, but there should also be some use of appropriate secondary sources, such as books, photographs and videos. 'Working scientifically' is described separately in the programme of study, but must always be taught through and clearly related to the teaching of substantive science content in the programme of study. Throughout the notes and guidance, examples show how scientific methods and skills might be linked to specific elements of the content. Pupils should read and spell scientific vocabulary at a level consistent with their increasing word-reading and spelling knowledge at key stage 1

LKS2	The principal focus of science teaching in lower key stage 2 is to enable pupils to broaden their scientific view of the world around them. They should do this through exploring, talking about, testing and developing ideas about everyday phenomena and the relationships between living things and familiar environments, and by beginning to develop their ideas about functions, relationships and interactions. They should ask their own questions about what they observe and make some decisions about which types of scientific enquiry are likely to be the best ways of answering them, including observing changes over time, noticing patterns, grouping and classifying things, carrying out simple comparative and fair tests and finding things out using secondary sources of information. They should draw simple conclusions and use some scientific language, first, to talk about and, later, to write about what they have found out. 'Working scientifically' is described separately at the beginning of the programme of study, but must always be taught through and clearly related to substantive science content in the programme of study. Throughout the notes and guidance, examples show how scientific methods and skills might be linked to specific elements of the content. Pupils should read and spell scientific vocabulary correctly and with confidence, using their growing word-reading and spelling knowledge.
UPS2	The principal focus of science teaching in upper key stage 2 is to enable pupils to develop a deeper understanding of a wide range of scientific ideas. They should do this through exploring and talking about their ideas; asking their own questions about scientific phenomena; and analysing functions, relationships and interactions more systematically. At upper key stage 2, they should encounter more abstract ideas and begin to recognise how these ideas help them to understand and predict how the world operates. They should also begin to recognise that scientific ideas change and develop over time. They should select the most appropriate ways to answer science questions using different types of scientific enquiry, including observing changes over different periods of time, noticing patterns, grouping and classifying things, carrying out comparative and fair tests and finding things out using a wide range of secondary sources of information. Pupils should draw conclusions based on their data and observations, use evidence to justify their ideas, and use their scientific knowledge and understanding to explain their findings. 'Working and thinking scientifically' is described separately at the beginning of the programme of study, but must always be taught through and clearly related to substantive science content in the programme of study. Throughout the notes and guidance, examples show how scientific methods and skills might be linked to specific elements of the content. Pupils should read, spell and pronounce scientific vocabulary correctly.
KS3	The principal focus of science teaching in key stage 3 is to develop a deeper understanding of a range of scientific ideas in the subject disciplines of biology, chemistry and physics. Pupils should begin to see the connections between these subject areas and become aware of some of the big ideas underpinning scientific knowledge and understanding. Examples of these big ideas are the links between structure and function in living organisms, the particulate model as the key to understanding the properties and interactions of matter in all its forms, and the resources and means of transfer of energy as key determinants of all of these interactions. They should be encouraged to relate scientific explanations to phenomena in the world around them and start to use modelling and abstract ideas to develop and evaluate explanations. Pupils should understand that science is about working objectively, modifying explanations to take account of new evidence and ideas and subjecting results to peer review. Pupils should decide on the appropriate type of scientific enquiry to undertake to answer their own questions and develop a deeper understanding of factors to be taken into account when collecting, recording and processing data. They should evaluate their results and identify further questions arising from them. 'Working scientifically' is described separately at the beginning of the programme of study, but must always be taught through and clearly related to substantive science content in the programme of study. Teachers should feel free to choose examples that serve a variety of purposes, from showing how scientific ideas have developed historically to reflecting modern developments in science. Pupils should develop their use of scientific vocabulary, including the use of scientific nomenclature and units and mathematical representations

Progression of Scientific Knowledge

Year 1	Year 2	Year3	Year 4	Year 5	Year 6
Working scientifically	**Working scientifically**	**Working scientifically**	**Working Scientifically**	**Working scientifically**	**Working scientifically**
	Living things and their habitats Living and dead, describe habitats, basic food chains		**Living things and their habitats** Group living things, use classification keys. Change in environment can threaten life	**Living things and their habitats** Animal - different life cycles, reproduction in plants and animals	**Living things and their habitats** Classifications including microorganisms, plants and animals.
Plants Name basic parts—identify common plants	**Plants** Seed/bulb grow into plants. What plants need	**Plants** Function - including how water is transported Life cycle of plants			
Animals, including humans Name common animals Name carnivores, herbivores, omnivores	**Animals, including humans** Animals have offspring, basic needs for survival. Importance of exercise, food hygiene.	**Animals, including humans** Need for right amount of nutrition Skeletons and muscles	**Animals, including humans** Basic function of digestive system. Teeth. Food chains	**Animals, including humans** How humans change with age	**Animals, including humans** Human circulatory system. Exercise, drugs and lifestyle.
		Rocks Group different rocks, how they are formed Fossils			**Evolution and inheritance** Fossil Offspring different to parents. Animal adaptation—Evolution
Everyday materials Name. Describe and sort everyday materials	**Uses of every day materials** Uses of materials Changing shape of materials		**States of matter** Solids, Liquids, gases Change state, Evaporation/condensation	**Properties and changes of materials** Dissolve, separating, reversible changes. Change that produce new materials.	
		Light Need for light to see. How shadows are formed - size.	**Sound** How sound is made, travels. Pitch and volume		**Light** Travels in straight lines, How light enables us to see. How shadows are formed - shape
		Forces and magnets Compare different surfaces. Magnets		**Forces** Gravity, air/water resistance, friction. Levers, pulleys and gears	
Seasonal Changes Observe weather and changes across seasons				**Earth and Space** Movement Earth, planets & moon. Night and day	
			Electricity Simple circuits, Switches Conductors and insulators		**Electricity** brightness of lamp, volume of buzzer. symbols circuit diagrams.

