

Scheme of Work

Cambridge Primary

Science 0097

Stage 2

This Cambridge Scheme of Work is for use with the

Cambridge Primary Science Curriculum Framework published in September 2020 for first teaching in September 2021.

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# Introduction

This document is a scheme of work created by Cambridge Assessment International Education for Cambridge Primary Science Stage 2.

It contains:

* suggested units showing how the learning objectives in the curriculum framework can be grouped and ordered
* at least one suggested teaching activity for each learning objective
* a list of subject-specific language that will be useful for your learners
* some possible models and representations that are relevant to the learning objectives
* some possible misconceptions learners may have, or develop
* sample lesson plans.

You do not need to use the ideas in this scheme of work to teach Cambridge Primary Science Stage 2. This scheme of work is designed to indicate the types of activities you might use, and the intended depth and breadth of each learning objective. These activities are not designed to fill all of the teaching time for this stage. You should use other activities with a similar level of difficulty, including those from endorsed resources.

The accompanying teacher guide for Cambridge Primary Science will support you to plan and deliver lessons using effective teaching and learning approaches. You can use this scheme of work as a starting point for your planning, adapting it to suit the requirements of your school and needs of your learners.

## Long-term plan

This long-term plan shows the units in this scheme of work and a suggestion of how long to spend teaching each one. The suggested teaching time is based on 45 total hours of teaching for Science Stage 2 at 1.5 hours a week. The actual number of teaching hours may vary according to your context.

| Unit and suggested order | Suggested teaching time |
| --- | --- |
| **Unit 2.1** Materials in our world | 17% (7.5 hours) |
| **Unit 2.2** Living things in different places | 19% (8.5 hours) |
| **Unit 2.3** Light from different sources | 17% (7.5 hours) |
| **Unit 2.4** Growing and keeping healthy | 17% (7.5 hours) |
| **Unit 2.5** Make a change | 13% (6.5 hours) |
| **Unit 2.6** Polar explorer | 17% (7.5 hours) |
| **Total** | **45** **hours** |

## Sample lesson plans

You will find two sample lesson plans at the end of this scheme of work. They are designed to illustrate how the suggested activities in this document can be turned into lessons. They are written in more detail than you would use for your own lesson plans. The Cambridge Primary Science Teacher Guide has information on creating lesson plans.

## Other support for teaching Cambridge Primary Science Stage 2

Cambridge Primary centres receive access to a range of resources when they register. The Cambridge Primary support site at [**https://primary.cambridgeinternational.org**](https://primary.cambridgeinternational.org) is a password-protected website that is the source of the majority of Cambridge-produced resources for the programme. Ask the Cambridge Coordinator or Exams Officer in your school if you do not already have a log-in for this support site.

Included on this support site are:

* the Cambridge Primary Science Curriculum Framework, which contains the learning objectives that provide a structure for your teaching and learning
* grids showing the progression of learning objectives across stages
* the Cambridge Primary Science Teacher Guide, which will help you to implement Cambridge Primary Science in your school
* templates for planning
* worksheets for short teacher training activities that link to the teacher guide
* assessments provided by Cambridge
* a list of endorsed resources, which have been through a detailed quality assurance process to make sure they are suitable for schools teaching Cambridge Primary Science worldwide
* links to online communities of Cambridge Primary teachers.

## Resources for the activities in this scheme of work

We have assumed that you will have access to these resources:

* paper, graph paper, pens, pencils, rulers and calculators for learners to use
* clean water
* the internet.

Other suggested resources for individual units and/or activities are described in the rest of this document. You can swap these for other resources that are available in your school.

Activities that require a resource that may be more difficult to find are marked ‘Requires additional resources*’*, with a suggested alternative activity immediately below.

The Cambridge Primary Science Equipment List provides a list of recommended scientific equipment that your school should have access to in order to teach all stages of Cambridge Primary Science. It is available on the support site.

## Websites

There are many excellent online resources suitable for teaching Cambridge Primary Science. Since these are updated frequently, and many are only available in some countries, we recommend that you and your colleagues identify and share resources that you have found to be effective for your learners.

## Approaches to teaching Cambridge Primary Science Stage 2

There are three components to the Cambridge Primary Science Curriculum:

* four content strands (Biology, Chemistry, Physics, and Earth and Space)
* one skills strand (Thinking and Working Scientifically)
* one context strand (Science in Context).

When planning lessons, the three components should work together to enable you to provide deep, and rich, learning experiences for your learners.

We recommend you start your planning with a learning objective from one of the four content strands. This determine the focus of the lesson. Once there is a content learning objective lesson focus you can consider what Thinking and Working Scientifically learning objectives can be integrated into your teaching so learners are developing their scientific skills alongside their knowledge and understanding of science.

This approach is exemplified in this scheme of work by providing activities that cover the content learning objectives while also developing selected Thinking and Working Scientifically learning objectives. Some Thinking and Working Scientifically learning objectives are covered multiple times over the scheme of work which reflects the need for learners to have several opportunities to develop skills.

The selection, and frequency, of Thinking and Working Scientifically learning objectives in this scheme of work may match the needs of your learners. However, the selection of Thinking and Working Scientifically learning objectives needs suit the requirements of your school and needs of your learners. Any changes to what Thinking and Working Scientifically learning objectives are selected to be developed when teaching the content learning objectives will require activities to be reviewed and edited.

Once you are confident with the combination of content and Thinking and Working Scientifically learning objectives, you then have the option to integrate context into your lessons to show how the learning objectives and/or skills relate to the world the learners know and experience. The Science in Context learning objectives provide guidance on doing this. As including context is dependent on your learners and your context, the scheme of work does not give contextual links to an activity. Possible ways to contextualise units are provided in the unit introductions, aligned to the relevant Science in Context objectives.

Further support about integrating Thinking and Working Scientifically and Science in Context into lessons can be found in the Cambridge Primary Science Teacher Guide.

Models and representations

Scientists use models and representations to represent objects, systems and processes. They help scientists explain and think about scientific ideas that are not visible or are abstract. Scientists can then use their models and representations to make predictions or to explain observations. Cambridge Primary Science includes learning objectives about models and representations because they are central to learners’ understanding of science. They also prepare learners for the science they will encounter later in their education.

To support the integration of models and representations into your teaching, for each learning objective we have suggested possible models you may wish to use.

Misconceptions

Scientific misconceptions are commonly held beliefs, or preconceived ideas, which are not supported by available scientific evidence. Scientific misconceptions usually arise from a learner’s current understanding of the world. These ideas will informed by their own experiences rather than evidence. To support you in addressing misconceptions, for each learning objective in each unit we have suggested, where relevant, possible misconceptions to be aware of.

Due to the range of misconceptions that learners can hold not all misconceptions have been provided and you may encounter learners with misconceptions not presented in this scheme of work.

Misconceptions may be brought to the lesson by the learners, reinforced in the lesson, or created during a lesson. It is important that you are aware of misconceptions that learners may exhibit so that you can address them appropriately.

