# Working Scientifically

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Chartered Science Teacher
CSciTeach

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CPD MARK
LEAD FACILITATOR

CPD MARK
ONLINE FACILITATOR

Science
ACROSS THE CITY

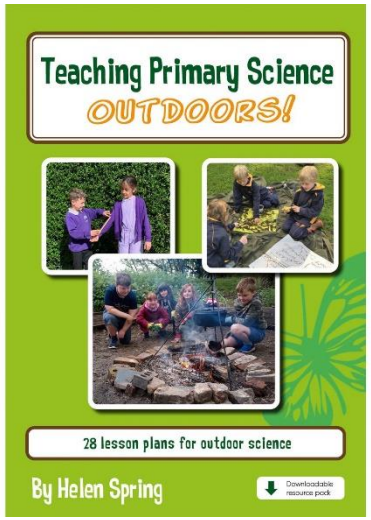
PSQM
Primary Science Quality Mark

HOWSHAM MILL
RENEWABLE HERITAGE TRUST

Explorify
Champion

fascinate

The Association for Science Education
Promoting Excellence in Science Teaching and Learning




POLAR EXPLORER
PROGRAMME

CLEAPSS
primary

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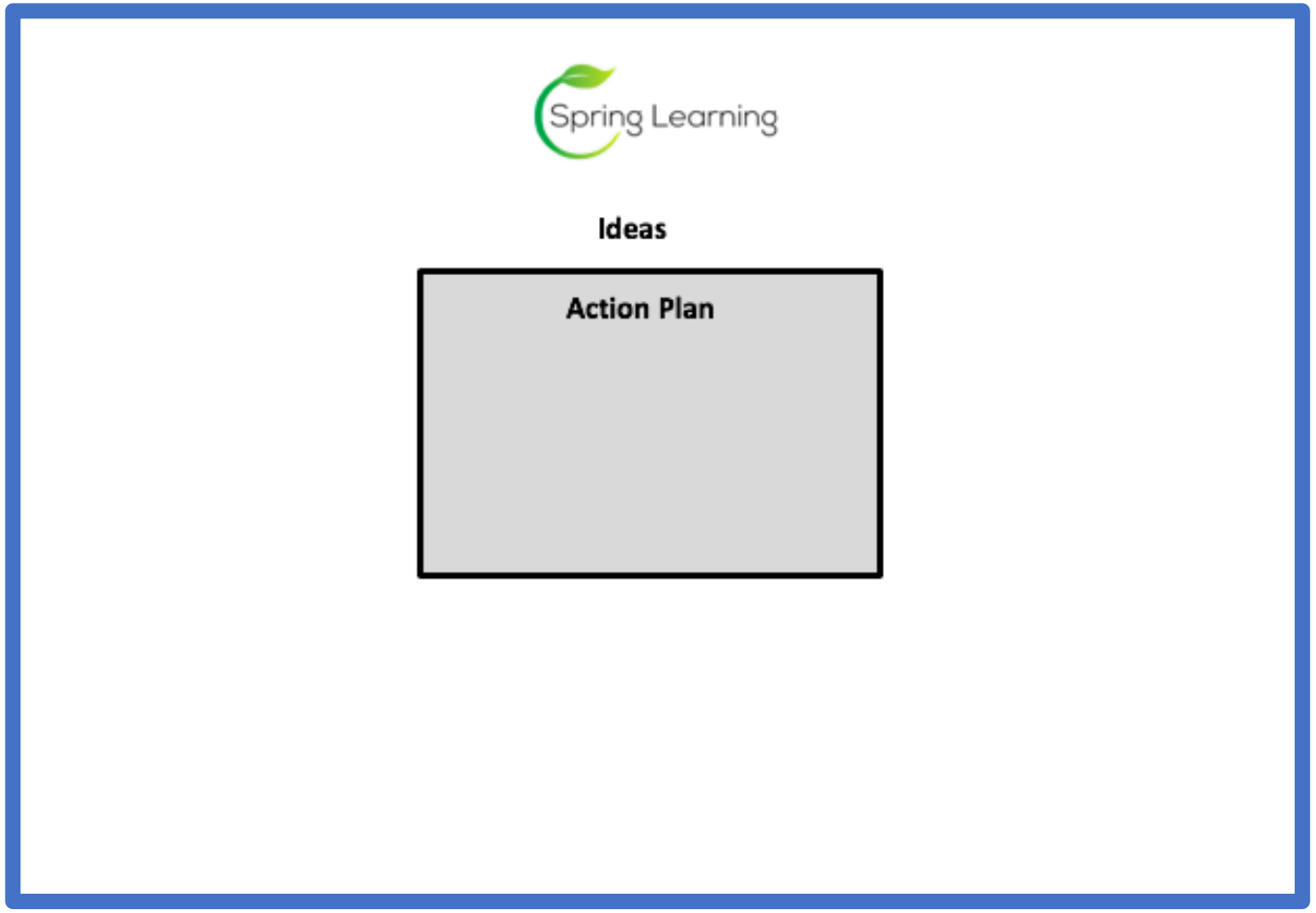
# Action planning



