

# Science

## Milestones for progress

Because the threshold concepts are repeated in each year group it is important that students progress in their understanding of them. The curriculum at St Botolph's sets out this progression in the form of three 'Milestones'. Each Milestone contains a range of descriptors which give more detail to be discovered within the concept. Over a two year period students will become more and more familiar with these details by exploring them in a breadth of contexts. These descriptors are not exhaustive and should only be used as a guide for teachers. They should not be 'ticked off' as each one is covered: they should be repeated in as many different contexts as possible.

Threshold Concept	Milestone 1	Milestone 2	Milestone 3
<p style="text-align: center;">Investigation (1)</p>	<ul style="list-style-type: none"> <li>• Ask and answer scientific questions about the world around them. (Questioning)</li> <li>• Use simple equipment to measure and make observations. (Measurement)</li> <li>• Follow a set of instructions to perform a range of simple tests, making simple predictions for what might happen and suggesting ways to answer their questions. (Investigation)</li> <li>• Observe objects, materials, living things and changes over time, sorting and grouping them based on their features and explaining their reasoning. (Observation)</li> </ul>	<ul style="list-style-type: none"> <li>• Ask relevant scientific questions, independently, about the world around them and begin to identify how they can answer them. (Questioning)</li> <li>• Take accurate measurements in standard units, using a range of equipment. (Measurement)</li> <li>• Begin to independently plan, set up and carry out a range of comparative and fair tests, making predictions and following a method accurately. (Investigation)</li> <li>• Begin to choose which observations to make and for how long and make systematic, careful observations and comparisons, identifying changes and connections. (Observations)</li> </ul>	<ul style="list-style-type: none"> <li>• Ask and answer deeper and broader scientific questions about the local and wider world that build on and extend their own and others' experiences and knowledge. (Questioning)</li> <li>• Take accurate, precise and repeated measurements in standard units, using a range of chosen equipment. (Measurement)</li> <li>• Plan and carry out a range of enquiries, including writing methods, identifying and controlling variables, deciding on equipment and data to collect and making predictions based on prior knowledge and understanding. (Investigation)</li> <li>• Independently, decide which observations to make, when and for how long and make systematic and careful observations, using them to make comparisons, identify changes, classify and make links between cause and effect. (Observations)</li> </ul>

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<p style="text-align: center;">Investigation (2)</p>	<ul style="list-style-type: none"> <li>• Begin to notice patterns and relationships in their data and explain what they have done and found out using simple scientific language. (Report &amp; conclude)</li>   <li>• Use a range of methods (tables, charts, diagrams and Venn diagrams) to gather and record simple data with some accuracy. (Gather &amp; record data)</li> </ul>	<ul style="list-style-type: none"> <li>• Use scientific vocabulary to report and answer questions about their findings based on evidence collected, draw simple conclusions and identify next steps, improvements and further questions. (Report &amp; conclude)</li>   <li>• Gather, record, classify and present observations and measurements in a variety of ways (pictorial representations, timelines, diagrams, keys, tables, charts and graphs). (Gather &amp; record data)</li> </ul>	<ul style="list-style-type: none"> <li>• Report on and validate their findings, answer questions and justify their methods, opinions and conclusions, and use their results to suggest improvements to their methodology, separate facts from opinions, pose further questions and make predictions for what they might observe. (Report &amp; conclude)</li>   <li>• Choose an appropriate approach to record accurate results, including scientific diagrams, labels, timelines, classification keys, tables, models and graphs (bar, line and scatter), linking to mathematical knowledge. (Gather &amp; record data)</li> </ul>

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Place	<ul style="list-style-type: none"> <li>Describe a range of local habitats and habitats beyond their locality (rainforests, deserts, oceans and mountains) and what all habitats provide for the things that live there and ask and questions about seasonal change. (Habitats)</li> </ul>	<ul style="list-style-type: none"> <li>Describe how environments can change due to human and natural influences and the impact this can have on living things. (Habitats)</li> </ul>	<ul style="list-style-type: none"> <li>Research and describe different farming practices in the UK and how these can have positive and negative effects on natural habitats. (Habitats)</li> <li>Research unfamiliar animals and plants from a range of habitats, deciding upon and explaining where they belong in the classification system. (Habitats)</li> </ul>