It is important to note that not all misconceptions are inappropriate based on the conceptual understanding learners are expected to have at different stages of their education. Therefore, some misconceptions may be validly held by learners at certain stages of their learning. A misconception of this type is known as an age-appropriate concept. Trying to move learners away from age-appropriate concepts too soon may give rise to other, more significant, misconceptions or barriers to their understanding of science. Over time age-appropriate concepts can become misconceptions when they start to interfere with the expected level of understanding learners need to have.

The misconceptions flagged in this scheme of work are considered to be either inappropriate concepts for a learner at this stage of understanding science or important age-appropriate concepts to be aware of so they are not challenged too early.

Health and safety

An essential part of this curriculum is that learners develop skills in scientific enquiry. This includes collecting primary data by experiment. Scientific experiments are engaging and provide opportunities for first-hand exploration of phenomena. However, they must, at all times, be conducted with the utmost respect for safety, specifically:

* It is the responsibility of the teacher in charge to adhere and conform to any national, regional and school regulation in place with respect to safety of scientific experimentation.
* It is the responsibility of the teacher in charge to make a risk assessment of the hazards involved with any particular class or individual when undertaking a scientific experiment that conforms to these regulations.

Cambridge International takes no responsibility for the management of safety for individual published experiments or for the management of safety for the undertaking of practical experiments in any given location. Cambridge International only endorses support material in relation to curriculum content and is not responsible for the safety of activities contained within it. The responsibility for the safety of all activities and experiments remains with the school.

The welfare of living things

Throughout biology, learners study a variety of living things, including animals. As part of the University of Cambridge, Cambridge International shares the approach that good animal welfare and good science work together.

Learners should have opportunities to observe animals in their natural environment. This should be done responsibly and not in a way that could cause distress or harm to the animals or damage to the environment.

If living animals are brought into schools then the teacher must ensure that any national, regional and school regulations are followed regarding animal welfare. In all circumstances, the teacher responsible must ensure all animals have:

* a suitable environment, including being housed with, or apart from, other animals (as required for the species)
* a suitable diet
* the opportunity to exhibit normal behaviour patterns
* protection from pain, injury, suffering and disease.

There is no requirement for learners to participate in, or observe, animal dissections for Cambridge Primary. Although dissection can provide a valuable learning opportunity, some learners decide not to continue studying biology because they dislike animal dissection. Several alternatives are available to dissection (such as models and diagrams) which you should consider during your planning.

If you decide to include animal dissection then animal material should be obtained from premises licensed to sell them for human or pet consumption, or from a reputable biological supplier. This approach helps to ensure animal welfare standards and also decreases the risk from pathogens being present in the material. Neither you nor your learners should kill animals for dissection.

When used, fresh material should be kept at 5 °C or below until just before use. Frozen material should be defrosted slowly (at 5 °C) without direct heat. All fresh or defrosted material should be used within 2 days. Preserved animal materials should only be handled when wearing gloves and in a well-ventilated room.

The responsibility for ensuring the welfare of all animals studied in science remains with the school.

# Unit 2.1 Materials in our world

| Unit 2.1 Materials in our world (7.5 hours) |
| --- |
| Outline of unit: |
| This explores materials and their properties within the context of rocks (including their extraction). It begins with a look at how rocks can be different from, and similar to each other, then explains where rocks come from and how humans use them for a range of different purposes. Learners then consider the origins of other natural and manufactured materials. The unit finishes by taking a closer look at why materials are chosen for different purposes based on their properties; learners consider why some materials are much better suited to certain uses than others.  With a lot of activities in this unit, there should be discussion around materials and their properties with opportunities for learners to hear and apply a broad range of scientific vocabulary. |
| Recommended prior knowledge or previous learning required for the unit: |
| Learners will benefit from previous experiences of:   * identifying, naming, describing, sorting and grouping common materials (e.g. wood, plastic, metal, glass, rock, paper, fabric) * understanding the difference between an object and a material * understanding that all materials have a variety of properties and describing common materials in terms of their properties * knowing that Earth is the planet on which we live and land is made of rock and soil. |
| Suggested examples for teaching Science in Context: |
| ***2SIC.01*** *Talk about how some of the scientific knowledge and thinking now was different in the past.*  While learning about rock extraction, learners could look at the difference that advances in technology and scientific understanding have made to the life of a miner by finding out more about the lives of miners both in the past and now.  ***2SIC.02*** *Talk about how science explains how objects they use, or know about, work.*  It is likely that learners will be familiar with rocks but may never have thought about their origin, the difference between different rocks and the reasons for these differences. Discussion of different rocks and their uses in our everyday lives will highlight the science behind these common objects.  ***2SIC.03*** *Know that everyone uses science and identify people who use science professionally.*  Studying rock extraction provides an opportunity to learn about the people involved in this work, as well as what is then done with the rocks that are extracted. If possible, a visit to a quarry or similar setting would allow learners to see the science in action. Learners could also find out more about people working with rocks (e.g. archaeologist, geologist).  ***2SIC.04*** *Talk about how science helps us understand our effect on the world around us.*  Quarries and mines provide a context for discussion about how humans have altered the natural environments around them and the impact on the plants and animals that inhabit them. |