# Learning outcomes

You will be able to:

- Explore how to raise the profile of the 5 types of Enquiry in our own classrooms
- Develop understanding of Progression in Working Scientifically and conceptual understanding
- Explore resources and strategies that can help to develop pupil independence and Working Scientifically Skills

# Welcome…

**What makes good science?**

https://www.google.com/imgres?imgurl=https%3A%2F%2Fwww.tika.ai%2Fwp-content%2Fuploads%2F2019%2F08%2FpJnHi8gUamLJTTU1jxUKCraR.jpeg&imgrefurl=https%3A%2F%2Fwww.tika.ai%2Fproductivity-hack-post-its-in-your-pocket%2F&tbnid=AQCj6Bo_PKWFcM&vet=12ahUKEwioiu215tXzAhXy7uAKHbdVBlUQMygNegUIARDgAg..i&docid=tcwM5g-TZwrQsM&w=3000&h=1702&q=post%20its&ved=2ahUKEwioiu215tXzAhXy7uAKHbdVBlUQMygNegUIARDgAg

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# What do you think the aims of the Primary Science Curriculum are?

## Aims

The national curriculum for science aims to ensure that all pupils:

- develop **scientific knowledge and conceptual understanding** through the specific disciplines of biology, chemistry and physics
- develop understanding of the **nature, processes and methods of science** through different types of science enquiries that help them to answer scientific questions about the world around them
- are equipped with the scientific knowledge required to understand the **uses and implications** of science, today and for the future.

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# 5 Types of Enquiry

## The nature, processes and methods of science

'Working scientifically' specifies the understanding of the nature, processes and methods of science for each year group. It should not be taught as a separate strand. The notes and guidance give examples of how 'working scientifically' might be embedded within the content of biology, chemistry and physics, focusing on the key features of scientific enquiry, so that pupils learn to use a variety of approaches to answer relevant scientific questions. These types of scientific enquiry should include: observing over time; pattern seeking; identifying, classifying and grouping; comparative and fair testing (controlled investigations); and researching using secondary sources. Pupils should seek answers to questions through collecting, analysing and presenting data. 'Working scientifically' will be developed further at key stages 3 and 4, once pupils have built up sufficient understanding of science to engage meaningfully in more sophisticated discussion of experimental design and control.

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# 5 Types of Enquiry


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# 5 Types of Enquiry in EYFS

Science in EYFS

ELG: The Natural World

Children at the expected level of development will:

- Explore the natural world around them, making observations and drawing pictures of animals and plants;
- Know some similarities and differences between the natural world around them and contrasting environments, drawing on their experiences and what has been read in class;
- Understand some important processes and changes in the natural world around them, including the seasons and changing states of matter.


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# Progression in Working Scientifically

‘KS1 - pupils 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.’

Science programme of study 2014


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# Progression in Working Scientifically

‘LKS2 - Pupils 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.’


Science programme of study 2014

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# Progression in Working Scientifically

‘UKS2 – Pupils should select the most appropriate ways to answer science questions using different types of scientific enquiry to answer their own questions, 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.’


Science programme of study 2014

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# Resources for planning for progression in Working Scientifically

Substantive knowledge (the stuff about science)

Working Scientifically

Enquiry type

Question to investigate

https://www.facebook.com/Primary-Science-Geeks-332136757195457

@priscigeeks

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# Resources for planning for progression in Working Scientifically

