CAMBRIDGE PRIMARY Science

Teacher's Resource

Jon Board and Alan Cross

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Introduction

The *Cambridge Primary Science* series has been developed to match the Cambridge International Examinations Primary Science curriculum framework. It is a fun, flexible and easy to use course that gives both learners and teachers the support they need. In keeping with the aims of the curriculum itself, it encourages learners to be actively engaged with the content, and develop enquiry skills as well as subject knowledge.

This Teacher's Resource for Stage 1 gives extensive support for teaching Stage 1 of the curriculum framework. It frequently references the Learner's Book, ISBN 978-1-107-61138-2 and Activity Book, ISBN 978-1-107-61142-9, for Stage 1, offering guidance on how to get the best out of using those products. There are also many additional teaching ideas for you to choose from.

The main sections in this Teacher's Resource are:

Teaching ideas. These give you a whole range of ideas for how to present the topics in the classroom. This includes ideas for classroom activities, assessment and differentiation, and suggestions for ICT resources. References to the Learner's Book and Activity Book are provided throughout, including guidance notes on the activities suggested in the Learner's Book. The teaching ideas are also available in editable format on the CD-ROM included with this Teacher's Resource, so that you can include your own notes.

Worksheets. A large collection of worksheets offers further activity and exercise ideas in addition to those included in the Learner's Book and Activity Book, while some of the worksheets are intended to support the Learner's Book activities. The worksheets are also available in editable format on the CD-ROM included with this Teacher's Resource, so that you can adapt them to your own needs.

Pictures. A selection of high-resolution pictures has been provided on the CD-ROM for use on the interactive whiteboard, or for learners to view on digital devices at school if you have that facility. You might also print the pictures out for learners to look at. Suggestions on how to use these pictures to consolidate and extend learning are provided in the teaching ideas.

Answers to questions. Answers to all the questions from the Learner's Book, the exercises in the Activity Book and the worksheets in this resource are provided.

We hope you enjoy using this series.

With best wishes,
the Cambridge Primary Science team.

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Teaching sequence

Throughout the *Cambridge Primary Science* series, the units are presented in the same order as in the Cambridge International Examinations Primary Science curriculum framework, for easy navigation and to help you ensure that the curriculum is covered. However, this is not necessarily the best sequence in which to teach the material. For example, all the biology topics would be taught in one large block, whereas you may prefer to present a more balanced and varied route through the different areas of science.

When planning your teaching sequence, it is advisable to think about how the science topics fit in with the other subjects you teach. You should also consider topics within the science curriculum that are best taught at a particular time of year. For example, Unit 2 Growing plants is best taught at a time of year when learners can observe plants growing and flowering. The best time of year to teach this unit will therefore depend on where you are in the world.

As a general rule, we would advise teaching Unit 4 What is it made of? before Unit 5 Pushing and pulling. Understanding why the same forces have different effects on different materials requires understanding of material properties. The topic on senses in Unit 3 Ourselves leads naturally into both Unit 4, where senses are used to describe materials, and Unit 6 Hearing sounds. We would advise teaching Unit 3 before both Unit 4 and Unit 6. Following Unit 3 directly with either Unit 4 or Unit 6 will reinforce learning about senses by immediately giving a practical example of where and how they are used. Finally, we suggest beginning the year with something about the children themselves, such as Unit 1 Being alive or Unit 3 Our senses.

These are two alternative sequences you might consider, though you may invent your own. In each of these sequences Unit 2 is placed last, but it might slot into any other point in each sequence. In these sequences the following colour code is used: Biology units are dark grey, Chemistry units grey and Physics units white.

Sequence 1:

Unit 3 Ourselves	Unit 4 What is it made of?	Unit 1 Being alive	Unit 5 Pushing and pulling	Unit 6 Hearing sounds	Unit 2 Growing plants

Sequence 2:

Unit 1 Being alive	Unit 3 Ourselves	Unit 6 Hearing sounds	Unit 4 What is it made of?	Unit 5 Pushing and pulling	Unit 2 Growing plants

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Scientific enquiry

Scientific enquiry is about how scientific ideas come about, supported by investigations and evaluating the data and other evidence that are produced through those investigations. The ideas underpin all areas of science. Therefore, the Scientific enquiry section of the curriculum framework is not included as a separate teaching unit in the teaching sequences suggested above. Rather, Scientific enquiry should be taught in an integrated fashion, alongside teaching of the other content areas.

The *Cambridge Primary Science* has been written to support this way of working. By allowing learners to carry out the activities in the Learner's Book you will cover all the Scientific enquiry objectives in the curriculum framework. These activities can be supported by further activities suggested in the teaching ideas and worksheets in this Teacher's Resource, and through the exercises focused on planning investigations and evaluating data in the Activity Book.

