CAMBRIDGE PRIMARY Science

Teacher's Resource

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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 to develop enquiry skills as well as subject knowledge.

This Teacher's Resource for Stage 2 gives extensive support for teaching Stage 2 of the curriculum framework. It frequently references the *Learner's Boo*k, ISBN 978-1-107-61139-9 and *Activity Book*, ISBN 978-1-107-61143-6, for Stage 2, 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 on 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 other 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 an 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.

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 1 Going outside is best taught in the warmer months when learners can observe plants and animals. This will depend on the local climate.

Unit 3 Changing materials includes lots of hands-on testing for learners. It might therefore be a useful unit to teach early on so as to establish the importance of learner independence in investigations. Unit 4 Light and dark is best taught before Unit 6 The Earth and the Sun which may require a clearer understanding of light and dark; but this is by no means essential. If you are in a part of the world that experiences clear seasons, it would be better to teach Unit 4 at a time of year when it is likely to be sunny, and the days are not too short. This way you can make the most of the opportunity to examine shadows outside.

Learners might see these six topics at Stage 2 as quite separate. You should point clearly to links between the content of the different units. For example, Units 2 and 3 both examine the different properties of various materials, which builds on knowledge from Stage 1. Further links that can be made are suggested in the Teaching ideas.

These are two alternative sequences you might consider, though you may invent your own. Biology units are dark grey, chemistry units light grey and physics units white.

Sequence 1:

Unit 1 Going outside	Unit 3 Changing materials	Unit 2 Looking at rocks	Unit 5 Electricity	Unit 4 Light and dark	Unit 6 The Earth and the Sun

Sequence 2:

Unit 3 Changing materials	Unit 5 Electricity	Unit 4 Light and dark	Unit 6 The Earth and the Sun	Unit 2 Looking at rocks	Unit 1 Going outside

Scientific enquiry

Scientific enquiry is about how scientific ideas emerge, 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* series 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 2. 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

Collect evidence by making observations when trying to answer a science question.
Learners may collect evidence in the form of pictures, numbers and words through hands-on investigations and research in age-appropriate books. Teachers should model these skills and organise opportunities for shared writing and discussion of evidence. Encourage learners to have a science question in mind as they collect evidence, and to find evidence that will help to answer that specific question. It will help them to work sometimes in pairs and groups and sometimes alone. They should gather information from a range of sources and by counting and measuring using standard and non-standard measures. The skill of collecting evidence should be developed across the whole stage, but examples could include: Learner's Book Activity 1.3 Today's weather; Worksheet 2.3c How good is soil for growing seeds?

Use first-hand experience, e.g. observe melting ice.
Learners should be given every opportunity to learn from observation of first-hand experience. Try to ensure that all learners (or as many as possible) are able to handle and describe materials and experiences. They should use their senses of sight, touch and hearing. Encourage them to discuss what they experience and whether it reinforces previous similar experiences or is different in some way. Ensure that you model careful observation and, importantly, the correct science vocabulary relevant to the experience. The key word in this objective is 'use', so bear in mind that learners should not just have experiences, but also use those experiences to further their learning. Observations can be used to identify similarity and difference, use vocabulary, elicit understanding, generate questions and record observations in many different forms. You may have to model the use of first-hand experiences, for example by pointing out similarities as well as differences. The materials provide numerous opportunities including: Learner's Book Activity 2.3 Finding the rock in soil; Activity Book Exercise 1.3 Our weather.

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Use simple information sources.
A range of simple information sources should be used by learners. These will include the results of their observations and investigations, and suitable secondary sources such as internet sites and books. Again learners need to use the information, which means more than just gather it. They can use it to check out ideas they may have, to answer questions, to extend the range of information available, to generate more questions, to look for patterns, to identify examples and to define ideas. Examples of such information sources include websites such as www.bbc.co.uk/learningzone/clips/how-have-different-animals-adapted-to-their-habitats/12665.html, which shows a four-minute clip of animals in hot, cold, wet and dry environments. Many more websites are suggested throughout the Teaching ideas.

Plan investigative work

Ask questions and suggest ways to answer them.
By encouraging your learners to ask science questions you are setting an excellent tone for your science teaching. Learners may need support framing questions in a scientific way, but they will be highly motivated by questions they generate themselves. Model and teach them question formats including: How far…? How many…? How fast…? Which is louder? Will it grow? Will it die? and What will happen if…? You should increasingly ask them to pose 'why' questions so that they are forced to consider explanations. Use numerous simple examples to model this process, such as Why do adult birds have babies? or Why do insects keep moving as if they are searching for something?