| Learning objective | Key vocabulary | Possible models and representations | Possible misconceptions |
| --- | --- | --- | --- |
| **2ESp.01** Describe and compare different types of rock. | Rock, stone, pebble, boulder, compare, same, similar, different, difference, size, rough, smooth, shiny, dull, waterproof, crystals | Learners can draw pictures of different rocks and focus on how to represent the differences between them. | Learners can think that a ‘rock’ and a ‘stone’ or ‘pebble’ are different things, rather than understanding that ‘stone’ and ‘pebble’ are words commonly used for small rocks. Make it clear to your learners that stones and pebbles are rocks, they are just sometimes called stones or pebbles because we use different words to differentiate rocks by size. For example, pebbles and stones are small rocks and a large rock could be called a boulder.  Learners can also assume the word ‘similarity’ implies things are identical, rather than just alike. Ensure you make clear the difference between things that are identical and things that are similar. |
| **2Cp.01** Describe a property as a characteristic of a material and understand that materials can have more than one property. | Material, property, characteristic, feature, hard, soft, rough, smooth, dull, shiny, rigid, flexible, bendy, waterproof, permeable, opaque, transparent | Learners can create simple diagrams on which they draw an image of a material, then label a number of characteristics of that material. For example, they could label an image of a piece of metal as rigid, shiny, smooth and waterproof. | Learners can assume that the term ‘material’ refers only to fabric. Ensure you use the term correctly many times and give learners lots of opportunities to practise the correct use while carrying out activities that explore materials and their properties. |
| **2Cp.02** Explain why materials are chosen for specific purposes on the basis of their properties. |
| **2ESp.02** Know rocks are extracted from the Earth in different ways, including from quarries, mines and riverbeds. | Rock, Earth, extract, extracted, extraction, quarry, mine, riverbed | Labelled diagrams of working quarries, mines and riverbeds (showing the equipment and processes necessary for rock extraction) can help learners understand how the rocks we use are extracted from the Earth. | Learners can think that rocks were made by humans, rather than correctly understanding that they are formed naturally. This misconception will be addressed as Learners consider the different ways rocks can be extracted from the Earth. |
| **2Cm.01** Understand that some materials occur naturally and others are manufactured. | Material, natural, manufactured | Learners can study a diagram of an outdoor environment which includes manufactured materials; they label which materials are naturally occurring and which ones are manufactured. | Learners can assume everything exists because a human made it. Address this misconception by making the distinction between natural and manufactured very clear to learners, and repeatedly using this vocabulary to describe materials when carrying out the activities in this unit. |
| **2ESp.03** Know that human activity can affect the environment. | Environment, affect, impact, change, natural, manufactured | Learners could use drama to demonstrate their understanding of human activity affecting the environment. | Learners can assume that every environment they encounter has been made that way by humans, rather than understanding that some areas have naturally formed. Make learners aware of environments that have been created and shaped by nature as well as those that have been altered or entirely manufactured by humans, pointing out the differences between them. |
| **2Cp.03** Know that materials can be tested to determine their properties. | Material, property, hard, soft, rough, smooth, dull, shiny, rigid, flexible, bendy, waterproof, permeable, opaque, transparent | Learners can represent the testing of a material through a series of diagrams or a comic strip. | Learners can assume that ‘smooth’ means the same as ‘soft’, and ‘rough’ means the same as ‘hard’. To address this misconception, allow learners to feel a range of materials with different combinations of these properties, for example something that is smooth and hard or an object that is soft and rough, repeatedly modelling the correct vocabulary throughout. |

# Unit 2.1 Suggested activities

| Learning objective | Thinking and Working Scientifically opportunities | Suggested teaching activities and resources |
| --- | --- | --- |
| **2ESp.01** Describe and compare different types of rock.  **2Cp.01** Describe a property as a characteristic of a material and understand that materials can have more than one property. | **2TWSp.01** Ask questions about the world around us and talk about how to find answers.  **2TWSc.01** Sort and group objects, materials and living things based on observations of the similarities and differences between them.  **2TWSc.06** Collect and record observations and/or measurements by annotating images and completing simple tables. | **Comparing rocks (requires additional resources)**  Allow learners to explore a range of different types of rocks. They could use simple equipment to make close observations (e.g. magnifying glasses or hand lenses).  *What can you observe about this rock?*  *What similarities/differences are there between these rocks?*  Discuss with learners what they would like to find out about rocks; prompt them to consider how they could find out the answers.  *Could we investigate that ourselves in the classroom?*  *Where might we find more information in order to answer your question?*  Record learners’ questions and refer back to them when carrying out other activities that address them.  Explain the term ‘property’ as a characteristic (a feature) something has. Ask learners for examples of properties based on the observations of rocks that they have made (e.g. hard, smooth, shiny). Give learners a set of sorting criteria based on properties they can see or feel (e.g. smooth or rough, those that have crystals and those that do not, and shiny or dull) and ask them to sort their rocks. Afterwards, encourage learners to come up with their own sorting criteria.  After sorting according to a number of different properties, highlight the fact that materials, including rocks, can have more than one property. Demonstrate by choosing one rock and listing its properties. Learners then draw a simple image of one or more rocks and label it with the properties they have observed.  **Resources:**  Assortment of different rocks, magnifying glasses or hand lenses |
| **2TWSp.01** Ask questions about the world around us and talk about how to find answers.  **2TWSc.01** Sort and group objects, materials and living things based on observations of the similarities and differences between them.  **2TWSc.05** Use a given secondary information source to find an answer to a question. | **Comparing rocks**  Show learners photographs of a range of rocks with observable differences (e.g. different colours, clear differences in texture).  *What can you observe about this rock?*  *What similarities/differences are there between these rocks?*  Discuss with learners what they would like to find out about rocks; prompt them to consider how they could find out the answers.  *Could we investigate that ourselves in the classroom?*  *Where might we find more information in order to answer your question?*  Record learners’ questions and refer back to them when carrying out other activities that address them.  Explain the term ‘property’ as a characteristic something has (e.g. hard, shiny, waterproof). Give learners cards, each displaying a photograph of a type of rock and a brief list of its properties. Ask learners to sort their cards according to given properties of the rock (by carefully observing the picture or reading the list). Afterwards, encourage learners to come up with their own sorting criteria.  After sorting according to a number of different properties, highlight the fact that materials, including rocks, can have more than one property; demonstrate by choosing one rock and listing its properties.  **Resources:**  Rock cards |
| **2ESp.02** Know rocks are extracted from the Earth in different ways, including from quarries, mines and riverbeds.  **2ESp.03** Know that human activity can affect the environment. | **2TWSc.05** Use a given secondary information source to find an answer to a question. | **Finding out where rocks come from**  Tell learners that we are going to learn where rocks come from and discuss their initial ideas. Explain that rocks are not manufactured by anyone, they are natural. In this context, ‘natural’ means it has been formed by nature, rather than having been created by people. Humans extract many rocks from the Earth. Show learners photographs of quarries, mines and riverbeds, ideally showing workers and machinery, and talk about what can be seen.  *Where is the rock being taken from in this picture?*  *What are the workers doing?*  *Why do you think they need machinery to help?*  Divide learners into three groups and give each group a set of photographs and simple information texts about a particular environment (quarries, mines or riverbeds). Explain that their task is to find out more about the environment they have been given and feedback what they have learned to the other groups. This could include what kind of rocks are extracted there, what role workers and/or machinery play in rock extraction and whether rock extraction helps or harms the plants and animals living in the area. Learners can consider the effect of both the initial creation and working of the site (which may disrupt wildlife in the area) and the new habitats provided by some disused quarries where plant and animal life is thriving.  After giving learners sufficient time to research their environment, ask them to share with the other groups what they have learned. Reiterate that rocks are formed naturally, humans are able to extract them from the Earth in a variety of different ways and summarise the environmental impact of these sites.  **Resources:** Photographs, simple texts about rock extraction |
| **2Cm.01** Understand that some materials occur naturally and others are manufactured. | **2TWSc.05** Use a given secondary information source to find an answer to a question.  **2TWSc.06** Collect and record observations and/or measurements by annotating images and completing simple tables. | **Where do materials come from?**  Show learners a range of familiar materials including some that occur naturally and some that are manufactured (e.g. plastic, metal, wood, cotton, paper, and rock). Ask them to share their ideas about where the materials came from.  *Where do you think these materials come from?*  *How do you think they were made?*  Note: It may be appropriate to explain that objects can be made of multiple materials. Objects can be manufactured from a range of materials and each material can be natural or, themselves, manufactured.  For each material, ask learners to decide whether they think the material is naturally occurring or manufactured (i.e. made by people); they should explain their reasoning and record their ideas in a simple table.  Then give learners simple information texts that explain the origins of their materials. They research whether their materials are naturally occurring or manufactured. As they work, learners complete another column on their table to indicate whether or not they were correct.  After learners have done their own research, bring them back together. Go through each material and make clear whether they are naturally occurring or manufactured.  **Resources:** Samples of familiar materials, simple information texts |
| **2Cp.02** Explain why materials are chosen for specific purposes on the basis of their properties. | **2TWSc.06** Collect and record observations and/or measurements by annotating images and completing simple tables. | **Materials in our school**  Discuss with learners how materials can have more than one property, and make this clear by selecting a material they are familiar with (e.g. metal) and listing its properties. Ask learners to do the same, using materials that are present in the classroom.  Explain that materials are chosen for different purposes based on their properties. Give an example using an object they are familiar with (e.g. our tables are made of wood because wood is strong, rigid, and can be cut to the shape we need).  Learners then annotate a picture of the classroom (or pictures of objects in the classroom). They list the materials that have been used to make different objects, and why the materials are suitable for that purpose (e.g. glass for windows, metal for chairs, fabric for their clothing).  When learners have completed labelling their diagrams, ask them to share their explanations of the properties that make different materials suitable for familiar objects. Then suggest alternative materials and discuss whether they would also be suitable based on their properties.  *Would paper be a good material to make windows out of? Why?*  *Are there any other materials that would be suitable to make a table out of? Why do you think this is?*  **Resources:** Photographs of the classroom |
| **2Cp.03** Know materials can be tested to determine their properties. | **2TWSp.02** Make predictions about what they think will happen.  **2TWSc.02** Use given equipment appropriately.  **2TWSa.01** Describe what happened during an enquiry and if it matched their predictions. | **Choosing a material for a lunchbox (requires additional resources)**  Show learners an image of a quarry worker who needs their help to find the best material to make a new lunchbox. Tell them we will decide what properties the material will need to have and then carry out an investigation to test a range of materials.  *What properties will this material need to have?*  *Which material will be a good fit?*  *Which material do you think would be unsuitable for this purpose?*  Tell learners that the most important thing to this person is that their lunch does not get damaged when they work outside. This includes making sure their lunch does not get wet.  *How could we test materials to see which are waterproof?*  Show learners how to test whether a material is waterproof or not, by covering a small, clear cup with the material and dropping water onto the top using a pipette. Learners need to observe the cup beneath to see if the water goes through the material. Use paper (or thick fabric) for the demonstration material and explain that that they may need to be patient as it can take some time for the water to pass through the material. Link this to the ‘real life’ context of the investigation; the worker’s food will need to be in the lunchbox for several hours before it is eaten, so the material must keep out water over a long period of time.  Provide a range of materials (e.g. card, paper, fabric, wood, metal, rock, rigid plastic, flexible plastic) for learners to test. Ask them to make a prediction about which materials will be waterproof and which will not. Then allow learners to carry out the investigation themselves and record their observations in a table.  Come back together to discuss findings and see if learners’ predictions were correct. Discuss which of the waterproof materials would be best for a lunchbox. Highlight that not all waterproof materials would be suitable (e.g. a lunchbox made of rock would be too heavy to carry around all day).  **Resources:** Clear cups, pipettes, range of different materials |
| **2TWSc.05** Use a given secondary information source to find an answer to a question. | **Choosing the most suitable rock**  Explain to learners that different kinds of rocks can have very different properties. Show them two very different rocks (e.g. soft, light chalk, hard, dark slate). Pictures of rocks could also be used. Tell them that, when new kinds of rock are discovered, scientists carry out tests to find out the properties of these new rocks. This research done by scientists can be used to choose the best rocks for a range of different jobs.  Give learners a table which lists a number of uses for rocks (e.g. statues carved by hand, decorative columns, drawing materials, roof tiles). Learners then use simple ‘fact files’ about different kinds of rock to select which kind of rock will be best suited for each purpose.  **Resources:** Two different kinds of rock, fact files for different rocks, table listing uses of rocks |

