

# Science

## Essential Characteristics of Scientists

- The ability to think independently and raise questions about working scientifically and the knowledge and skills that it brings.
- Confidence and competence in the full range of practical skills, initiative in, for example, planning and carrying out scientific investigations.
- Excellent scientific knowledge and understanding which is demonstrated in written and verbal explanations, solving challenging problems and reporting scientific findings.
- High levels of originality, imagination or innovation in the application of skills.
- The ability to undertake practical work in a variety of contexts, including fieldwork.
- A passion for science and its application in past, present and future technologies.



## Working Scientifically

This is the first '**Key Threshold Concept**' within which pupils will develop The Essential Characteristics outlined above.

In this document the '**Key Threshold Concepts**' are in red font.

The Essential Characteristics above are broken down into a progression of descriptors at three '**Milestones**' (the end of Year 2, Year 4 and Yr 6).

For The Working Scientifically Key Threshold Concept, the Milestone Descriptors are developed alongside the coverage identified below for the remaining 10 Key Threshold Concepts. These are the skills that are the key to scientific thinking and opportunities to develop them should be considered in all science planning.

Teachers should follow the progression of teaching '**Working Scientifically**' scientific skills that is outlined in THE ESSENTIALS CURRICULUM (see poster), recording which skills have been planned into which topics by using the Science Unit Assessment Grid template. The expectation is that each of the scientific skills for the age appropriate milestone will have been covered in depth at least once in every scientific topic listed below.

Years 1-2

### Milestone 1



- Ask simple questions.
- Observe closely using simple equipment.
- Perform simple tests.
- Identify and classify.
- Use observations and ideas to suggest answers to questions.
- Gather and record data to help in answering questions.

Years 3-4

### Milestone 2



- Ask relevant questions.
- Set up simple, practical enquiries and comparative and fair tests.
- Make accurate measurements using standard units, using a range of equipment, e.g. thermometers and data loggers.
- 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, bar charts and tables.
- Report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions.
- Use results to draw simple conclusions and suggest improvements, new questions and predictions for setting up further tests.
- Identify differences, similarities or changes related to simple, scientific ideas and processes.
- Use straightforward, scientific evidence to answer questions or to support their findings.

Years 5-6

### Milestone 3



- Plan enquiries, including recognising and controlling variables where necessary.
- Use appropriate techniques, apparatus, and materials during fieldwork and laboratory work.
- Take measurements, using a range of scientific equipment, with increasing accuracy and precision.
- Record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, bar and line graphs, and models.
- Report findings from enquiries, including oral and written explanations of results, explanations involving causal relationships, and conclusions.
- Present findings in written form, displays and other presentations.
- Use test results to make predictions to set up further comparative and fair tests.
- Use simple models to describe scientific ideas, identifying scientific evidence that has been used to support or refute ideas or arguments.

Working Scientifically

<b>'Key Threshold Concepts'</b>	<b>CYCLE A</b>			<b>CYCLE B</b>			<b>CYCLE C</b>		
Milestone Descriptors	<b>AUT 19</b>	<b>SPR 20</b>	<b>SUM 20</b>	<b>AUT 20</b>	<b>SPR 21</b>	<b>SUM 21</b>	<b>AUT 21</b>	<b>SPR 22</b>	<b>SUM 22</b>
<b>Investigate Living Things</b>									
Sc4/2.1a recognise that living things can be grouped in a variety of ways			✓						
Sc4/2.1b explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment			✓						
Sc4/2.1c recognise that environments can change and that this can sometimes pose dangers to living things.			✓						
Sc5/2.1a describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird			✓						
Sc5/2.1b describe the life process of reproduction in some plants and animals.			✓						

<b>Understand Plants</b>									
Sc3/2.1a identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers			✓						✓
Sc3/2.1b explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow) and how they vary from plant to plant			✓						✓
Sc3/2.1c investigate the way in which water is transported within plants			✓						✓
Sc3/2.1d explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal.			✓						✓

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<b>Understand animals and humans</b>									
Sc3/2.2a identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat						✓			
Sc3/2.2b identify that humans and some other animals have skeletons and muscles for support, protection and movement.						✓			
Sc4/2.2a describe the simple functions of the basic parts of the digestive system in humans						✓			
Sc4/2.2b identify the different types of teeth in humans and their simple functions						✓			
Sc4/2.2c construct and interpret a variety of food chains, identifying producers, predators and prey.						✓			
Sc5/2.2a describe the changes as humans develop to old age.						✓			

<b>Investigate Materials (Rocks)</b>									
Sc3/3.1a compare and group together different kinds of rocks on the basis of their appearance and simple physical properties					✓				
Sc3/3.1b describe in simple terms how fossils are formed when things that have lived are trapped within rock					✓				
Sc3/3.1c recognise that soils are made from rocks and organic matter.					✓				

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<b>Investigate Light and Seeing</b>									
Sc3/4.1a recognise that they need light in order to see things and that dark is the absence of light		✓							
Sc3/4.1b notice that light is reflected from surfaces		✓							
Sc3/4.1c recognise that light from the sun can be dangerous and that there are ways to protect their eyes		✓							
Sc3/4.1d recognise that shadows are formed when the light from a light source is blocked by a solid object		✓							
Sc3/4.1e find patterns in the way that the size of shadows change.		✓							
<b>Understand Movement, Forces and Magnets</b>									
Sc3/4.2a compare how things move on different surfaces				✓					
Sc3/4.2b notice that some forces need contact between 2 objects, but magnetic forces can act at a distance	✓								
Sc3/4.2c observe how magnets attract or repel each other and attract some materials and not others	✓								
Sc3/4.2d compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials	✓								
Sc3/4.2e describe magnets as having 2 poles	✓								
Sc3/4.2f predict whether 2 magnets will attract or repel each other, depending on which poles are facing.	✓								
Sc5/4.2a explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object				✓					
Sc5/4.2b identify the effects of air resistance, water resistance and friction, that act between moving surfaces				✓					
Sc5/4.2c recognise that some mechanisms including levers, pulleys and gears allow a smaller force to have a greater effect				✓					

[illegible]

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<b>Understand Earth’s Movement in Space</b>									
Sc5/4.1a describe the movement of the Earth, and other planets, relative to the Sun in the solar system								✓	
Sc5/4.1b describe the movement of the Moon relative to the Earth								✓	
Sc5/4.1c describe the Sun, Earth and Moon as approximately spherical bodies								✓	
Sc5/4.1d use the idea of the Earth’s rotation to explain day and night, and the apparent movement of the sun across the sky.								✓	

<b>Investigate Sound and Hearing</b>									
Sc4/4.1a identify how sounds are made, associating some of them with something vibrating				✓					
Sc4/4.1b recognise that vibrations from sounds travel through a medium to the ear				✓					
Sc4/4.1c find patterns between the pitch of a sound and features of the object that produced it				✓					
Sc4/4.1d find patterns between the volume of a sound and the strength of the vibrations that produced it.				✓					
Sc4/4.1e recognise that sounds get fainter as the distance from the sound source increases				✓					

	CYCLE A			CYCLE B			CYCLE C		
	AUT 19	SPR 20	SUM 20	AUT 20	SPR 21	SUM 21	AUT 21	SPR 22	SUM 22
<b>Understand Electrical Circuits</b>									
Sc4/4.2a identify common appliances that run on electricity	✓								
Sc4/4.2b construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers	✓								
Sc4/4.2c identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery	✓								
Sc4/4.2d recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit	✓								
Sc4/4.2e recognise some common conductors and insulators, and associate metals with being good conductors.	✓								