Predict what will happen before deciding what to do.
Make it routine that before a test, experiment or demonstration you ask the learners to say what they think will happen. Encourage them to explain how they arrived at their prediction. This will be a challenge for some learners so they may need some support at this stage. The prediction can be given in any form. Do give attention and value to all predictions, emphasising that predictions do not have to be correct. What is important is that the prediction can be tested, and that the test will show whether or not the prediction was correct – either way, we have learnt something! Learners should then use their prediction to help them decide how they will carry out the test or experiment.

Recognise that a test or comparison may be unfair.
This is an important step towards being able to design a fair test. Allow the learners to consider and review potential investigations and discuss whether they are fair or not. You might initiate this with examples which are grossly unfair. It will assist some learners to see a potential test trialled so that they can see the element which is not fair. For example, you could demonstrate a test in which you compare how high two balls bounce, but drop the balls from different heights.

Obtain and present evidence

Make suggestions for collecting evidence.
Ensure that pairs and groups have time to consider how a test or investigation is carried out. This will give learners the opportunity to think about evidence they might collect. It will help them if they understand the science question being addressed and then consider variables which they might change, measure/observe or control. Do give time to all suggestions as you want to encourage everyone to contribute. Learners may make suggestions which are not used but these are still acceptable suggestions. Opportunities for developing this skill can be found throughout the materials; for example, in Activity 1.1 Compare two different places learners can suggest which two different places they want to investigate.

Talk about risks and how to avoid danger.
It is worthwhile to shift a little responsibility onto the learners by asking them to think about risks posed to themselves and others by their investigation. A few minutes spent as a pair, group or class considering potential risks will result in a safer classroom and also in learners increasingly thinking about harmful consequences. Challenge them to suggest ways to make the activities as safe as possible. Ultimately, it is of course your responsibility to ensure that activities are safe. But, involving the learners is one very effective way of making sure they understand ideas about safety. Unit 3 has many opportunities to think about risk in the activities that involve heating different materials.

Make and record observations.
Learners should make a variety of different observations, which they then record. These include drawings and sketches, photographs and writing. They should use different senses and realise that this is an important part of what scientists do. Learners should use their observations to confirm or reject predictions, to make comparisons and to identify similarity and difference. Making and recording observations should be a key part of any activity. But you can particularly focus on this skill in Unit 1 where learners are expected to make observations of the weather and record data.

Take simple measurements.
Many of the materials provided cater for measurements in non-standard units. For example, Exercise 6.3 in the Activity Book asks learners to measure the length of shadows using counters or coins. As you progress through the mathematics curriculum, you can also allow learners to make measurements of length and time in standard units in a science context. Indeed, this is a good way of reinforcing the skills learnt in mathematics. Other phenomena may be measured more qualitatively, and may be based on comparison. For example, in Worksheet 1.3d learners make a wind meter and use this to make qualitative measurements of the wind strength. Measurements on different days can then be compared.

Use a variety of ways to tell others what happened.
In the future, learners should be able to select the means by which they will describe their findings. At this stage, you should create opportunities to try out a range of methods and consider how effective they are. These might include forms of writing, drawings, sketches, models, audio recording, photographs and film. You can create these opportunities for any activities, but learners can be particularly creative in sharing their weather observations in Unit 1, and their observations of shadows in Units 4 and 6.

Consider evidence and approach

Make comparisons.
Learners should make comparisons in observations and in results from their investigations. They should seek similarities and differences and examples they find unexpected. These are often examples which allow learners to review their understanding. The materials include many opportunities for comparisons. Sometimes these are obvious, such as in Activity 1.1 where learners compare the living organisms they find in two different places. However, learners should also begin to realise that they are making comparisons in other situations, and that conclusions can be drawn from the comparisons. For example, in Activity 4.1 they are comparing how different objects appear in a dark place, from which they can conclude that some of these objects are light sources while others are not.

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Identify simple patterns and associations.
Learners should consider observations and evidence carefully to establish any patterns. This may help learners to spot that one thing leads to another, or that two phenomena always appear together, which helps them to understand the science. This skill can be practised in many different contexts. For example, from the activities in Topic 5.4 learners should realise that there is a pattern in how the coloured wires from a buzzer or motor need to be connected to a cell to make a circuit work. Learners can use the patterns they identify to make further predictions. For example, learners can use the weather data they record in Unit 1 to see if they can predict the weather to come.