Here, we give a further introduction to the Scientific enquiry objectives listed in the Cambridge Primary Science curriculum framework for Stage 1. For each framework statement, some background information is given on the level that learners are expected to achieve at this stage. Also, some specific examples are given of activities suggested in this series that can be used to help learners develop each skill.

Ideas and evidence

Try to answer questions by collecting evidence through observation

Learners should gather evidence including data from simple practical investigations, and from research using age-appropriate books, websites or from people. They should be able to do this working in small groups or individually. This will include counting (tallying) certain observations, measuring uniform non-standard units, and finding information from different sources. Learners may need support and guidance in dealing with evidence, for example deciding which information is relevant.

The skill of collecting evidence should be developed across the whole stage, but examples could include:

- Learner's Book Activity 1.1: investigating what living things can be found in the school grounds.
- Activity Book Exercise 2.1: looking carefully at the parts of a plant.

Teachers should model these skills and organise opportunities for shared writing and discussion of evidence. For example, after completing an investigation, ask learners to discuss whether the evidence collected can be used to answer the initial question or prediction.

Plan investigative work

Ask questions and contribute to discussions about how to seek answers

Learners can be encouraged to ask simple scientific questions such as How far…? How many…? How fast…? Which is louder? Will it grow? Will it die? and What will happen if…? Some learners may ask more complex 'why' questions. But at this stage the focus is still more on observations than explanations.

Make predictions

Learners may communicate their predictions in spoken, written or sketched form or, in some cases, they could even act them out. Ask Learners to say whether they agree or disagree with a prediction made by the teacher or another learner. At this stage some learners may find it difficult to give a

reason for their prediction but others may be able to do this. All learners should be encouraged to think about their previous experience at home or at school before making a prediction.

Decide what to do to try to answer a science question
Learners should be able to discuss ways in which they might conduct an investigation prompted by the teacher. For example, they might be able to suggest the things needed to plant a seed, or suitable non-standard units to measure a distance. Some learners may find it easier to correct the teacher acting out an investigation incorrectly than to suggest their own ideas from scratch. These skills can be developed in units that involve a lot of investigative work, such as the topics of pushing and pulling in Unit 5 and hearing sounds in Unit 6. For example, you might ask learners how they could find out how far sounds travel in Topic 6.3 and to suggest different ways of measuring distances from the sound to the listener. As teacher you should design many opportunities for learners to discuss their progress and thoughts while planning the investigation, carrying it out, and considering the results.

Obtain and present evidence

Explore and observe in order to collect evidence (measurements and observations) to answer questions
Learners should be able to consider different ways to collect evidence, for example by setting up a test, making observations, reading or asking someone. Different ways of collecting evidence can be introduced across the stage. In the later units, ask learners at intervals to suggest ways to collect evidence to answer a question.

Any measurements at this stage will be in the form of non-standard units, such as numbers of building blocks for measuring distances. More often evidence will be collected as comparative observation, for example whether a sound is quiet, medium or loud; whether a plant is short, taller or tallest.

Learners should be able to talk about the similarities and differences they observe. Be aware that learners often find differences easier to identify than similarities. They should identify the main features of objects and those shared by different objects. Many topics lend themselves to practising observation and comparison. For example, Learner's Book Activities 3.1a How are we similar?, and 3.2 Our differences.

You should encourage learners to use their different senses to make observations. Sight, sound, touch and smell can all often be used. You should discourage the use of taste though in all tests except explicit taste tests, such as the one suggested in the teaching ideas for Topic 3.4. In all cases ensure that any observations are safe for learners.

Suggest ideas and follow instructions
Learners need to be encouraged to suggest ideas, while following instructions is an important skill which is useful across the curriculum. It is important to find a balance between these two skills. At this stage many activities will involve a discussion where learners can suggest ideas about how to investigate a question. This can be followed by the investigation in which learners follow instructions that were decided on during the discussion. For example, in Activity 6.3 learners plan an investigation into how far sounds can travel and may suggest different ways of measuring the distance between each learner and the sound source. In the investigation, they may then follow instructions given by the teacher which are based on these suggestions.

Record stages in work

Learners can record observations using measurements – for example '6 steps' – or comparative judgements – for example loud or quiet. Learners can cut and stick words, numbers or pictures to record what they observe. For example for the question 'Which sounds are loud?', learners could stick the word 'quiet', 'loud' or 'medium' next to a picture of each sound.

Learners are often asked to record what they see using drawings. For example, Learner's Book Activities 3.1a and 3.1b both ask learners to draw. It is not necessary to record every stage of every investigation.

Learners can record the different stages of an investigation into how something changes over time. For example, in Unit 2 Growing plants, it is helpful to record at least the start and the end of the investigations. In many cases recording one or more in between stages will also be useful to allow learners to see the progression.