Progression in Working Scientifically

	EYFS	Year 1 (KS1 Skills)	Year 2 (KS1 Skills)	Year 3 (LKS2 Skills)	Year 4 (LKS2 Skills)	Year 5 (UKS2 Skills)	Year 6 (UKS2 Skills)
Working Scientifically	To use the following practical scientific methods, processes and skills (With support and guidance)	To use the following practical scientific methods, processes and skills **(adult support may be needed)**	To use the following practical scientific methods, processes and skills with **increasing confidence**	To use the following practical scientific methods, processes and skills –	To use the following practical scientific methods, processes and skills –	To use the following practical scientific methods, processes and skills –	To use the following practical scientific methods, processes and skills –
Questioning and enquiring Planning	Show curiosity about objects, events and people. Playing & Exploring Questions why things happen Speaking: 30-50 months Engage in open-ended activities. Playing & Exploring Take a risk, engage in new experiences and learn by trial and error. Playing & Exploring	Ask **simple** questions about the world around us. **Begin** to recognise that their scientific questions can be answered in different ways (different types of enquiry including - observing changes over time, noticing patterns, grouping and classifying, carrying out simple comparative tests, finding things out from secondary sources).	Ask questions about the world around us. Recognise that their scientific questions can be answered in different ways (different types of enquiry including - observing changes over time, noticing patterns, grouping and classifying, carrying out simple comparative tests, finding things out from secondary sources).	Ask ***some*** relevant questions and use different types of scientific enquiries to answer them. ***Begin*** to explore everyday phenomena and the relationships between living things and familiar environments. ***Begin*** to develop their ideas about functions, relationships and interactions. ***Begin*** to raise their own questions about the world around them. ***Begin*** to make some decisions about which types of enquiry will be the best way of answering questions including observing changes over time, noticing patterns, grouping and classifying, carrying out simple comparative and fair tests, finding things out using secondary sources.	Ask relevant questions and use different types of scientific enquiries to answer them. Explore everyday phenomena and the relationships between living things and familiar environments. ***Begin*** to develop their ideas about functions, relationships and interactions. Raise their own questions about the world around them. Make ***some*** decisions about which types of enquiry will be the best way of answering questions including observing changes over time, noticing patterns, grouping and classifying, carrying out simple comparative and fair tests, finding things out using secondary sources.	***Begin*** to plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary. ***Begin*** to explore and talk about ideas, ask their own questions about scientific phenomena, analyse functions, relationships and interactions more systematically. ***Begin*** to recognise some more abstract ideas and begin to recognise how these ideas help them to understand how the world operates. ***Begin*** to recognise scientific ideas change and develop over time. Begin to select the most appropriate ways to answer science questions using different types of scientific enquiry (including observing changes over different periods of time, noticing patterns, grouping and classifying, carrying out comparative and fair tests and finding things out using a wide range of secondary sources of information.)	Plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary. Explore and talk about ideas, ask their own questions about scientific phenomena, analyse functions, relationships and interactions more systematically. ***Begin*** to recognise more abstract ideas and begin to recognise how these ideas help them to understand how the world operates. **Begin** to recognise scientific ideas change and develop over time. Select the most appropriate ways to answer science questions using different types of scientific enquiry (including observing changes over different periods of time, noticing patterns, grouping and classifying, carrying out comparative and fair tests and finding things out using a wide range of secondary sources of information.)

Observing and measuring Pattern seeking	Develop ideas of grouping, sequences, cause and effect Creating &Thinking Critically Know about similarities and differences in relation to places, objects, materials and living things ELG: The World Closely observes what animals, people and vehicles do The World 8-20 months Use senses to explore the world around them Playing & Exploring Make links and notice patterns in their experience Creating & Thinking Critically Choose the resources they need for their chosen activities ELG: Self Confidence & Self Awareness Handle equipment and tools effectively ELG: Moving & Handling Make observations of animals and plants and explain why some things occur, and talk about changes ELG: The World	**Begin** to observe, using simple equipment. **With help**, observe changes over time, **Begin** to use simple measurements and equipment (e.g. hand lenses, egg timers) to gather data.	Observe closely, using simple equipment. Use observations and ideas to suggest answers to questions. To observe changes over time and, with guidance and **begin** to notice patterns and relationships. To say what I am looking for and what I am measuring. To know how to use simple equipment safely. Use ***simple*** measurements and equipment with increasing independence (e.g. hand lenses and egg timers) ***Begin*** to progress from non-standard units, reading mm, cm, m, ml, l, °C	***Begin*** to make systematic and careful observations and, where appropriate, take accurate measurements using standard units, using a range of equipment, including thermometers and data loggers. ***Begin*** to look for naturally occurring patterns and relationships and decide what data to collect to identify them. Help to make decisions about what observations to make, how long to make them for and the type of simple equipment that might be used. Learn to use some new equipment appropriately (eg data loggers). ***Begin*** to see a pattern in my results. ***Begin*** to choose from a selection of equipment. ***Begin*** to observe and measure accurately using standard units including time in minutes and seconds.	Make systematic and careful observations and, where appropriate, take accurate measurements using standard units, using a range of equipment, including thermometers and data loggers. ***Begin*** to look for naturally occurring patterns and relationships and decide what data to collect to identify them. Help to make decisions about what observations to make, how long to make them for and the type of simple equipment that might be used. Learn to use new equipment appropriately (e.g. data loggers). Can see a pattern in my results. Can choose from a selection of equipment. Can observe and measure accurately using standard units including time in minutes and seconds.	***Begin*** to take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings where appropriate. ***Begin*** to identify patterns that might be found in the natural environment. ***Begin*** to make their own decisions about what observations to make, what measurements to use and how long to make them for and whether to repeat them. ***Choose*** the most appropriate equipment and explain how to use it accurately. ***Begin*** to interpret data and find patterns. Select equipment on my own. Can make a set of observations and say what the interval and range are. ***Begin*** to take accurate and precise measurements – N, g, kg, mm, cm, mins, seconds, cm²V, km/h, m per sec, m/ sec Graphs – pie, line	Take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings where appropriate. Identify patterns that might be found in the natural environment. Make their own decisions about what observations to make, what measurements to use and how long to make them for and whether to repeat them. Choose the most appropriate equipment and explain how to use it accurately. Can interpret data and find patterns. Select equipment on my own. Can make a set of observations and say what the interval and range are. Accurate and precise measurements – N, g, kg, mm, cm, mins, seconds, cm²V, km/h, m per sec, m/ sec Graphs – pie, line, bar