PLAN
Planning for assessment

The Ogden Trust
making physics matter

why & how?
PRIMARY SCIENCE TEACHING TRUST

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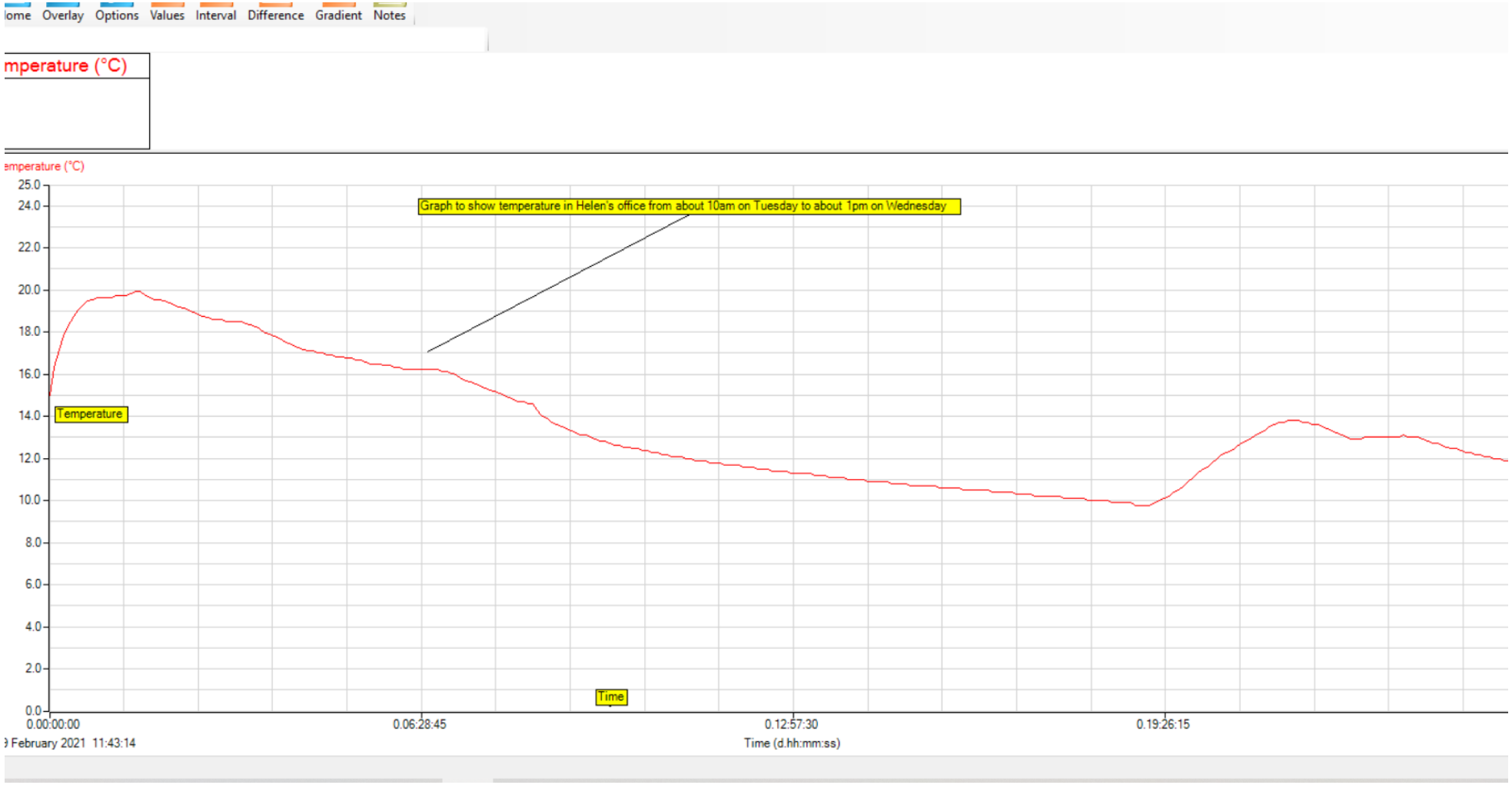
# Observing over time

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Substantive knowledge (the stuff about science)

Understand temperature of materials can be measured in °C

Take accurate measurements using standard units, using a range of equipment including thermometers and data loggers

Working Scientifically


Enquiry type

Which material is best for keeping our hot chocolate warm?