Talk about predictions (orally and in text), the outcome and why this happened.
Having made predictions in many activities in the materials, time should be found for learners to discuss and consider whether their observations support the different predictions made or not. They should look at different outcomes of activities and say why they think these things happened. Opportunities can be found in all the topics. Good examples include: Activity 3.4, where learners can discuss whether the effects of heating different foods were what they expected; Activity 4.4a, where learners study whether they can successfully make the hand shadows, and if not, what they are doing wrong.

Review and explain what happened.
This can be the most challenging part of science for younger children. However, this means that they can learn most from it. Some learners will need to talk about the investigations and review their results carefully. For example, after completing an investigation, ask learners to review the initial questions and determine the extent of their success in answering the question. They should also review their predictions, and determine whether or not the predictions were correct.. They may need to have time to talk about things that went well, difficulties they encountered, and things that surprised them. There are very good opportunities to practise this skill: for example, in Topic 3.3, both in Activity 3.3 where learners stretch elastic bands of different thicknesses, and in Worksheet 3.3d where learners stretch different materials. These activities lend themselves to thinking about scientific explanations for the observations recorded, as well as factors relating to the test itself such as whether it was fair, or would have been easier to do a different way.

The following table gives an overview of which resources are available in the Stage 2 products in this series to support each scientific enquiry objective.

Framework statement	Learner's Book	Activity Book	Teacher's Resource
Ideas and evidence			
Collect evidence by making observations when trying to answer a science question.	Activities 1.1, 1.2, 1.3, 2.1, 3.1, 3.3, 3.4, 4.1, 4.2, 5.1, 5.4a, 5.4b, 6.2, 6.3a, 6.3b	Exercise 1.3	Worksheets 1.3a, 1.3d, 2.1a, 2.1b, 2.3c, 2.3d, 3.1a, 3.3b, 3.3d, 3.4a, 3.4c, 3.5d, 4.2, 5.3b, 6.2a, 6.3
Use first-hand experience, e.g. observe melting ice.	Activities 1.1, 1.2, 1.3, 2.1, 2.2, 2.3, 2.4, 3.1, 3.2, 3.3, 3.4, 3.5, 4.1, 4.2, 4.3, 4.4a, 4.4b, 5.1, 5.3, 5.5, 6.2, 6.3a, 6.3b	Exercise 1.3	Worksheets 1.3a, 1.3d, 2.1a, 2.1b, 2.1c, 2.2b, 2.3a, 2.3b, 2.3c, 2.3d, 2.4a, 2.4b, 3.1, 3.2a, 3.2b, 3.3a, 3.3b, 3.3d, 3.4b, 3.4c, 3.5a, 3.5b, 3.5c, 3.5d, 4.1a, 4.2, 4.3a, 4.3b, 5.3b, 6.2a, 6.3
Use simple information sources.	Activities 1.4, 3.2, 3.4, 4.4a, 5.1, 5.2 Check your progress questions Unit 1 Q2, Q4; Unit 2 Q1	Exercises 3.1, 5.1	Worksheets 1.1d, 1.2b, 1.3a, 1.3c, 1.3d, 2.2c
Plan investigative work			
Ask questions and suggest ways to answer them.	Activities 3.3, 4.1, 6.3a		Worksheets 3.3a, 3.3b, 3.3d, 3.5d
Predict what will happen before deciding what to do.	Activities 1.2, 3.1, 3.5, 4.1, 4.2, 5.3, 5.4a, 5.4b, 5.5, 6.3a	Exercises 3.1, 3.3, 3.5, 4.4	Worksheets 1.2b, 2.1c, 2.3c, 2.3d, 3.1, 3.3a, 3.3b, 3.3d, 3.4b, 3.5a, 3.5b, 3.5c, 3.5d, 3.5e, 4.1a, 4.4, 5.3b
Recognise that a test or comparison may be unfair.	Activities 1.1, 3.3, 3.5, 6.3a, 6.3b	Exercise 6.3	Worksheets 2.1c, 2.3c, 2.3d, 3.3d, 3.5b, 3.5d
Obtain and present evidence			
Make suggestions for collecting evidence.	Activities 1.1, 1.2, 4.1, 6.2, 6.3a, 6.3b		Worksheets 1.1d, 2.3c, 3.3d, 3.5d, 4.4
Talk about risks and how to avoid danger.	Activities 1.4, 3.3, 4.1, 4.3, 5.2, 5.3, 5.4a, 5.5, 6.2, 6.3a, 6.3b	Exercise 5.2	Worksheet 3.3d, 3.4b, 5.2