Investigating	Find ways to solve problems / find new ways to do things / test their ideas Creating & Thinking Critically	Perform simple tests **with support**. To **begin** to discuss my ideas about how to find things out. To **begin** to say what happened in my investigation.	Perform simple tests. To discuss my ideas about how to find things out. To say what happened in my investigation.	Set up some simple practical enquiries, comparative and fair tests. ***Begin*** to recognise when a simple fair test is necessary and help to decide how to set it up. ***Begin*** to think of more than one variable factor. I can set up some simple practical enquiries. Including comparative and fair tests.	Set up simple practical enquiries, comparative and fair tests. ***Recognise*** when a simple fair test is necessary and help to decide how to set it up. Can think of more than one variable factor.	***Begin*** to use test results to make predictions to set up further comparative and fair tests. ***Begin*** to recognise when and how to set up comparative and fair tests and explain which variables need to be controlled and why. ***Begin*** to suggest improvements to my method and give reasons. ***Begin*** to decide when it is appropriate to do a fair test.	Use test results to make predictions to set up further comparative and fair tests. Recognise when and how to set up comparative and fair tests and explain which variables need to be controlled and why. Suggest improvements to my method and give reasons. Decide when it is appropriate to do a fair test.
Recording and reporting findings	Create simple representations of events, people and objects Being Imaginative: 40-60+ months	**Begin** to record simple data. Gather and record data **with some adult support**, to help in answering questions. **Begin** to record and communicate their findings in a range of ways. Can show my results in a ***simple*** **table that my teacher has provided.**	Gather and record data to help in answering questions. Record **simple** data. Record and communicate their findings in a range of ways. Can show my results in a table that **my teacher has provided**	Gather, record, and begin to classify and present data in a variety of ways to help in answering questions. ***Begin*** to record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts and tables. ***Begin*** to report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions. ***Begin*** to use notes, simple tables and standard units and help to decide how to record and analyse their data. ***Begin*** to record results in tables and bar charts.	Gather, record, classify and present data in a variety of ways to help in answering questions. 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. Use notes, simple tables and standard units and help to decide how to record and analyse their data. Can record results in tables and bar charts.	***Begin*** to record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables and bar and line graphs. ***Begin*** to report and present findings from enquiries. ***Begin*** to decide how to record data from a choice of familiar approaches ***Begin*** to choose how best to present data.	Record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables and bar and line graphs. Report and present findings from enquiries. Decide how to record data from a choice of familiar approaches. Can choose how best to present data.
Identifying, grouping and classifying		Identify and classify **with some support.** To **begin** to observe and identify, compare and describe.	Identify and classify. Observe and identify, compare and describe.	***Begin*** to identify differences, similarities or changes related to simple scientific ideas and processes.	Identify differences, similarities or changes related to simple scientific ideas and processes.	***Begin*** to use and develop keys and other information records to identify, classify and describe living things and materials.	Use and develop keys and other information records to identify, classify and describe living things and materials.

		To **begin** to use simple features to compare objects, materials and living things and, with help, decide how to sort and group them.	Use simple features to compare objects, materials and living things and, with help, decide how to sort and group them.	***Begin*** to talk about criteria for grouping, sorting and classifying and use simple keys. ***Begin*** to compare and group according to behaviour or properties, based on testing.	Talk about criteria for grouping, sorting and classifying and use simple keys. Compare and group according to behaviour or properties, based on testing.		
Research	Comments and asks questions about aspects of their familiar world such as the place where they live or the natural world The World: 30-50 months Answer how and why questions about their experiences ELG: Understanding	To **begin** to use simple secondary sources to find answers. To begin to find information to help me from books and computers with help. **Begin** to ask people questions to find answers.	Use simple secondary sources to find answers. Can find information to help me from books and computers with help. Ask people questions to find answers.	***Begin*** to recognise when and how secondary sources might help to answer questions that cannot be answered through practical investigations.	***Begin*** to recognise when and how secondary sources might help to answer questions that cannot be answered through practical investigations.	***Begin*** to recognise which secondary sources will be most useful to research their ideas.	Recognise which secondary sources will be most useful to research their ideas.
Conclusions	Develop their own narratives and explanations by connecting ideas or events ELG: Speaking	**Begin** to talk about what they have found out and how they found it out. To **begin** to say what happened in my investigation. To **begin** to say whether I was surprised at the results or not. To **begin** to say what I would change about my investigation.	Talk about what they have found out and how they found it out. To say what happened in my investigation. To say whether I was surprised at the results or not. To say what I would change about my investigation.	I am ***beginning*** to use results to draw simple conclusions , make predictions for new values, suggest improvements and raise further questions. ***Beginning*** to use straightforward scientific evidence to answer questions or to support their findings. ***With help***, am beginning to look for changes, patterns, similarities and differences in their data in order to draw simple conclusions and answer questions. ***With support***, am beginning to identify new questions arising from the data, make new predictions and find ways of improving what they have already done. ***Beginning*** to see a pattern in my results.	Using results to draw simple conclusions ,make predictions for new values, suggest improvements and raise further questions. Use straightforward scientific evidence to answer questions or to support their findings. ***With help***, look for changes, patterns, similarities and differences in their data in order to draw simple conclusions and answer questions. ***With support,*** identify new questions arising from the data, make new predictions and find ways of improving what they have already done. Can see a pattern in my results.	B***eginning*** to report and present 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. ***Begin*** to identify scientific evidence that has been used to support or refute ideas or arguments. ***Begin*** to draw conclusions based on their data and observations, use evidence to justify their ideas, use scientific knowledge and understanding to explain their findings. ***Begin*** to use test results to make predictions to set up further comparatives 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. Identify scientific evidence that has been used to support or refute ideas or arguments. Draw conclusions based on their data and observations, use evidence to justify their ideas, use scientific knowledge and understanding to explain their findings. Use test results to make predictions to set up further comparatives and fair tests. Look for different causal relationships in their data and identify

				Beginning to say what I found out, linking cause and effect. ***Beginning*** to say how I could make it better. ***Beginning*** to answer questions from what I have found out	Can say what I found out, linking cause and effect. Can say how I could make it better. Can answer questions from what I have found out.	***Begin*** to look for different causal relationships in their data and identify evidence that refutes or supports their ideas. Use their results to identify when further tests and observations are needed. ***Begin*** to separate opinion from fact. ***Begin*** to draw conclusions and identify scientific evidence. Can use simple models. Know which evidence proves a scientific point. ***Begin*** to use test results to make predictions to set up further comparative and fair tests.	evidence that refutes or supports their ideas. Use their results to identify when further tests and observations are needed. Separate opinion from fact. Can draw conclusions and identify scientific evidence. Can use simple models. Know which evidence proves a scientific point. Use test results to make predictions to set up further comparative and fair tests.
Vocabulary	Builds up vocabulary that reflects the breadth of their experience Understanding: 30-50 months	**With help**, use some simple scientific language **Begin** to use some science words. Use comparative language **with support.**	Use simple scientific language and ***some*** science words. Use comparative language – bigger, faster etc	***Begin*** to use some scientific language to talk and, later, write about what they have found out. ***Begin*** to use relevant scientific language. ***Begin*** to use comparative and superlative language.	Use some scientific language to talk and, later, write about what they have found out. Use relevant scientific language. Use comparative and superlative language	***Beginning*** to read, spell and pronounce scientific vocabulary correctly. A ***Beginning*** to use relevant scientific language and illustrations to discuss, communicate and justify scientific ideas. ***Beginning*** to confidently use a range of scientific vocabulary. ***Beginning*** to use conventions such as trend, rogue result, support prediction and -er word generalisation. ***Beginning*** to use scientific ideas when describing simple processes.	Read, spell and pronounce scientific vocabulary correctly. Use relevant scientific language. And illustrations to discuss, communicate and justify scientific ideas. Can confidently use a range of scientific vocabulary. Can use scientific ideas when describing simple processes. Can use the correct science vocabulary