# Unit 2.2 Living things in different places

| Unit 2.2 Living things in different places (8.5 hours) |
| --- |
| Outline of unit: |
| This unit uses the school environment as a stimulus for learning about different plants and animals and the spaces they live in. It begins with exploration of the different environments within the school grounds (e.g. playing fields, pavements, flowerbeds, ponds, trees, concrete areas, tarmac areas).  Then learners consider animals and their offspring. Initially, this should be taught using animals that can be found in local habitats and therefore familiar to learners, although other animals that interest the learners could also be included. Unit 2.6, Polar explorer, builds on the learning in this unit, and covers a broader range of habitats.  This unit could be greatly enhanced by bringing animals into the classroom for learners to observe over time (e.g. chicks hatching from eggs, frogs developing from frogspawn, caterpillars becoming butterflies). Please note the advice on the welfare of living things in the Introduction to this scheme of work.  If your school grounds have a very limited range of different environments, we suggest you use environments in the areas surrounding the school. |
| Recommended prior knowledge or previous learning required for the unit: |
| Learners will benefit from previous experience of:   * recognising and naming the main external parts of the human body * describing ways in which humans are similar and different to each other * identifying their senses (limited to sight, hearing, taste, smell and touch) and linking them with the correct body part * recognising that animals, including humans, need water, air and suitable food to survive * identifying things that are living and things that have never been alive * recognising and naming the major parts of a flower (limited to roots, leaves, stem and flower) * knowing that plants need light and water to grow. |
| Suggested examples for teaching Science in Context: |
| **2SIC.03** *Know that everyone uses science and identify people who use science professionally*  Learning about animals and how they change as they grow provides a good opportunity for learners to find out more about people who raise animals professionally (e.g. farmers). They could visit a farm to observe animals at different stages in their lives and how the young animals resemble their parents.  **2SIC.04** *Talk about how science helps us understand our effect on the world around us*  The activities in which learners investigate the number of plants and animals in the different environments within their school could provide a good stimulus for discussion about how human activity has impacted these environments and the wildlife that resides in them. For example, learners could discuss why they found more animals in the greener parts of their school and consider what the plant and animal life was like in that area before a playground space was created. |