Make and record observations.	Activities 1.1, 1.2, 1.3, 2.1, 2.2, 2.3, 2.4, 3.1, 3.2, 3.3, 3.4, 3.5, 4.1, 4.2, 4.3, 5.1, 5.3, 5.4a, 5.4b, 5.5, 6.2, 6.3a, 6.3b	Exercises 1.1, 1.3, 2.3, 3.2, 3.4, 5.3, 5.5	Worksheets 1.1a, 1.1b, 1.1c, 1.1d, 1.3a, 1.3b, 1.3d, 2.1a, 2.1b, 2.1c, 2.2a, 2.2b, 2.3a, 2.3b, 2.3c, 2.3d, 2.4a, 2.4b, 3.1a, 3.2a, 3.2b, 3.3a, 3.3b, 3.3d, 3.4a, 3.4b, 3.4c, 3.5a, 3.5b, 3.5c, 3.5d, 4.1a, 4.2, 4.3a, 4.3b, 4.4, 5.3a, 5.3b, 5.3c, 5.3d, 5.4a, 5.4b, 5.5, 6.2a, 6.3
Take simple measurements.	Activities 1.1, 3.3, 3.4, 3.5, 6.2, 6.3b	Exercises 6.3	Worksheets 1.3a, 2.1c, 2.3, 3.3a, 3.3b, 3.3d, 3.5a, 3.5b, 3.5d, 6.2a, 6.3
Use a variety of ways to tell others what happened.	Activities 1.3, 1.4, 2.1, 2.2, 2.4, 3.1, 3.5, 4.2, 5.2, 5.3, 6.2	Exercises 1.3, 2.1, 3.1, 3.4, 3.5, 4.2, 5.3, 5.5	Worksheets 1.2b, 1.3b, 1.3d, 1.4, 2.1a, 2.1b, 2.1c, 2.2a, 2.2c, 2.3b, 2.4a, 2.4b, 3.1a, 3.5a, 3.5b, 3.5e, 4.1b, 4.2, 5.3b, 5.3c, 5.3d, 5.4a, 5.4b, 6.2a, 6.3
Consider evidence and approach			
Make comparisons.	Activities 1.1, 2.1, 2.2, 2.3, 2.4, 3.1, 3.3, 3.4, 4.1, 5.4a, 5.4b Check your progress question Unit 6 Q1	Exercises 1.3, 1.4, 2.1, 2.3, 2.4, 3.1, 3.2, 3.3, 3.5, 4.3, 5.3, 5.5, 6.1, 6.3	Worksheets 1.1a, 1.1b, 1.3b, 1.3c, 2.1a, 2.1b, 2.1c, 2.2a, 2.3a, 2.3b, 2.3c, 2.3d, 2.4a, 2.4b, 3.1, 3.2b, 3.3b, 3.3c, 3.3d, 3.4a, 3.4b, 3.4c, 3.5b, 3.5d, 4.1a, 4.2, 4.3b, 5.1, 6.1a, 6.1b, 6.2a, 6.2b, 6.3
Identify simple patterns and associations.	Activities 1.1, 2.4, 3.3, 3.4, 3.5, 4.3, 4.4a, 4.4b, 5.4a, 5.4b, 6.1, 6.2, 6.3a, 6.3b Check your progress questions Unit 4 Q3, Unit 5 Q3, Unit 5 Q4, Unit 6 Q3	Exercises 1.4, 2.1, 2.3, 3.1, 3.3, 4.3, 4.4	Worksheets 1.4, 2.1c, 2.2c, 2.3a, 2.3b, 2.3c, 2.3d, 2.4b, 3.2b, 3.3c, 3.4b, 4.2,4.3b, 6.1a, 6.1b, 6.2a, 6.2b, 6.3
Talk about predictions (orally and in text), the outcome and why this happened.	Activities 3.1, 4.1, 4.2, 5.4a, 5.4b, 5.5		Worksheets 2.3c, 2.3d, 3.3d, 4.1a, 4.4
Review and explain what happened.	Activities 3.4, 4.2, 4.4b, 5.4a, 5.5, 6.2 Check your progress question Unit 1 Q1, Q4; Unit 4 Q2	Exercises 1.3, 2.1, 2.3, 3.1, 3.3, 3.5, 4.2, 5.3, 5.5	Worksheets 1.3c, 3.1, 3.2b, 3.3b, 3.3c, 3.3d, 3.4b, 3.5c, 4.3a, 5.3a, 5.5