Question to investigate

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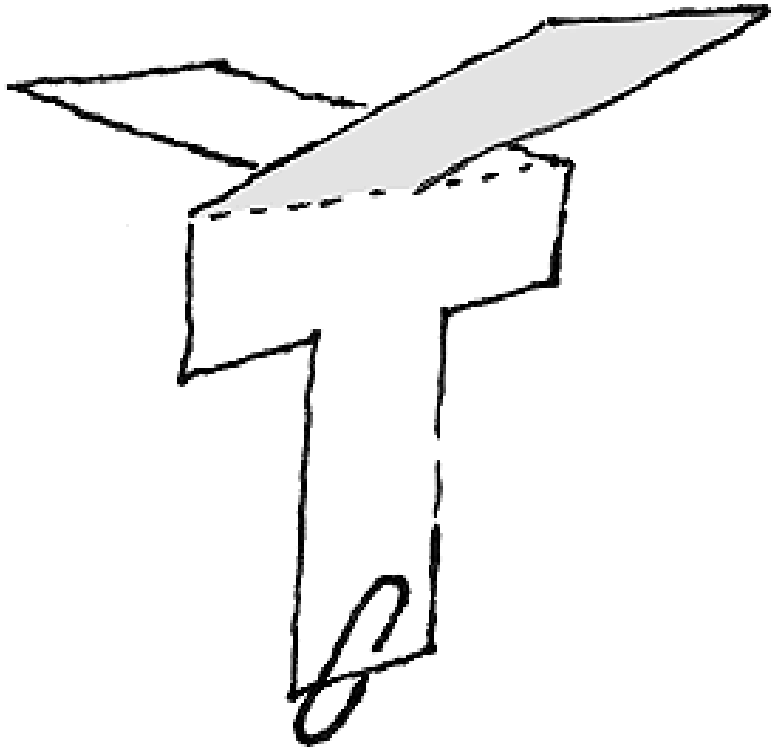
# Comparative and Fair Tests



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Substantive knowledge (the stuff about science)

Describe the life processes of reproduction in some plants.

planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary

Working Scientifically


Which seed shape takes the longest to fall?

Enquiry type

Question to investigate

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# Research using secondary sources

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Substantive knowledge (the stuff about science)

identify and describe the basic structure of a variety of common flowering plants, including trees

Asking simple questions and recognising that they can be answered in different ways.

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Enquiry type

What can we find out about plants?

Question to investigate

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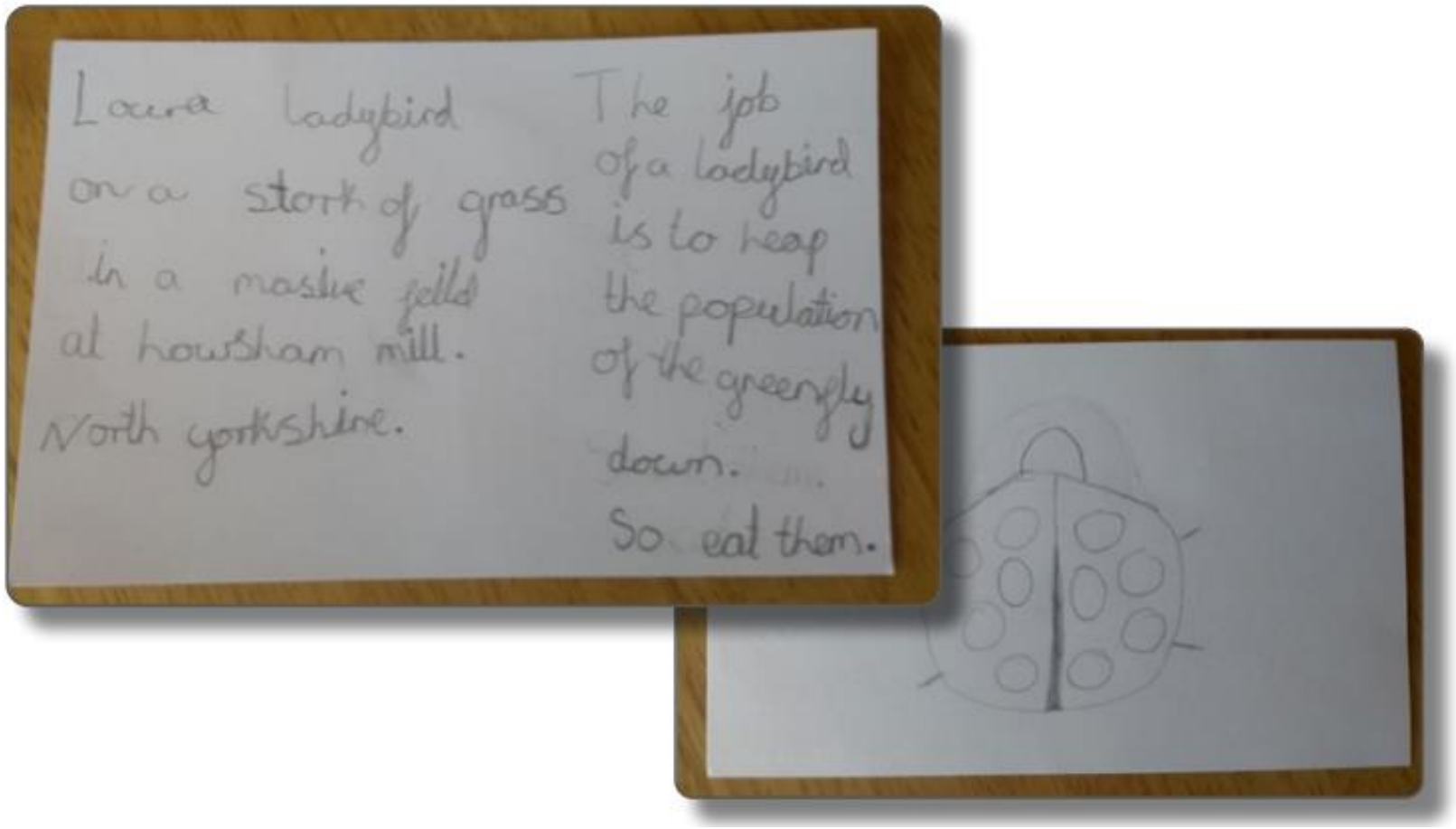
# Pattern seeking