| Learning objective | Key vocabulary | Possible models and representations | Possible misconceptions |
| --- | --- | --- | --- |
| **2Be.01** Know that an environment in which a plant or animal naturally lives is its habitat. | Animal, plant, wildlife, environment, habitat, area, inhabit | Diagrams of different habitats that include representations of relevant environmental features.  For example, an ocean habitat is made of a body of salt water. | Learners can assume that plants (and animals) are in certain places because humans put them there. Throughout this unit, highlight to learners the reasons why plants and animals can be found in certain spaces (e.g. they are sheltered, there is plenty of food). |
| **2Be.02** Know that different habitats contain different plants and animals. | Animal, plant, wildlife, environment, habitat, area, inhabit, compare, difference, different, similar, similarity, same  Additional vocabulary that may be relevant depending on the examples used includes: mammal, fish, bird, amphibian, reptile, insect | Diagrams of habitats could be shown, or made by learners. Learners could identify, and label, different plants and animals on these diagrams. | Learners often assume insects and other small animals are not in fact animals. Similarly, they do not consider humans to be animals.  Learners may not consider grass or trees to be plants as they do not have the structure of common flowering plants, they are very familiar with.  To support learners in overcoming these misconceptions, repeatedly demonstrate the correct use of ‘animal’ and ‘plant’ vocabulary to name these living things and give them lots of opportunity to experience a diverse range of plants and animals. |
| **2Bs.01** Compare how animals, including humans, are similar and different in their external body parts and skin covering. | Arm, leg, head, body, ears, eyes, nose, mouth, hands, claws, nails, paws, hair, fur, skin, scales | Toy and model animals can be used as scientific models to represent animals in the classroom when learners cannot observe them first hand; learners can take a closer look and refer to them when describing and comparing animals. Discuss with learners the ways in which these toy animals are accurate and how they differ from the real ones, e.g. a toy spider may be larger than a real one and have more visible eyes; a toy tiger will be smaller and may not have soft fur and other toys may exaggerate the features of an animal. |
| **2Be.03** Identify similarities and differences between local environments in terms of hot, cold, dry, wet, many plants, few plants, many animals and few animals. | Environment, compare, similar, similarity, difference, different, lots, many, few, temperature, hot, hotter, hottest, warm, warmer, warmest, cold, colder, coldest, wet, dry, damp | Learners could draw diagrams of different environments to support them in identifying key differences. | Learners may link the term ‘temperature’ to having a fever when ill due to the common use of the word. Discuss the meaning of the word and acknowledge its scientific and common uses, highlighting how it will be used in science lessons. Learners can also assume the word ‘similarity’ implies things are identical, rather than just alike. Ensure you make clear the difference between things that are identical and things that are similar. |
| **2Bp.03** Describe how the offspring of animals, including humans, change as they become older. | Grow, change, parent, child, baby, offspring, young, old, elderly, age | Toy and model animals can be used as scientific models to represent real animals. Baby dolls can be compared with other toys modelled on humans at different stages in life; help learners observe that baby dolls tend to look relatively true-to-life, whereas dolls and action figures based on teenage and young adult characters may have unrealistic features (e.g. longer legs). | Learners often think that humans and other animals continue growing throughout their lives, as this is the experience they have personally had so far. To deal with this misconception, you could invite adults of different ages into your classroom, stand side by side with them and highlight that older people are not always taller than younger ones. |
| **2Bp.04** Know that animals, including humans, produce offspring that have a combination of features from their parents. | Parent, child, offspring, features, inherit, similar, different | The similarities between parents and offspring could be represented by a simple diagram such as a family tree. For example, a white cat and a ginger cat shown as the parents and below them three kittens with different coats of ginger and white fur. | Learners can think that when we ‘inherit’ something it refers to receiving money or property from a deceased relative, due to the common use of the word. In this unit, the word is used to refer to features that animals (including) humans have that their parents also have. Give learners lots of opportunities to hear and use this word in context, as well as discussing the common use of the word to help them become clear on its meaning. |