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<p style="text-align: center;">Nature (1)</p>	<ul style="list-style-type: none"> <li>• Identify and name a variety of plants and animals in a range of habitats and microhabitats. (Identification &amp; classification)</li>   <li>• Describe how plants need water, light and a suitable temperature to grow and stay healthy. (Parts &amp; function)</li>   <li>• Interpret and construct simple food chains to describe how living things depend on each other as a source of food. (Nutrition)</li> </ul>	<ul style="list-style-type: none"> <li>• Compare, sort and group living things in a variety of ways based on observable features and behaviour. (Identification &amp; classification)</li>   <li>• Name and describe the functions of the different parts of flowering plants (roots, stem, leaves and flowers). (Parts &amp; function)</li>   <li>• Identify the four different types of teeth in humans and other animals, and describe their functions. (Function)</li>   <li>• Investigate how water is transported within plants. (Parts &amp; function)</li>   <li>• Construct and interpret a variety of food chains and webs to show interdependence and how energy is passed on over time. (Nutrition)</li> </ul>	<ul style="list-style-type: none"> <li>• Use and construct classification systems to identify animals and plants from a range of habitats. (Identification &amp; classification)</li>   <li>• Classify living things into groups according to common observable characteristics and based on similarities and differences. (Identification &amp; classification)</li>   <li>• Label and draw the parts of a flower involved in sexual reproduction in plants (stamen, filament, anther, pollen, carpel, stigma, style, ovary, ovule and sepal). (Parts &amp; functions)</li>   <li>• Describe how animals and plants can be bred to produce offspring with specific and desired characteristics (selective breeding). (parts &amp; functions)</li>   <li>• Explain that the circulatory system in animals transports oxygen, water and nutrients around the body. (Nutrition)</li> </ul>

Threshold Concept	Milestone 1	Milestone 2	Milestone 3
Nature (2)	<ul style="list-style-type: none"><li>• Explain how animals, including humans, need water, food, air and shelter to survive. (Survival)</li></ul>	<ul style="list-style-type: none"><li>• Explain how adaptations help living things to survive in their habitat. (Survival)</li></ul>	<ul style="list-style-type: none"><li>• Identify how animals and plants are adapted to suit their environment, such as giraffes having long necks for feeding, and that adaptations may lead to evolution. (Survival)</li></ul>

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<p style="text-align: center; font-size: 24px; color: white;">Humankind</p>	<ul style="list-style-type: none"> <li>• Describe the stages of human development (baby, toddler, child, teenager and adult). (Human body)</li>   <li>• Describe what humans need to survive. (Staying safe)</li>   <li>• Describe the importance of a healthy lifestyle, including exercise, a balanced diet and good hygiene. (Healthy lifestyle)</li> </ul>	<ul style="list-style-type: none"> <li>• Describe how humans need the skeleton and muscles for support, protection and movement. (Human body)</li>   <li>• Describe the purpose of the digestive system, its main parts and each of their functions. (Human Body)</li>   <li>• Explain why light from the Sun can be dangerous. (Staying safe)</li>   <li>• Explain the precautions needed for working safely with electrical circuits. (Staying safe)</li>   <li>• Explain the importance and characteristics of a healthy, balanced diet. (Healthy lifestyle)</li>   <li>• Describe what damages teeth and how to look after them. (Healthy lifestyle)</li> </ul>	<ul style="list-style-type: none"> <li>• Describe the process of human reproduction. (Human body)</li>   <li>• Name and describe the purpose of the circulatory system and the functions of the heart, blood vessels and blood. (Human body)</li>   <li>• Explain the precautions needed for working safely when heating, burning, cooling and mixing materials. (Staying safe)</li>   <li>• Explain the impact of positive and negative lifestyle choices on their body. (Healthy lifestyle)</li> </ul>

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Materials	<ul style="list-style-type: none"> <li>• Observe what happens when a range of everyday materials, including foods, are heated and cooled, sorting and grouping them based on their observations. (Identification and Classification)</li> <li>• Compare the suitability of a range of everyday materials for particular uses. (Properties and Uses)</li> </ul>	<ul style="list-style-type: none"> <li>• Group and sort materials into solids, liquids or gases; reflective and non-reflective. (Identification and Classification)</li> <li>• Describe materials as electrical conductors or insulators. (Properties and Uses)</li> <li>• Compare and group rocks based on their appearance, properties or uses. (Properties and Uses)</li> </ul>	<ul style="list-style-type: none"> <li>• Investigate and identify good thermal insulators, describing their common features. (Identification and Classification)</li> <li>• Compare and group everyday materials by their properties, including hardness, solubility, transparency, conductivity (electrical and thermal) and magnetism. (Identification and Classification)</li> <li>• Separate mixtures by filtering, sieving and evaporating. (Properties and Uses)</li> <li>• Describe, using diagrams, how light behaves when reflected off a mirror (plane, convex or concave) and when passing through a lens (concave or convex). (Properties and Uses)</li> </ul>

Threshold Concept	Milestone 1	Milestone 2	Milestone 3
Comparison	<ul style="list-style-type: none"> <li>• Compare and group materials in a variety of ways, such as based on their physical properties; being natural or man-made and being recyclable or non-recyclable. (Physical things)</li> <li>• Compare and group things that are living, dead or have never been alive. (Physical things)</li> <li>• Compare shadows made by different objects and materials. (Phenomena)</li> <li>• Compare the volume and pitch of sounds made by instruments, their voices or other objects. (Phenomena)</li> </ul>	<ul style="list-style-type: none"> <li>• Investigate and compare a range of magnets (bar, horseshoe and floating) and explain that magnets have two poles (north and south) and that opposite poles attract each other, while like poles repel each other. (Physical things)</li> <li>• Compare common household equipment and appliances that are and are not powered by electricity. (Physical things)</li> <li>• Compare how objects move over surfaces made from different materials. (Phenomena)</li> <li>• Compare how the volume of a sound changes at different distances from the source. (Phenomena)</li> </ul>	<ul style="list-style-type: none"> <li>• Compare the living things in two contrasting areas of a habitat (top vs bottom of a hill, full sun vs shade, exposed location vs sheltered location or well-trodden path vs unused area). (Physical things)</li> <li>• Compare and describe, using a range of toys, models and natural objects, the effects of water resistance, air resistance and friction. (Phenomena)</li> <li>• Compare and give reasons for variations in how components in electrical circuits function (brightness of lamps; volume of buzzers and on or off of switches). (Phenomena)</li> </ul>