						Beginning to use the correct science vocabulary	
Understanding		Can **begin** to talk about how science helps us in our daily lives e.g. torches and lights help us see when it is dark. **Beginning** to understand science can sometimes be dangerous.	Can talk about how science helps us in our daily lives e.g. torches and lights help us see when it is dark. **Beginning** to understand science can sometimes be dangerous	***Begin*** to know which things in science have made our lives better. Can ***begin*** to understand risk in science.	Knows which things in science have made our lives better. Can understand there is some risk in science.	***Beginning*** to talk about how scientific ideas have changed over time. ***Beginning*** to explain the positive and negative effects of scientific development. ***Beginning*** to see how science is useful in everyday life. ***Beginning*** to say which parts of our lives rely on science.	Can talk about how scientific ideas have changed over time. Can explain the positive and negative effects of scientific development. Can see how science is useful in everyday life. Can say which parts of our lives rely on science.

Overview: EYFS

	National Curriculum Expectations
Autumn	Recognising similarities and differences and asking why this is? Make simple observations and predictions Gathering information and recording findings in a variety of ways They make observations of animals and plants and explain why some things occur, and talk about changes Talk about environmental features, animals and plants and be able to answer questions.
Spring	Recognising similarities and differences and asking why this is? Make simple observations and predictions Gathering information and recording findings in a variety of ways They make observations of animals and plants and explain why some things occur, and talk about changes Talk about environmental features, animals and plants and be able to answer questions.
Summer	Recognising similarities and differences and asking why this is? Make simple observations and predictions Gathering information and recording findings in a variety of ways They make observations of animals and plants and explain why some things occur, and talk about changes Talk about environmental features, animals and plants and be able to answer questions.

Overview: Year 1

	Subject Progression		Working Scientifically	
Autumn	**Biology** *Plants*	• Identify and name a variety of common wild and garden plants, including deciduous and evergreen trees, e.g. five examples of each from the school's locality. • Identify and describe the basic structure of a variety of common flowering plants, including trees, and name parts, e.g. leaves, flowers, roots, stem/trunk.	Scientific Attitudes & Planning	**Scientific Attitudes & Planning** • Asking simple questions and recognizing that they can be answered indifferent ways
	Biology /Physics *Seasonal changes*	• Observe and describe changes across four seasons. • Observe and describe the weather and how it varies. • Observe and describe how the length of the day changes at different times of the year.	Measuring &Observing	**Measuring & Observing** • Observing closely using simple equipment • Performing simple tests
Spring	**Chemistry** *Everyday materials*	• Identify a variety of common materials and objects made from them. • Identify and name a variety of everyday materials (e.g. wood, metal, glass, paper, water, rock). • Use simple language to describe the physical properties of materials (e.g. hard, soft, rough, smooth, shiny, dull). • Use the physical properties of materials to compare and group them.	Recording &Presenting	**Recording & Presenting** • Gathering and recording data to help in answering questions • Identifying and classifying
Summer	**Biology** *Animals*	• Identify and name a variety of common animals that they have seen. • Compare first-hand the similarities and differences of different animals. • Group familiar animals according to what they eat. • Describe and compare features of a variety of common animals (fin, wing, claw, scales, feather etc.) • Name and locate simple parts of the human body, including those related to the senses.	Analysing & Evaluating	**Analysing & Evaluating** • Use their observations and ideas to suggest answers to questions

Overview: Year 2

	Subject Progression		Working Scientifically	
Autumn	**Biology** *Plants*	• Observe and describe how seeds and bulbs grow into mature plants. • Recognise that water, light and a suitable temperature are needed for survival and growth.	Scientific Attitudes & Planning	**Scientific Attitudes & Planning** • Asking simple questions and recognizing that they can be answered indifferent ways
	Biology *Needs of animals*	• Describe the main changes that occur as young animals, including humans, grow into adults. • Describe the basic needs of animals, including humans, for survival. • Describe the importance of exercise, a balanced diet and hygiene for humans.	Measuring & Observing	**Measuring & Observing** • Observing closely using simple equipment • Performing simple tests
Spring	**Biology** *Living things and their habitats*	• Identify, with reasons, things that are alive, dead, or never been alive. • Describe the survival needs of animals including humans, and recognise that animals and plants usually live in habitats that are suited to them. • Describe how plants and animals depend on each other (food chains). • Identify and name a variety of plants and animals that they have seen or experienced in their habitats, including microhabitats (e.g. under log). • Describe how animals get their food from other animals or plants • Use simple food chains to describe feeding relationships.	Recording & Presenting	**Recording & Presenting** • Gathering and recording data to help in answering questions • Identifying and classifying
Summer	**Chemistry** *Uses of everyday materials*	• Identify and compare the properties of everyday materials, to assess their suitability for particular purposes. • Investigate how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching.	Analysing & Evaluating	**Analysing & Evaluating** • Use their observations and ideas to suggest answers to questions