# Unit 2.2 Suggested activities

| Learning objective | Thinking and Working Scientifically opportunities | Suggested teaching activities and resources |
| --- | --- | --- |
| **2Be.01** Know that an environment in which a plant or animal naturally lives is its habitat.  **2Be.02** Know that different habitats contain different plants and animals. | **2TWSc.04** Follow instructions safely when doing practical work.  **2TWSc.02** Use given equipment appropriately. | **Searching for plants and animals (requires additional resources)**  This activity focuses on the different plants and animals you would expect to find in local habitats. Introduce the word ‘habitat’ and explain that it means the environment that a plant or animal naturally lives in. Throughout the activity, make sure to model the use of this new term in context to help learners become familiar with it.  Discuss with learners which plants and animals they would expect to find in the habitats around the school grounds. Ensure learners understand that insects and other similar, small creatures (e.g. spiders, worms, slugs) are also animals.  *What animals have you seen on the school field?*  *Have you ever seen any animals in the playground?*  *Where can you find lots of plants?*  *Can you name any of the plants you have seen?*  Tell learners we are going to become explorers and investigate what wildlife can be found in different school habitats. If possible, learners should collect and make closer observations of smaller animals (e.g. caterpillars, snails). Explain that we need to be very gentle with any animals we collect and return them to their habitat when we have finished our observations.  Demonstrate the equipment learners will use to make their observations and collect small animals. (E.g. magnifying glasses, small, clear containers, paintbrushes for collecting insects, pooters or pond nets). Take learners to two contrasting areas of the school grounds (e.g. a field/grassed area, a playground, a dark, sheltered area behind some buildings, a pond, an area with lots of trees and shrubs). If you do not have two distinct areas within the school grounds, you could visit local parks or gardens. Learners can record their findings by pictures, photographs or by listing the names of the animals they find.  Following the activity, discuss what learners have found out. This should include consideration of the differences between different habitats.  *Which habitat had the most plants?*  *Were there any animals that you found in more than one habitat?*  *Which animals were only found in one habitat?*  *Why do you think you did not find many plants on the playground?*  For health and safety reasons, remind learners that some animals may bite or sting if threatened. Additionally, if you are taking the learners outside of the school grounds and/or to an area with water (e.g. a pond), follow school procedures including carrying out a full risk assessment of the activity beforehand and alert everybody to any risks.  **Resources:** Equipment for collecting and observing small animals and plants |
| **2TWSm.01** Know that a model represents an object or idea in a clear way.  **2TWSm.03** Describe the difference between a diagram and a picture. | **Creating scientific diagrams**  Tell learners that they are going to create some scientific diagrams to help others learn about animals (or plants) in our local habitat. Show learners a photograph and a scientific diagram, side by side, of an animal (or plant) that can be found locally. To make the difference clear, ensure the diagram is accurate and labelled.  *What is the difference between these two images?*  *Which one gives us more information about the animal?*  *Why might the diagram be more useful for someone who has never seen this animal before?*  Highlight to learners that a diagram is not what we really see; it is a representation of something real. There is some detail missing. We call a diagram a model as it helps us think about the real thing.  Learners create their own scientific diagrams using real animals (e.g. insects) or plants from the school environment; clear photographs could also be used. This activity can be done in the classroom or outside. To cover a range of habitats, it is recommended groups of learners focus on wildlife from one specific location and then move to wildlife from another location. Encourage learners to make close observations to ensure their labelled diagrams are as accurate as possible.  To finish the activity, ask learners to assess each other’s drawings, commenting on which elements are the most accurate and suggesting ways the diagrams could be improved. Remind learners that a diagram is not what we really see, but a representation of something real. Look at the range of diagrams and talk about how we find different animals and plants inhabiting (i.e. inhabiting) different environments.  **Resources:** Photograph and scientific diagram to show learners, small animals collected from the school environment, magnifying glasses or hand lenses |
| **2TWSc.01** Sort and group objects, materials and living things based on observations of the similarities and differences between them. | **Comparing plants**  Show learners images of different plants from at least two different environments, including two photographs on which the environment is clearly visible, some familiar plants which can be found in the school grounds (or surrounding area) and some very different plants (e.g. desert plants with small, spiky leaves; rainforest plants with broad, flat leaves and bright flowers).  *Do you know the names of any of these plants?*  *Can you see any similarities/differences between the plants?*  *Where would you expect to see this plant?*  Give out a selection of smaller images of these plants and ask the learners to describe them.  *What shape are the leaves on your plant?*  *Is your plant tall or short?*  *Does your plant have any flowers?*  Then play ‘Guess the Plant’ to help learners focus in on the differences between leaves. One learner secretly chooses a plant from those on the photographs and the others must guess which it is by asking yes or no questions. E.g. ‘Are the leaves pointed at the end?’ ‘Does it have flowers?’  Learners then suggest their own criteria (e.g. shape, colour, size) and sort the plants into groups according to these criteria. Their sorted plants could be recorded with simple drawings or photographs. To make this activity less challenging, you could suggest the criteria for learners.  Finally, ask the learners to sort the plants according to whether they could be found on the school grounds or not. After sorting, remind learners that different plants can be found in different environments. Make this clear by showing photographs of two different plants in their own habitats.  This activity can be extended by asking learners to choose criteria for a Venn diagram and then sorting the plants.  **Resources:** Photographs of plants |
| **2Bs.01** Compare how animals, including humans, are similar and different in their external body parts and skin covering. | **2TWSc.05** Use a given secondary information source to find an answer to a question.  **2TWSc.01** Sort and group objects, materials and living things based on observations of the similarities and differences between them.  **2TWSc.06** Collect and record observations and/or measurements by annotating images and completing simple tables. | **Comparing features of animals**  Show learners a range of images of familiar animals that can be found in the local environment (including humans and one animal that does not have legs). Tell learners they will be looking closely at similarities and differences between these animals, and check that all learners understand the vocabulary ‘similar’ and ‘different’. Draw learners’ attention to the legs of each animal and discuss how these differ from each other.  *How many legs does this animal have?*  *How do these legs move?*  *How does the animal with no legs move?*  *Are all of the legs on this animal the same shape?*  Tell learners that their task today is to compare specific features of some of the animals we have been looking at. Model choosing two animals and completing a simple three column table:   |  |  |  | | --- | --- | --- | | First animal… | Features to look for… | Second animal… | |  | eyes |  | |  | legs |  | |  | skin or covering |  | |  | etc. |  |   Learners then select their own animals and complete their own tables.  Discuss as a class what the learners have noticed in terms of similarities and differences between different animals.  *Which body parts do all (or most) of the animals have?*  *How do the feet differ on different animals?*  *What do these two animals have in common?*  Explain that animals, in general, have standard body parts but they might look different on different animals; this is one of the reasons humans are classed as animals, as we share key features with other animals.  This activity can be extended by asking the learners to select their own features to compare, rather than having them already listed in the table.  **Resources:** Photographs of animals |
| **2Be.03** Identify similarities and differences between local environments in terms of hot, cold, dry, wet, many plants, few plants, many animals and few animals. | **2TWSc.05** Use a given secondary information source to find an answer to a question.  **2TWSc.06** Collect and record observations and/or measurements by annotating images and completing simple tables. | **Comparing environments**  Show learners photographs of two environments within the local area, one environment is relatively dry and the other environment is relatively wet (e.g. a field and cave, a meadow and a forest). Discuss the similarities and differences.  *Do you think we would find the same animals and plants in these two environments?*  *Do you think the temperature would be the same in both of these environments?*  *Which would be drier?*  Discuss with learners how we can describe environments by the living things in them (e.g. quantity, type) and the environmental conditions (e.g. temperature, if it is dry or wet).  Tell learners they will be comparing the features of two different environments that can be found in their local area. Encourage them to think of their own ideas for comparison as well as the terms listed in the learning objective.  Provide learners with photographs and simple fact files containing information about a range of different environments in the local area (e.g. numbers of plants and animals in the area, the temperature and how wet/dry the areas are). Learners research similarities and differences, and record their findings in a simple table.  Bring learners back together to discuss their findings about the similarities and differences in different environments.  *Which environment is home to the most plant life?*  *Are there any animals found in both environments?*  *How do the environments differ in temperature?*  *Which environments are considered to be dry and which ones wet?*  **Resources:** Photographs of environments, fact files containing information about a range of different environments. |
| **2Bp.03** Describe how the offspring of animals, including humans, change as they become older. | **2TWSc.01** Sort and group objects, materials and living things based on observations of the similarities and differences between them.  **2TWSc.05** Use a given secondary information source to find an answer to a question. | **Changes with age**  Ask learners to think about how they have changed since they were babies.  *Have you changed size?*  *What can you do now that you could not do before?*  Then think about how they might change as they get older.  *How do you think your body will be different in 20 years’ time?*  *What will you be able to do then that you cannot do now?*  Explain that, like humans, other animals have offspring that change as they grow. Encourage learners to share examples of any animals they know that have had offspring or have changed as they have aged.  *How could we find out how animals change as they become older?*  Draw the conclusion that we could either make some first-hand observations of animals or use secondary sources (e.g. diagrams, information books).  Give learners sets of pictures showing young and adult animals (including humans). Ask them to identify which pictures are of the same animal (e.g. puppy and dog, lamb and sheep, kitten and cat, foal and horse). Then ask them to discuss the changes as the animal gets older.  *How is the older animal different to the younger animal?*  **Resources:** Pictures of young and old animals |
| **2TWSm.01** Know that a model represents an object or idea in a clear way.  **2TWSm.03** Describe the difference between a diagram and a picture. | **Diagrams that show animals getting older**  Show learners a series of photographs and a scientific diagram, both showing an animal at different stages in its life; the diagram should be accurate, labelled and include arrow(s) from the younger to the older animal)  *What is the difference between these two images?*  *Which one gives us more information about how the animal changes as it grows?*  *Why might the diagram be more useful for someone who has never seen this animal before?*  Highlight to learners that a diagram is not exactly what we really see; it is a representation of something real. There is some detail missing. We call a diagram a model as it helps us think about the real thing.  Learners then create diagrams showing how animals change as they grow. They can use photographs, information books and/or draw on first-hand experience of farm (or zoo) animals and pets. To make their diagram clear, instruct learners to draw the young animal first and include an arrow pointing to the older animal.  This activity could be enhanced by bringing animals into the classroom for learners to see the changes or differences between young and old (e.g. hatching chicks, growing frogs from frogspawn). If you do bring animals into the classroom, make sure to follow your school risk assessments for any activities involving animals and ensure all learners practise good hygiene after handling the animals.  **Resources:** Pictures of young and old animals, labelled scientific diagram showing the aging of an animal, information books |
| **2Bp.04** Know that animals, including humans, produce offspring that have a combination of features from their parents. | **2TWSc.01** Sort and group objects, materials and living things based on observations of the similarities and differences between them. | **Animals and their parents**  If appropriate, ask learners to think about how their appearance is similar to their parents’; this conversation may not be appropriate for some learners due to their family background (e.g. learners who have been adopted).  *In what ways are you similar to your parents?*  Show learners some pictures of celebrity families.  *In what ways does the child look like the father?*  *In what ways does the child look like the mother?*  Tell learners that humans inherit a combination of features from their parents, and this is the same for other animals. Display a range of young and their parents, from the same species, that show clearly how the features of the offspring have been inherited from the parents; use animals (and/or breeds of animals) that are relevant to your learners. For example, kittens whose fur colouring is a mixture of both parents; a breed of dog (e.g. a cockapoo) that has been bred from two other distinct breeds (i.e. a cocker spaniel and a poodle).  End with a discussion about how the learners can group animals, drawing their attention to the fact that animal offspring have a combination of features inherited from their parents.  *How would you sort these animals into groups?*  *How might we sort these animals into their family groups?*  *How did you know that child belonged to those parents?*  *Which features do the parent animals have that can be seen in the children?*  **Resources:** Images of a celebrity family, images of animals and their offspring |