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Substantive knowledge (the stuff about science)

Identify that most living things live in habitats to which they are suited…

observing closely, using simple equipment

Working Scientifically


Enquiry type

Where can we find the most worms?

Question to investigate

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# Identifying, classifying and grouping


https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.vecteezy.com%2Fvector-art%2F682467-set-of-random-objects&psig=AOvVaw2m4mmZ99sdcP6w1fcw_wZ1&ust=1587707769153000&source=images&cd=vfe&ved=2ahUKEwjnmPy97v3oAhUP2eAKHUnbCowQr4kDegUIARCeAg

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Substantive knowledge (the stuff about science)

Working Scientifically


Enquiry type

Question to investigate

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# Planning for the 5 types of enquiry

| Year 2 | Observing over time | Pattern seeking | Identifying, classifying and grouping | Comparative and fair testing | Research using secondary sources |
|---|---|---|---|---|---|
| Living things and their habitats | | | | | |
| Plants | | | | | |
| Animals including humans | | | | | |
| Uses of everyday materials | | | | | |

# Assessing Working Scientifically

**Overview of TAPS plans for Focused Assessment of Working Scientifically**

*(Any focus can be chosen for open-ended enquiries, these are only suggestions)*

| | Plan | | Do | | Review | |
|---|---|---|---|---|---|---|
| | **Ask Qs and plan enquiry** | **Set up enquiry** | **Observe + Measure** | **Record** | **Interpret + Report** | **Evaluate** |
| **KS1** (age 5-7) ***Develop close obs*** | Ask simple Qs and recognise that they can be answered in different ways*. | Perform simple tests. | Observe closely, using simple equipment. | Gather and record data to help in answering questions. | Identify and classify. *Use appropriate scientific language to communicate ideas.* | Use their observations and ideas to suggest answers to questions. |
| **Y1 TAPS plans** | Materials: reflection tests | Materials: floating and sinking | Plants: structure | Seasons: seasonal change | Animals inc Humans: animal classification | Animals inc Humans: body parts |
| **Y2 TAPS plans** | Materials: waterproof | Materials: rocket mice | Plants: compare growth | Living things: woodlice habitats | Living things: nature spotters | Animals inc Humans: handspans |
| **Lower KS2** ***(age 7-9)*** ***Develop systematic approach*** | Ask relevant questions and use different types* of scientific enquiries to answer them. | Set up simple practical enquiries, comparative and fair tests. | Make systematic and careful observations and, where appropriate, take accurate measurements using standard units, using a range of equipment, including 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, keys, bar charts, and tables. | Report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions. Identify differences, similarities or changes related to simple scientific ideas and processes. | Use 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. |
| **Y3 TAPS plans** | Animals inc Humans: investigating skeletons | Forces: shoe grip Forces: strongest magnet | Plants: measuring plants | Light: making shadows Forces: cars down ramps | Rocks: rock reports | Plants: function of stem Forces: balloon rockets |
| **Y4 TAPS plans** | Sound: investigating pitch | Materials: drying materials | Materials: measure temperature | Living things: local survey | Electricity: conductors Sound: string telephones | Animals inc Humans: teeth (eggs) in liquids |
| **Upper KS2** ***(age 9-11)*** ***Develop independ-ence*** | Plan different types* of scientific enquiries to answer *their own questions,* including recognising and controlling variables where necessary. | Use test results to make predictions to set up further comparative and fair tests. | Take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate | Record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs. | Report and present findings from enquiries, inc conclusions and causal relationships, in oral and written forms such as displays and other presentations, *using appropriate scientific language*. | Explain degree of trust in results. Identify *and evaluate* scientific evidence *(their own and others')* that has been used to support or refute ideas or arguments. |
| **Y5 TAPS plans** | Materials: dissolving Materials: nappy absorbency | Materials: insulation layers | Animals inc Human: growth survey Forces: spinners | Materials: sugar cubes Space: craters | Materials: champion tapes Living things: life cycle research | Forces: aquadynamics |
| **Y6 TAPS plans** | Electricity: bulb brightness | Animals inc Humans: heart rate | Light: investigating shadows | Living things: outdoor keys | Living things: invertebrate research | Evolution: fossil habitats Evolution: egg strength |