Consider evidence and approach

Make comparisons

Learners should be able to make comparisons between, for example, each other (Activities 3.1a and 3.1b, Activity 3.2) and between living things. They should also be able to compare differences in, for example, materials. For example, in Activity 4.2 learners make comparisons between fabrics. This is extended in the investigation on Worksheet 6.2a where learners compare how fabrics muffle sound.

Compare what happened with predictions

Learners will need to be encouraged to look back at their predictions. Some learners may feel disappointed if their prediction was not correct. Explain to learners that science is often more interesting when predictions are proved wrong as this may show that we have learned something new. Some of the most important scientific discoveries have come from experiments that did not show the results that were expected. However, an unexpected result may also be the result of an investigation not being set up properly or not being a fair comparison. In this case it is important to talk about this with learners and, if there is time, to plan and complete an improved investigation.

At this stage learners can be expected to say whether their prediction was correct or not. Some may be able to give a simple reason – 'It grew more because it had water. I thought it would.' In Activity 5.3 learners are asked to predict whether objects will need a push or a pull to move them, then find out which is needed, then compare what happened with their predictions. In Activity 6.1 learners are asked to predict the sounds they will hear when they sit in silence for a short while and then compare what they thought they would hear with what they actually heard.

Model and communicate ideas in order to share, explain and develop them

Communication between scientists is vital. Scientists always record what they do in experiments, so that the results can be checked by others. There have been famous occasions, for example, the claim to have achieved 'cold fusion', where the results reported could not be repeated by others. In Topic 2.1, learners model what they have learnt in the lesson by 'building plants'. In Activity 5.1, learners are encouraged to explain what they are doing, which is communication.

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The following table gives an overview of which resources are available in the Stage 1 products in this series to support each Scientific enquiry objective.

Framework statement	Learner's Book	Activity Book	Teacher's Resource
Ideas and evidence			
Try to answer questions by collecting evidence through observation	Activities 1.1, 1.2a, 2.1, 2.2, 2.3, 3.1a, 3.4, 4.1, 4.2, 4.3b, 5.1, 5.2, 5.4, 6.1, 6.3		Worksheets 1.1a, 1.2a, 2.2a, 2.3a, 4.2a, 6.2a
Plan investigative work			
Ask questions and contribute to discussions about how to seek answers	Activities 2.3, 4.3a, 4.3b, 5.4, 6.3	Exercise 4.3	Worksheets 4.3b, 6.2a
Make predictions	Activities 1.2a, 2.2, 2.3, 4.2, 5.3, 5.4, 6.1, 6.2, 6.3	Exercises 1.3, 2.2, 5.4	Worksheets 1.1a, 1.2a, 2.2a, 4.2a, 5.4b
Decide what to do to try to answer a science question	Activities 2.3, 3.2, 4.3b, 6.3	Exercise 1.3	Worksheets 4.2a, 4.3b, 6.2a
Obtain and present evidence			
Explore and observe in order to collect evidence (measurements and observations) to answer questions	Activities 1.1, 1.2a, 2.1, 2.2, 2.3, 3.1a, 3.2, 3.4, 4.1, 4.3a, 4.3b, 5.3, 5.4, 6.1, 6.2, 6.3	Exercises 2.1, 3.1, 5.2	Worksheets 1.1a, 1.2a, 2.2a, 2.3a, 2.3b, 4.1a, 4.3b, 6.2a
Suggest ideas and follow instructions	Activities 1.2b, 1.3, 2.2, 2.3, 3.4, 4.2, 4.3b, 5.1, 6.2, 6.3		Worksheets 1.3, 3.4, 4.2a, 6.2a
Record stages in work	Activities 1.1, 1.2a, 1.4, 2.2, 2.3, 3.1a, 3.1b, 4.1, 4.2, 5.2, 6.1, 6.3	Exercises 2.1, 3.1, 3.2, 4.3	Worksheets 1.1a, 1.2a, 1.3, 1.4a, 2.2a, 2.3a, 2.3b, 3.4, 4.1a, 4.2a, 4.3b, 6.2a, 6.3a
Consider evidence and approach			
Make comparisons	Activities 1.2a, 1.4, 2.2, 2.3, 3.1a, 3.1b, 3.2, 4.2, 4.3a, 4.3b, 5.2, 5.4, 6.1, 6.2, 6.3 Check your progress questions 3.1, 6.1, 6.3	Exercises 1.2, 1.3, 2.2, 3.1, 3.2, 4.3, 5.1, 5.2, 5.3, 6.2, 6.3	Worksheets 3.2, 4.3a, 6.2a, 6.2b, 6.3a
Compare what happened with predictions	Activities 2.2, 2.3, 4.2, 5.3, 6.1, 6.2		Worksheets 1.1a, 1.2a
Model and communicate ideas in order to share, explain and develop them	Activities 1.2b, 1.3, 2.2, 4.2, 4.3a, 4.3b, 5.1, 5.2 Check your progress questions 2.2, 2.3	Exercises 1.3, 6.3	Worksheet 2.1a