# Unit 2.3 Light from different sources

| Unit 2.3 Light from different sources (7.5 hours) |
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| Outline of unit: |
| This unit begins by introducing learners to the concept of ‘light sources’ and ‘darkness’ (i.e. the absence of light). Learners then consider our main source of light, the Sun, and how it appears to move across the sky during the course of the day. It is important that learners understand that it is dangerous to look directly at the Sun and they should never do so, even when wearing sunglasses.  Following the theme of light, learners then consider objects that use electricity and the construction of simple circuits in order to make a lamp light up. The use of practical equipment to explore simple circuits within this unit allows learners to develop their understanding of electricity. They will discover how a circuit must be complete in order to work. |
| Recommended prior knowledge or previous learning required for the unit: |
| Learners will benefit from prior experience of:   * identifying things that are powered by electricity * knowing that Earth is the planet on which we live * describing the Sun as a source of both heat and light, and knowing that it is one of many stars. |
| Suggested examples for teaching Science in Context: |
| ***2SIC.01*** *Talk about how some of the scientific knowledge and thinking now was different in the past.*  Learners could find out what different cultures in the past have believed about the night and day, what evidence scientists have gathered and how, over time, their scientific understanding about night and day has changed (based on the evidence available). Additionally, identifying objects from our everyday lives that need electricity to work can help learners to think about how life was different before the discovery of electricity.  ***2SIC.02*** *Talk about how science explains how objects they use, or know about, work.*  For those learners that use a range of electrical items in their everyday lives, this unit provides a context for discussion about the science behind familiar objects. Learning about the apparent movement of the Sun across the sky will give learners an explanation for an everyday occurrence that they may have not thought about before.  ***2SIC.03*** *Know that everyone uses science and identify people who use science professionally.*  Discussing the daily activities (e.g. food preparation, communication, entertainment) that rely on electricity will help learners to understand the relevance of this science to their own lives; they could consider how different their day would be if they did not have electricity. It may be appropriate for learners to meet and talk to an electrician. If a power plant is close to your school, a visit to a power plant (or a power-plant worker coming to the classroom) may support learners in their understanding of people who use science professionally. |

| Learning objective | Key vocabulary | Possible models and representations | Possible misconceptions |
| --- | --- | --- | --- |
| **2Ps.02** Know that darkness is the absence of light. | Dark, darkness, darker, light, light source, absence | Learners can use simple diagrams to represent darkness inside a box being dark and it being light outside the box. There is no expectation for learners to use ray diagrams at this stage. | Learners can think that they only need their eyes to see, sometimes assuming that their eyes send out ‘rays’. They have not understood that light from light sources is necessary; This is because many learners have rarely been in completely dark rooms. This misconception can be addressed by taking the learners to a completely dark area where no light at all can get in, and highlighting the fact that nothing can be seen even with their eyes open. (Note: some learners may be uncomfortable in a totally dark space.) |
| **2Ps.01** Know that there are many light sources, including the Sun. | Light, light source, Sun, emit  Additional vocabulary that may be relevant depending on the examples used include: torch, lamp, bulb, candle | Learners may use simple diagrams to represent light sources. There is no expectation for learners to be use ray diagrams at this stage. | Learners can think that objects that reflect light (e.g. reflective strips on clothing, the Moon) are light sources, as they can appear to give off their own light. This misconception can be addressed by learners observing that shiny, reflective objects do not create their own light when they are in a completely dark area. This misconception will also be addressed in later stages of Cambridge Primary Science. |
| **2ESs.01** Describe the apparent movement of the Sun during the day. | Sun, Earth, light, light source, move, movement, day, night, morning, noon, evening, horizon | Learners can use a simple diagram to show how the Sun appears to move during the day and to explain night and day in terms of the apparent absence or presence of the Sun. | It is likely that learners will think the Sun moves around the Earth, as it appears to do so in the sky (rather than understanding that the Earth moves around the Sun). This misconception will be addressed in Stage 4. In Stage 2 the aim is to identify the observable pattern of the movement of the Sun. |
| **2Pe.01** Identify how we use electricity and describe how to be safe with it. | Electricity, electric, power, energy, mains electricity, charge, rechargeable, battery, cell, wire, plug, plug socket/power outlet | Learners can role-play being safe, and unsafe, with electricity and the possible effects unsafe use can have. | Learners can think that all forms of electricity (and electrical equipment) are dangerous, as they will have been warned at home that sources of electricity are dangerous and must not be played with. It is important to repeatedly make clear the distinction between objects that are safe to handle (e.g. batteries) and those that should not be touched. |
| **2Pe.02** Recognise the components of simple circuits (limited to cells, wires and lamps). | Circuit, component, complete, cell, battery, wire, lamp | Simple pictures (or diagrams) can be used to represent circuits. There is no expectation that learners will use or create circuit diagrams at this stage. | Due to their common use, learners may refer to lamps as ‘bulbs’. While this is not an incorrect use of this words, it is important to also teach learners the scientific terms and give them lots of opportunity to hear and use this vocabulary in context. |
| **2Pe.03** Explore the construction of simple series circuits (limited to cells, wires and lamps). | Circuit, component, complete, cell, battery, wire, lamp, series | Simple pictures (or diagrams) can be used to represent circuits. There is no expectation will learners will use or create circuit diagrams at this stage. | Learners can be confused about how components need to be ordered and connected in a series circuit; for example thinking that both wires can touch the same end of the battery, or that a lamp can be lit by simply connecting one end of a wire to the lamp and the other to a battery. Misconceptions like these can be addressed by learners having lots of opportunities to experiment with this equipment so that they can see for themselves what works as a complete circuit and what does not. |