Overview: Year 3

	Subject Progression		Working Scientifically	
Autumn	**Chemistry** *Rocks*	• Compare and group rocks in different ways according to their properties. • Describe how fossils are formed. • Explain, in simple terms, that soils are made when rocks are weathered and break down into small particles that combine with organic matter to make soil.	Measuring & Observing Recording & Presenting	**Activity**: Observing, comparing and identifying different types of rock. **Measuring & Observing** • Make qualitative, systematic observations about rocks. **Recording & Presenting** • Use a classification key to identify rocks based on their hardness, permeability and appearance.
	Physics *Light*	• Explain that we need light in order to see, and that darkness is its absence. • Explain that we see objects because light is reflected from their surface. • Explain that shadows are formed when light from a source is blocked by an opaque object and that the position and shape of a shadow can vary.	Measuring &Observing Analysing & Evaluating	**Activity**: Exploring the impact of distance and light intensity on shadows. **Measuring & Observing** • Make accurate measurements using a ruler. **Analysing & Evaluating** • Identify patterns and draw simple conclusions.
Spring	**Biology** *Living organisms*	• Describe the nutritional needs of animals, including humans, showing knowledge of simple food groups (e.g. dairy, vegetables) in a healthy diet. • Name, locate and describe functions of main parts of the musculo skeletal system (e.g. skull, spine, ribs) in humans and in other animals. • Identify which parts protect, support or are involved in movement.	Analysing & Evaluating	**Activity**: Grouping and comparing features of animals with/without a skeleton. **Analysing & Evaluating** • Identify patterns, similarities and differences and use these to draw conclusions. • Reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions.

	Biology *Plants*	• Name, locate main and describe functions of the main features of plants, and how water is transported within plants. • Describe basic requirements of plants for life and growth (e.g. light, water) • Give relevant examples of different plants with contrasting requirements. • Name simple parts of a flower and describe their function. • Describe the role flowers play in the life cycle of the plant.	Scientific Attitudes & Planning Analysing & Evaluating	**Activity**: Exploring the impact that different conditions has on plant growth. **Scientific Attitudes & Planning** • Ask relevant questions and set up an experiment with controlled variables. **Analysing & Evaluating** • Draw conclusions and use these to make predictions about future experiments.
Summer	**Physics** *Forces &magnets*	• Describe and compare how things move on different surfaces, and how forces like friction affect this. • Describe how magnetic forces can act at a distance and in different ways. • Identify that some materials are magnetic while others are not. • Understand that not all metals are magnetic.	Measuring &Observing Analysing & Evaluating	**Activity**: Investigating whether materials are magnetic or not. **Measuring & Observing** • Make systematic observations. **Analysing & Evaluating** • Identify patterns, draw simple conclusions and use these to make predictions about the magnetism of other materials.

Overview: Year 4

	Subject Progression		Working Scientifically	
Autumn	**Biology** *Living things and their environment*	• Group, classify and identify animals and plants found locally and during field study trips, into broad groups practically, using keys or in other ways. • Explain how environmental changes may have an impact on living things, e.g. the effects of pollution, littering or building work.	Measuring &Observing Analysing & Evaluating	**Activity**: Investigating the relationship between the circumference of a tree and size of its leaves **Measuring & Observing** • Measure circumference of tree and length of leaves. **Analysing & Evaluating** • Identify patterns and whether there is a correlation. • Produce an oral or written report of the investigation.
	Biology *Food and digestion*	• Construct and interpret food chains, labelling producer, predator, prey. • Name, locate and describe the functions of the main parts of the digestive system, i.e. mouth, tongue, teeth, oesophagus, stomach, small intestine, large intestine, in humans. • Identify different types of teeth in humans, e.g. molar, canine and incisor, and describe their functions.	Attitudes & Planning Recording &Presenting Analysing & Evaluating	**Activity**: Investigating the how animals' teeth differ based on their diet. **Scientific Attitudes & Planning** • Ask scientifically relevant questions and identify a range of test animals. **Recording & Presenting** • Record and present information in an accurate, labelled diagram. **Analysing & Evaluating** • Draw conclusions about an animal's teeth and its diet.
Spring	**Chemistry** *States of matter*	• Group solids/liquids/gases based on their properties. • Describe how a variety of materials change state when they are heated or cooled. • Describe the water cycle and the part played by evaporation and condensation within that process.	Measuring &Observing Recording &Presenting	**Activity**: Investigating the melting point of chocolate, butter, cheese, soap etc. **Measuring & Observing**

			Analysing & Evaluating	• Make accurate measurements of temperature using a thermometer. **Recording & Presenting** • Design and use a table to record results; present these in a bar chart. **Analysing & Evaluating** • Produce an oral or written report or presentation of the investigation.
	Physics *Sounds*	• Use the idea that sounds are associated with vibrations, and that they require a medium, i.e. a solid, liquid or gas, to travel through, to explain how sounds are made and heard. • Describe the relationship between the pitch of a sound and the features of the object that produced it, and between the volume of a sound, the strength of the vibrations and the distance from a sound source.	Recording &Presenting Analysing & Evaluating	**Activity**: Investigating the pitch and volume of sounds using rulers and drums. **Recording & Presenting** • Design and use a table to record results. **Analysing & Evaluating** • Identify patterns, similarities and differences and make predictions about future results. • Evaluate the investigation and suggest improvements.
Summer	**Physics** *Electricity*	• Name a variety of appliances that run on mains and/or battery power. • Use simple apparatus to construct and control the flow of electricity in aseries circuit. • Describe how the circuit may be affected when changes are made to it. • Name common conductors (such as metals and water) and insulators (such as wood, plastic), and, given information about how an unknown material behaves in a circuit, classify it as a conductor or insulator.	Attitudes & Planning Analysing & Evaluating	**Activity**: Investigating conductors and insulators in a series circuit. **Scientific Attitudes & Planning** • Ask scientifically relevant questions and identify controlled variables. **Analysing & Evaluating** • Identify patterns and use these to draw conclusions and make predictions. • Suggest next steps to answer further scientific questions.

Overview: Year 5

	Subject Progression		Working Scientifically	
Autumn	**Chemistry** *Properties of materials*	• Observe properties of everyday materials and group in different ways. • Explain what happens when dissolving occurs in everyday situations. • Describe processes to separate mixtures and solutions (solid dissolved in liquid) into their component materials. • Give reasons for the use of everyday materials for different purposes, based on their properties. • Identify, with reasons, whether changes in materials are reversible or not.	Attitudes & Planning Analysing & Evaluating	**Activity**: Investigating techniques to separate mixtures (magnet, filter etc.). **Attitudes & Planning** • Set up scientific enquiries with controlled variables. **Analysing & Evaluating** • Reporting the enquiry, identifying further scientific evidence to support their findings. • Use test results to make predictions about further investigations.
Spring	**Biology** *Life cycle*	• Describe and compare different life cycles in some specific types of animals and plants, e.g. bat or hedgehog, newt, bumblebee, peregrine falcon. • Describe and compare different reproductive processes in some animals and plants, including asexual (e.g. taking cuttings) and sexual reproduction in plants and sexual reproduction in humans and other animals.	Attitudes & Planning Analysing & Evaluating	**Activity**: Researching and presenting life cycles of different organisms. **Attitudes & Planning** • Ask relevant questions and set up scientific enquiry with variables. **Analysing & Evaluating** • Identifying patterns and reporting the enquiry in an oral or written presentation.
	Biology *Human development*	• Describe the main changes as humans grow into adults and develop to old age, i.e. baby, child, adolescent, adult, old person.	Recording &Presenting Analysing & Evaluating	**Activity**: Investigating the relationship between size and gestation periods. **Recording & Presenting** • Record data and present results with a scatter graph. **Analysing & Evaluating**