***Types of enquiry including: observing changes over time, noticing patterns, grouping and classifying, comparative and fair tests, using secondary sources.***

(English 2013 National Curriculum statements, *additions from Interim Teacher Assessment framework 2016-7)*

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# How do you assess **Working Scientifically** in your school?

# How do you assess **Conceptual Understanding** in your school?

- Formative assessment
- Summative assessment
- Tests
- Resources

- Practical tasks
- Children's work
- Tracking

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# Good practice in Assessment of Primary Science

- Assessing Working Scientifically (PSTT TAPS)
- Assessing conceptual understanding (PLAN Assessment)
- An effective tracking system

| Year 5 | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Living things and their habitats** | | | | | | | | | | | | | | | | | | |
| Describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird | | | | | | | | | | | | | | | | | | |
| Describe the life process of reproduction in some plants and animals | | | | | | | | | | | | | | | | | | |
| **Animals, including humans** | | | | | | | | | | | | | | | | | | |
| Describe the changes as humans develop to old age | | | | | | | | | | | | | | | | | | |
| **Properties and changes of materials** | | | | | | | | | | | | | | | | | | |
| Compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets | | | | | | | | | | | | | | | | | | |
| Know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution | | | | | | | | | | | | | | | | | | |
| Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating | | | | | | | | | | | | | | | | | | |
| Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic | | | | | | | | | | | | | | | | | | |
| Demonstrate that dissolving, mixing and changes of state are reversible changes | | | | | | | | | | | | | | | | | | |
| Explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda | | | | | | | | | | | | | | | | | | |

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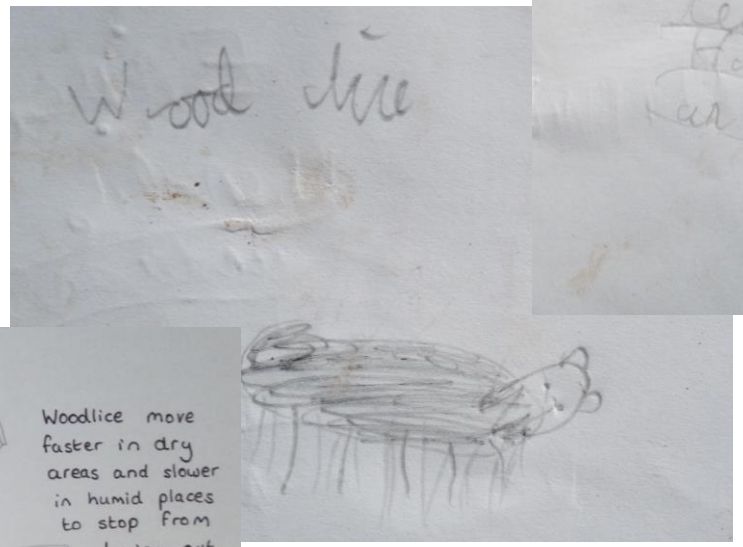
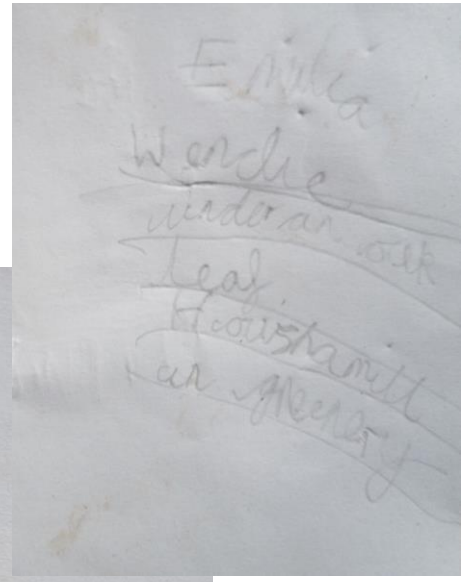
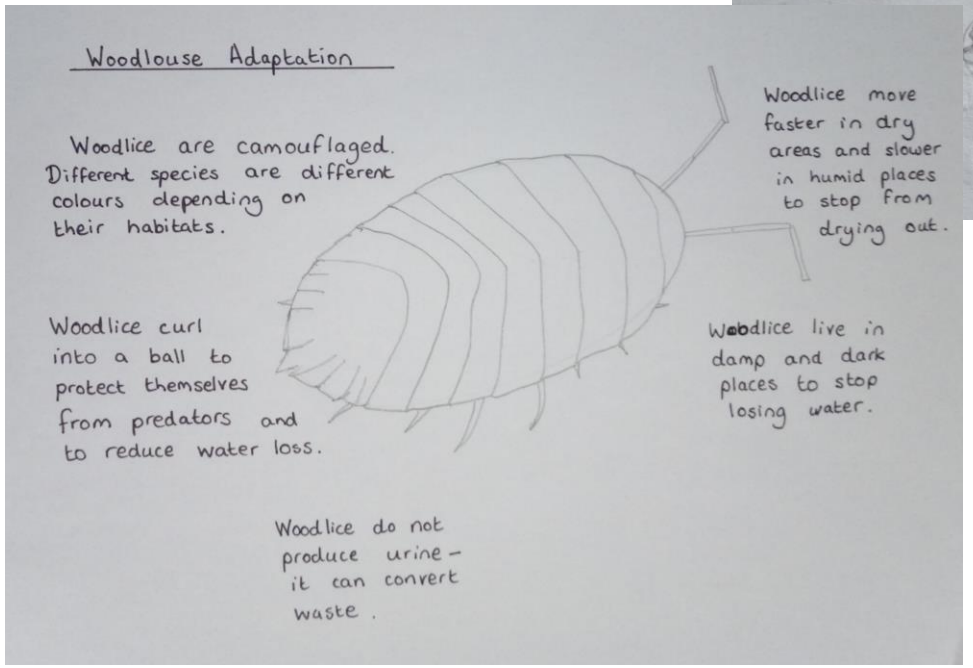
# Assessment of conceptual understanding

PLAN
Planning for assessment



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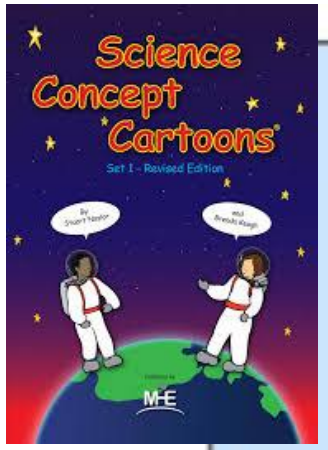



## 2.10 Rabbits and foxes

There are always more rabbits than foxes

There are more rabbits because they don't need as much to eat

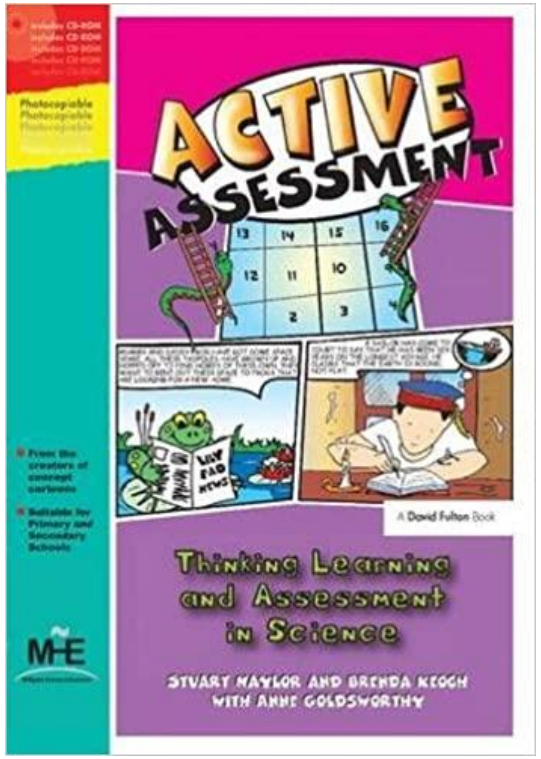
There are more rabbits because they produce more babies

There are more because foxes are at the top of the food chain and have more energy

?