Threshold Concept	Milestone 1	Milestone 2	Milestone 3
<p data-bbox="224 668 522 822">Processes (1)</p>	<ul data-bbox="657 244 1286 1300" style="list-style-type: none"> <li>• Describe typical UK seasonal weather patterns. (Pattern seeking)</li> <li>• Describe how some objects and materials can be changed and how these changes can be desirable or undesirable. (Changes)</li> <li>• Observe and describe different types of weather. (Earth)</li> <li>• Describe features of Earth using words and pictures. (Earth)</li> </ul>	<ul data-bbox="1332 244 1888 1339" style="list-style-type: none"> <li>• Find patterns in the way shadows change during the day. (Pattern seeking)</li> <li>• Compare and find patterns in the pitch and the volume of a sound, using a range of equipment, such as musical instruments. (Pattern seeking)</li> <li>• Describe simply how fossils are formed, using words, pictures or a model. (Changes)</li> <li>• Observe and explain that some materials change state when they are heated or cooled and measure or research the temperature in degrees Celsius (°C) at which materials change state. (Changes)</li> <li>• Investigate soils from the local environment, making comparisons and identifying features. (Earth)</li> <li>• Describe the water cycle using words or diagrams and explain the part played by evaporation and condensation. (Earth)</li> </ul>	<ul data-bbox="1933 244 2489 1415" style="list-style-type: none"> <li>• Use the idea of Earth's rotation to explain day and night, and the Sun's apparent movement across the sky. (Pattern seeking)</li> <li>• Explain, using words, diagrams or a model, why shadows have the same shape as the objects that cast them and how shadows can be changed. (Pattern seeking)</li> <li>• Identify, demonstrate and compare reversible and irreversible changes. (Changes)</li> <li>• Describe some significant changes that have happened on Earth and the evidence, such as fossils, that support this. (Changes)</li> <li>• Describe or model the movement of the planets in our Solar System, including Earth, relative to the Sun and the Moon relative to the Earth. (Earth)</li> <li>• Identify that light travels in straight lines.</li> <li>• Explain that due to how light travels, we can see things because they give out or reflect light into the eye. (Earth)</li> </ul>

Threshold Concept	Milestone 1	Milestone 2	Milestone 3
<p style="text-align: center;">Processes (2)</p>	<ul style="list-style-type: none"> <li>• Explain in simple terms how shadows are formed. (Phenomena)</li> <li>• Explain in simple terms how sounds are made. (Phenomena)</li> <li>• Sort and group objects that float and sink. (Forces)</li> <li>• Describe, following exploration, what simple electrical circuits can do. (Modelling)</li> <li>• Make models with moving parts. (Modelling)</li> </ul>	<ul style="list-style-type: none"> <li>• Describe dark as being the absence of light and that we need light to be able to see. (Phenomena)</li> <li>• Explain, using words or diagrams, how shadows are formed when a light source is blocked by an opaque object. (Phenomena)</li> <li>• Explain how sounds are made and heard using diagrams, models, written methods or verbally. (Phenomena)</li> <li>• Explain that an object will not move unless a push or pull (force) is applied, describing forces in action and whether the force requires direct contact or whether the force can act at a distance (magnetic force). (Forces)</li> <li>• Predict and describe whether a circuit will work based on whether or not the circuit is a complete loop and has a battery or cell. (Forces)</li> <li>• Make working models with simple mechanisms or electrical circuits.</li> <li>• Construct operational simple series circuits using a range of components and switches for control. (Modelling)</li> </ul>	<ul style="list-style-type: none"> <li>• Describe the Sun, Earth and Moon as approximately spherical bodies and use this knowledge to understand the phases of the Moon and eclipses. (Phenomena)</li> <li>• Describe, using scientific language, phenomena associated with light (rainbows, colours on soap bubbles and refraction in a glass of water). (Phenomena)</li> <li>• Explain that objects fall to Earth due to the force of gravity. (Forces)</li> <li>• Explain how the brightness of a lamp or volume of a buzzer is affected by the number and voltage of cells used in a circuit. (Forces)</li> <li>• Describe and demonstrate how simple levers, gears and pulleys assist the movement of objects. (Modelling)</li> <li>• Create circuits using a range of components and record diagrammatically using the recognised symbols for electrical components. (Modelling)</li> </ul>