				• Draw conclusions and explain causal relationships. • Identify further scientific evidence to support findings and make predictions.
Summer	**Physics** *Forces*	• Describe the effects of simple forces that involve contact (air and water resistance, friction), and gravity. • Identify simple mechanisms, including levers, gears and pulleys that allow a smaller force to have greater effect.	Measuring &Observing Recording &Presenting Analysing & Evaluating	**Activity**: Investigating air resistance and water resistance using parachutes. **Measuring & Observing** • Measure accurately using a ruler and stopwatch; take repeat readings. **Recording & Presenting** • Set up a table to record results, and present these using a bar chart. **Analysing & Evaluating** • Draw conclusions and explain relationships; evaluate investigation.
	Physics *Earth and space*	• Describe the shapes and relative movements of the Sun, Moon, Earth and other planets in the solar system. • Explain the apparent movement of the sun across the sky in terms of the earth's rotation and that this results in day and night.	Measuring &Observing Recording &Presenting	**Activity**: Investigating the monthly temperature and daylight hours in UK and country in the southern hemisphere (e.g. Australia). **Measuring & Observing** • Researching using the internet.. **Recording & Presenting** • Presenting findings using a bar chart and line graph.

Overview: Year 6

	Subject Progression		Working Scientifically	
Autumn	**Biology** *Evolution &inheritance*	• Describe how fossils provide evidence for evolution. • Use the basic ideas of inheritance, variation and adaptation to describe how living things have changed over time and evolved.	Attitudes & Planning Analysing & Evaluating	**Activity**: Investigating adaptations of various organisms. **Attitudes & Planning** • Ask relevant questions and define the parameters for scientific enquiry. **Analysing & Evaluating** • Explain causal relationships in a written or oral report; make predictions.
	Physics *Electricity*	• Use apparatus to construct and control a circuit, and describe how the circuit may be affected when changes are made to it. • Use recognised symbols to represent simple series circuit diagrams.	Measuring & Observing Recording & Presenting	**Activity**: Investigating the effect of wire length on the brightness of bulbs. **Measuring & Observing** • Ask relevant questions and define the parameters for scientific enquiry. **Analysing & Evaluating** • Explain causal relationships in a written or oral presentation.
Spring	**Physics** *Light*	• Use the idea that light from light sources, or reflected light, travels in straight lines and enters our eyes, to explain how we see objects. • Use the idea that light travels in straight lines to explain the formation, shape and size of shadows.	Recording & Presenting Analysing & Evaluating	**Activity**: Designing and making a periscope. **Recording & Presenting** • Create accurate, scientific diagrams to illustrate findings. **Analysing & Evaluating** • Report findings and identify wider applications for the scientific principle.

	Biology *Classifying living things*	• Explain how observable features, similarities and differences between types of plants, animals and micro-organisms are used to group and classify them, and give reasons why this is useful.	Attitudes & Planning Analysing &Evaluating	**Activity**: Designing and using own classification keys. **Scientific attitudes and planning** • Identify variables and design appropriate questions for classification key. **Analysing & Evaluating** • Evaluate the reliability of their classification key, and recognise limitations.
Summer	**Biology** *Functions of the human body*	• Name, locate and describe the functions of the main parts of the circulatory system, i.e. heart, blood vessels and blood. • Describe the effects of diet, exercise, drugs and lifestyle on how the human body functions.	Measuring &Observing Recording &Presenting	**Activity**: Investigating the effects of exercise on heart rate. **Measuring & Observing** • Making accurate measurements and repeat readings when required. **Recording & Presenting** • Presenting results using a scatter graph, and making conclusions from this.
	Chemistry *Chemical reactions*	• Identify, with reasons, whether changes in materials are reversible or not. • Recognise when a chemical reaction has taken place (e.g. colour change ;production of an odour; change in temperature; release of gas or formation of a solid).	Planning Measuring &Observing	**Activity**: Identifying when a chemical reaction has taken place. **Attitudes & Planning** • Set up a scientific enquiry with dependent and independent variables. **Measuring & Observing** • Make systematic observations and measurements using thermometer.

Understanding What Our Children Will Learn In Key Stage 3

The principal focus of science teaching in key stage 3 is to develop a deeper understanding of a range of scientific ideas in the subject disciplines of biology, chemistry and physics. Pupils should begin to see the connections between these subject areas and become aware of some of the big ideas underpinning scientific knowledge and understanding. Examples of these big ideas are the links between structure and function in living organisms, the particulate model as the key to understanding the properties and interactions of matter in all its forms, and the resources and means of transfer of energy as key determinants of all of these interactions. They should be encouraged to relate scientific explanations to phenomena in the world around them and start to use modelling and abstract ideas to develop and evaluate explanations.

Pupils should understand that science is about working objectively, modifying explanations to take account of new evidence and ideas and subjecting results to peer review. Pupils should decide on the appropriate type of scientific enquiry to undertake to answer their own questions and develop a deeper understanding of factors to be taken into account when collecting, recording and processing data. They should evaluate their results and identify further questions arising from them.

'Working scientifically' is described separately at the beginning of the programme of study, but must always be taught through and clearly related to substantive science content in the programme of study. Teachers should feel free to choose examples that serve a variety of purposes, from showing how scientific ideas have developed historically to reflecting modern developments in science.

Pupils should develop their use of scientific vocabulary, including the use of scientific nomenclature and units and mathematical representations.