# Resources to support assessment of conceptual understanding

Explorify





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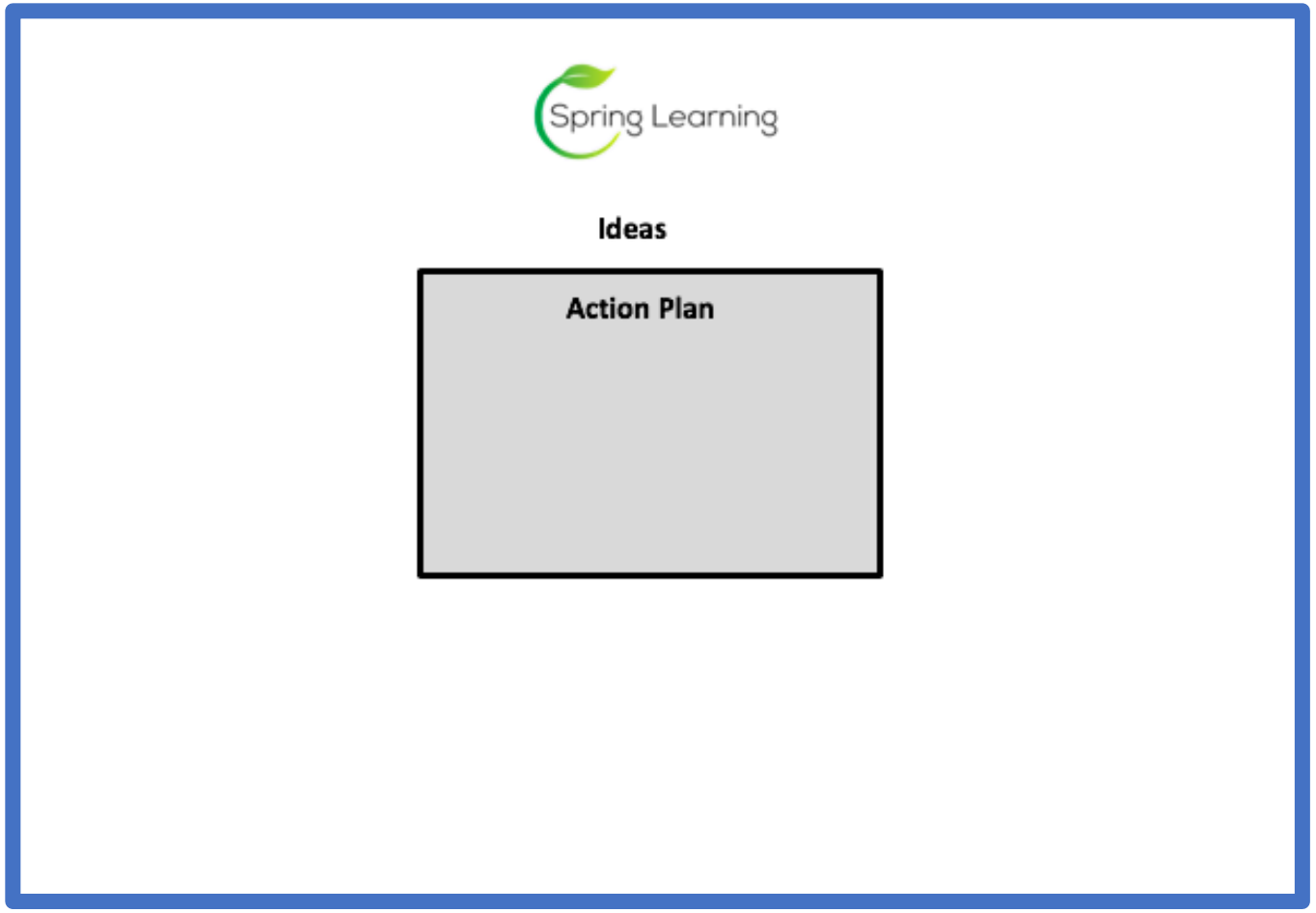
# Action planning and evaluations

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