Working scientifically

Through the content across all three disciplines, pupils should be taught to:

Scientific attitudes

- pay attention to objectivity and concern for accuracy, precision, repeatability and reproducibility
- understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review
- evaluate risks

Experimental skills and investigations

- ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience
- make predictions using scientific knowledge and understanding
- select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables
- use appropriate techniques, apparatus, and materials during fieldwork and laboratory work, paying attention to health and safety
- make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements
- apply sampling techniques

Analysis and evaluation

- apply mathematical concepts and calculate results
- present observations and data using appropriate methods, including tables and graphs
- interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions
- present reasoned explanations, including explaining data in relation to predictions and hypotheses

- evaluate data, showing awareness of potential sources of random and systematic error
- identify further questions arising from their results

Measurement

- understand and use SI units and IUPAC (International Union of Pure and Applied Chemistry) chemical nomenclature
- use and derive simple equations and carry out appropriate calculations
- undertake basic data analysis including simple statistical techniques

Subject content

Biology

Pupils should be taught about:

Structure and function of living organisms

Cells and organisation

- cells as the fundamental unit of living organisms, including how to observe, interpret and record cell structure using a light microscope
- the functions of the cell wall, cell membrane, cytoplasm, nucleus, vacuole, mitochondria and chloroplasts
- the similarities and differences between plant and animal cells
- the role of diffusion in the movement of materials in and between cells
- the structural adaptations of some unicellular organisms
- the hierarchical organisation of multicellular organisms: from cells to tissues to organs to systems to organisms

The skeletal and muscular systems

- the structure and functions of the human skeleton, to include support, protection, movement and making blood cells
- biomechanics – the interaction between skeleton and muscles, including the measurement of force exerted by different muscles
- the function of muscles and examples of antagonistic muscles

Nutrition and digestion

- the content of a healthy human diet: carbohydrates, lipids (fats and oils), proteins, vitamins, minerals, dietary fibre and water, and why each is needed
- calculations of energy requirements in a healthy daily diet
- the consequences of imbalances in the diet, including obesity, starvation and deficiency diseases
- the tissues and organs of the human digestive system, including adaptations to function and how the digestive system digests food (enzymes simply as biological catalysts)

- the importance of bacteria in the human digestive system
- plants making carbohydrates in their leaves by photosynthesis and gaining mineral nutrients and water from the soil via their roots

Gas exchange systems

- the structure and functions of the gas exchange system in humans, including adaptations to function
- the mechanism of breathing to move air in and out of the lungs, using a pressure model to explain the movement of gases, including simple measurements of lung volume
- the impact of exercise, asthma and smoking on the human gas exchange system
- the role of leaf stomata in gas exchange in plants

Reproduction

- reproduction in humans (as an example of a mammal), including the structure and function of the male and female reproductive systems, menstrual cycle (without details of hormones), gametes, fertilisation, gestation and birth, to include the effect of maternal lifestyle on the foetus through the placenta
- reproduction in plants, including flower structure, wind and insect pollination, fertilisation, seed and fruit formation and dispersal, including quantitative investigation of some dispersal mechanisms

Health

- the effects of recreational drugs (including substance misuse) on behaviour, health and life processes

Material cycles and energy

Photosynthesis

- the reactants in, and products of, photosynthesis, and a word summary for photosynthesis
- the dependence of almost all life on Earth on the ability of photosynthetic organisms, such as plants and algae, to use sunlight in photosynthesis to build organic molecules that are an essential energy store and to maintain levels of oxygen and carbon dioxide in the atmosphere
- the adaptations of leaves for photosynthesis

Cellular respiration

- aerobic and anaerobic respiration in living organisms, including the breakdown of organic molecules to enable all the other chemical processes necessary for life
- a word summary for aerobic respiration
- the process of anaerobic respiration in humans and micro-organisms, including fermentation, and a word summary for anaerobic respiration
- the differences between aerobic and anaerobic respiration in terms of the reactants, the products formed and the implications for the organism

Interactions and interdependencies

Relationships in an ecosystem

- the interdependence of organisms in an ecosystem, including food webs and insect pollinated crops
- the importance of plant reproduction through insect pollination in human food security
- how organisms affect, and are affected by, their environment, including the accumulation of toxic materials

Genetics and evolution

Inheritance, chromosomes, DNA and genes

- heredity as the process by which genetic information is transmitted from one generation to the next
- a simple model of chromosomes, genes and DNA in heredity, including the part played by Watson, Crick, Wilkins and Franklin in the development of the DNA model
- differences between species
- the variation between individuals within a species being continuous or discontinuous, to include measurement and graphical representation of variation
- the variation between species and between individuals of the same species meaning some organisms compete more successfully, which can drive natural selection
- changes in the environment which may leave individuals within a species, and some entire species, less well adapted to compete successfully and reproduce, which in turn may lead to extinction
- the importance of maintaining biodiversity and the use of gene banks to preserve hereditary material

Chemistry

Pupils should be taught about:

The particulate nature of matter

- the properties of the different states of matter (solid, liquid and gas) in terms of the particle model, including gas pressure
- changes of state in terms of the particle model

Atoms, elements and compounds

- a simple (Dalton) atomic model
- differences between atoms, elements and compounds
- chemical symbols and formulae for elements and compounds
- conservation of mass changes of state and chemical reactions

Pure and impure substances

- the concept of a pure substance
- mixtures, including dissolving
- diffusion in terms of the particle model
- simple techniques for separating mixtures: filtration, evaporation, distillation and chromatography
- the identification of pure substances

Chemical reactions

- chemical reactions as the rearrangement of atoms
- representing chemical reactions using formulae and using equations
- combustion, thermal decomposition, oxidation and displacement reactions

- defining acids and alkalis in terms of neutralisation reactions
- the pH scale for measuring acidity/alkalinity; and indicators
- reactions of acids with metals to produce a salt plus hydrogen
- reactions of acids with alkalis to produce a salt plus water
- what catalysts do

Energetics

- energy changes on changes of state (qualitative)
- exothermic and endothermic chemical reactions (qualitative)

The periodic table

- the varying physical and chemical properties of different elements
- the principles underpinning the Mendeleev periodic table
- the periodic table: periods and groups; metals and non-metals
- how patterns in reactions can be predicted with reference to the periodic table
- the properties of metals and non-metals
- the chemical properties of metal and non-metal oxides with respect to acidity

Materials

- the order of metals and carbon in the reactivity series
- the use of carbon in obtaining metals from metal oxides
- properties of ceramics, polymers and composites (qualitative)

Earth and atmosphere

- the composition of the Earth
- the structure of the Earth
- the rock cycle and the formation of igneous, sedimentary and metamorphic rocks
- Earth as a source of limited resources and the efficacy of recycling
- the composition of the atmosphere
- the production of carbon dioxide by human activity and the impact on climate

Physics

Pupils should be taught about:

Energy

Calculation of fuel uses and costs in the domestic context

- comparing energy values of different foods (from labels) (kJ)
- comparing power ratings of appliances in watts (W, kW)
- comparing amounts of energy transferred (J, kJ, kW hour)
- domestic fuel bills, fuel use and costs
- fuels and energy resources

Energy changes and transfers

- simple machines give bigger force but at the expense of smaller movement (and vice versa): product of force and displacement unchanged
- heating and thermal equilibrium: temperature difference between 2 objects leading to energy transfer from the hotter to the cooler one, through contact (conduction) or radiation; such transfers tending to reduce the temperature difference; use of insulators
- other processes that involve energy transfer: changing motion, dropping an object, completing an electrical circuit, stretching a spring, metabolism of food, burning fuels

Changes in systems

- energy as a quantity that can be quantified and calculated; the total energy has the same value before and after a change
- comparing the starting with the final conditions of a system and describing increases and decreases in the amounts of energy associated with movements, temperatures, changes in positions in a field, in elastic distortions and in chemical compositions
- using physical processes and mechanisms, rather than energy, to explain the intermediate steps that bring about such changes

Motion and forces

Describing motion

- speed and the quantitative relationship between average speed, distance and time (speed = distance ÷ time)
- the representation of a journey on a distance-time graph
- relative motion: trains and cars passing one another

Forces

- forces as pushes or pulls, arising from the interaction between 2 objects
- using force arrows in diagrams, adding forces in 1 dimension, balanced and unbalanced forces
- moment as the turning effect of a force
- forces: associated with deforming objects; stretching and squashing – springs; with rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and water
- forces measured in newtons, measurements of stretch or compression as force is changed
- force-extension linear relation; Hooke's Law as a special case
- work done and energy changes on deformation
- non-contact forces: gravity forces acting at a distance on Earth and in space, forces between magnets, and forces due to static electricity

Pressure in fluids

- atmospheric pressure, decreases with increase of height as weight of air above decreases with height

- pressure in liquids, increasing with depth; upthrust effects, floating and sinking
- pressure measured by ratio of force over area – acting normal to any surface

Balanced forces
- opposing forces and equilibrium: weight held by stretched spring or supported on a compressed surface

Forces and motion
- forces being needed to cause objects to stop or start moving, or to change their speed or direction of motion (qualitative only)
- change depending on direction of force and its size

Waves

Observed waves
- waves on water as undulations which travel through water with transverse motion; these waves can be reflected, and add or cancel – superposition

Sound waves
- frequencies of sound waves, measured in hertz (Hz); echoes, reflection and absorption of sound
- sound needs a medium to travel, the speed of sound in air, in water, in solids
- sound produced by vibrations of objects, in loudspeakers, detected by their effects on microphone diaphragm and the ear drum; sound waves are longitudinal
- the auditory range of humans and animals

Energy and waves
- pressure waves transferring energy; use for cleaning and physiotherapy by ultrasound; waves transferring information for conversion to electrical signals by microphone

Light waves
- the similarities and differences between light waves and waves in matter
- light waves travelling through a vacuum; speed of light
- the transmission of light through materials: absorption, diffuse scattering and specular reflection at a surface
- use of ray model to explain imaging in mirrors, the pinhole camera, the refraction of light and action of convex lens in focusing (qualitative); the human eye
- light transferring energy from source to absorber, leading to chemical and electrical effects; photosensitive material in the retina and in cameras
- colours and the different frequencies of light, white light and prisms (qualitative only); differential colour effects in absorption and diffuse reflection

Electricity and electromagnetism

Current electricity
- electric current, measured in amperes, in circuits, series and parallel circuits, currents add where branches meet and current as flow of charge
- potential difference, measured in volts, battery and bulb ratings; resistance, measured in ohms, as the ratio of potential difference (p.d.) to current

- differences in resistance between conducting and insulating components (quantitative)

Static electricity
- separation of positive or negative charges when objects are rubbed together: transfer of electrons, forces between charged objects
- the idea of electric field, forces acting across the space between objects not in contact

Magnetism
- magnetic poles, attraction and repulsion
- magnetic fields by plotting with compass, representation by field lines
- Earth's magnetism, compass and navigation
- the magnetic effect of a current, electromagnets, DC motors (principles only)

Matter

Physical changes
- conservation of material and of mass, and reversibility, in melting, freezing, evaporation, sublimation, condensation, dissolving
- similarities and differences, including density differences, between solids, liquids and gases
- Brownian motion in gases
- diffusion in liquids and gases driven by differences in concentration
- the difference between chemical and physical changes

Particle model
- the differences in arrangements, in motion and in closeness of particles explaining changes of state, shape and density; the anomaly of ice-water transition
- atoms and molecules as particles

Energy in matter
- changes with temperature in motion and spacing of particles
- internal energy stored in materials

Space physics
- gravity force, weight = mass x gravitational field strength (g), on Earth g=10 N/kg, different on other planets and stars; gravity forces between Earth and Moon, and between Earth and sun (qualitative only)
- our sun as a star, other stars in our galaxy, other galaxies
- the seasons and the Earth's tilt, day length at different times of year, in different hemispheres
- the light year as a unit of astronomical distance

Wider Expectations

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Autumn	**Seasonal Changes** **Animals Including Humans** **Everyday Materials** Trips Visitors Events Display	**Observational Skills** **Everyday Materials** Trips Visitors Events Display	**Light** **Rocks** Trips Visitors Events Display	**Electricity** **Sound** Trips Visitors Events Display	**Earth & Space** **Forces** Trips Visitors Events Display	**Electricity** **Light** Trips Visitors Events Display
Spring	**Seasonal Changes** **Animals** Trips Visitors Events Display	**Plants** **Living things and their habitats** Trips Visitors Events Display	**Plants** Trips Visitors Events Display	**States of matter** **Living things and their habitats** Trips Visitors Events Display	**Properties of materials** Trips Visitors Events Display	**Evolution and inheritance** **Living things and their habitats** Trips Visitors Events Display
Summer	**Seasonal Changes** **Plants** **Everyday Materials** **Scientific Skills** Trips Visitors Events Display	**Plants** **Animals Including humans** Trips Visitors Events Display	**Forces and magnets** **Animals Including Humans** Trips Visitors Events Display	**Animals Including humans** Trips Visitors Events Display	**Living things and their habitats** **Animals Including humans** Trips Visitors Events Display	**Animals Including humans** Trips Visitors Events Display