# Unit 2.3 Suggested activities

| Learning objective | Thinking and Working Scientifically opportunities | Suggested teaching activities and resources |
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| **2Ps.02** Know that darkness is the absence of light**.**  **2Ps.01** Know that there are many light sources, including the Sun. | **2TWSc.01** Sort and group objects, materials and living things based on observations of the similarities and differences between them. | **Exploring what is and is not a light source**  Discuss with learners their different ideas about where light comes from and make a list of their suggestions; include the Sun (adding it as your idea if none of the learners suggest it) and any objects they suggest as light sources that, in fact, reflect light (e.g. the Moon).  Tell learners that the scientific name for something that emits light is ‘light source’ and that ‘darkness’ refers to the absence of light. Explain that a place where there are no light sources (i.e. there is no light) will be completely dark and so we will not be able to see anything. If possible, close any blinds (or curtains) in the classroom and turn out the main lights to show learners how the room is now darker; the room will not be completely dark as there will be light coming in around the blinds or from small light sources (e.g. computers, other small electronic devices).  *Can you see where light from light sources is getting into our classroom?*  *Which parts of the room are darkest?*  Then, for contrast, take learners to an area that is completely dark; you may need to use some material (e.g. paper, thick fabric) to block out all external light in a small room. Be aware that some learners may not be comfortable in a completed dark space.  Return to the classroom and show learners a range of objects including light sources (e.g. torches, toys with lights), reflective objects (e.g. mirrors, reflective clothing strips) and some items that are neither light sources nor reflective. Ask learners to sort the objects according to whether or not they think they are light sources. While learners are sorting, talk to them about their ideas.  *Why do you think this is a light source?*  *Can you explain why you think this one is not a light source?*  After sorting, take the objects to the completely dark area and show learners which are (and which are not) light sources.  *Which ones were you right about?*  Finally, return to the list of light sources that learners suggested at the start of the activity. Discuss their suggestions; clarify which are (and which are not) light sources, allowing learners time to make improvements to their original ideas.  **Resources:** Selection of objects (including light sources, highly reflective objects, other objects), completely dark area |
| **2TWSc.06** Collect and record observations and/or measurements by annotating images and completing simple tables. | **Searching for light sources**  Remind learners that a light source is something that emits light.  *Can you see any light sources in this room?*  *What light sources do you have at home?*  Use this discussion to ensure all learners understand what a light source is and can identify some familiar objects that are light sources. Clarify that transparent objects (e.g. windows) are not light sources, they let light pass through them.  Take learners to at least two different areas of the school grounds to look for light sources; include one outdoor area so learners can identify the Sun as a light source. Learners record their findings on a two-column table (i.e. name of area, light sources found in that area). They could also photograph the light sources.  As a class, discuss their findings; compile a list of every light source found to show learners that there was a broad range.  *In which area did you find the most light sources?*  *Were all of the light sources giving off light that was the same colour?*  *Were some light sources creating brighter light than others?*  For health and safety reasons, ensure all learners know that it is not safe to look directly at the Sun because it can damage our eyes. |
| **2ESs.01** Describe the apparent movement of the Sun during the day. | **2TWSc.05** Use a given secondary information source to find an answer to a question.  **2TWSa.02** Identify simple patterns in results, e.g. increasing and decreasing patterns. | **Describing the movement of the Sun**  Begin with a discussion about the movement of the Sun to gather learner’s prior knowledge.  *Is the Sun always at the same point in the sky?*  *Have you ever seen a sunrise or sunset?*  *What happens to the Sun over the course of a day?*  *What safety measures do we need to take when learning about the Sun?*  Explain that it is not safe to look directly at the Sun because it can damage our eyes, so we are going to use secondary information sources to find out how the Sun appears to move during the day. Show learners a picture (or photograph) showing the Sun and the horizon at midday. Tell them that the picture shows the position of the Sun at 12 o’clock midday.  *How do you think the Sun’s position will be different earlier in the morning?*  Then show learners another picture of the same horizon, this time showing the Sun’s position at 9 o’ clock in the morning.  *How is it different?*  *Where do you think the Sun would be at 10 o’ clock in the morning? Why?*  *Where do you think it will be at 3 o’ clock in the afternoon?* *Why?*  Give learners sets of pictures showing the Sun at different times of the day; ask them to sequence them from morning to night.  *Why have you placed this picture first?*  *When is the Sun highest in the sky?*  *Can you see a pattern in the position of the Sun as the day passes?*  When the pictures have been sequenced, discuss the apparent movement of the Sun with learners. Explain that the Sun appears to move in an arc-like shape from one side of the horizon to the other over the course of the day. If possible, show learners a time-lapse (or sped up video) showing the Sun’s apparent movement across the sky during the day.  Ask learners to write a description of how the Sun appears to move during the day based on their sequenced pictures (and, if appropriate, what they observed in the video). Encourage them to make a clear link between the time of day and the Sun’s position in the sky.  For health and safety reasons, ensure all learners know that it is not safe to look directly at the Sun because it can damage our eyes.  **Resources:** Pictures of the Sun in different positions in the sky |
| **2Pe.01** Identify how we use electricity and describe how to be safe with it. | **2TWSa.03** Present and interpret results using tables block graphs. | **How do we use electricity?**  Discuss with learners how we use electricity in our everyday lives.  *Have you used any objects that need electricity today?*  *Can you see any electrical items in the classroom?*  *What safety rules should we remember when using electrical items?*  Tell learners that electrical objects can create heat, light, sound and/or movement; explain that some electrical objects create more than one of these outputs (e.g. a television can create light and sound). Provide examples of each and then encourage learners to think of their own examples.  *Can you see something electrical that creates sound?*  *What electrical items do you have in your home that create movement?*  Tell learners they will be gathering information about what electrical outputs in our school produce different output; ask learners to select heat, light, movement or sound. Visit 3 to 5 different areas of the school, learners keep a tally table of the number of objects that use electricity to create their chosen output in each area.  Support them representing this information as a block graph where blocks can be used to create a 3D block graph.  When the block graphs are complete, discuss the results.  *In which area did you find the most electrical objects?*  *Which area had the fewest?*  *Did you find more electrical objects for sound or light?*  *Why do you think this is?*  This activity can be extended by asking learners to draw their own axes. They can add their own scale and labels.  For health and safety reasons, remind learners that electrical outlets can be dangerous and so the holes should not be touched. Learners should also be made aware that some electrical items (e.g. kettles, electric ovens) may be very hot and so should not be touched.  **Resources:** Blocks for creating a 3D block graph. |
| **2TWSc.01** Sort and group objects, materials and living things based on observations of the similarities and differences between them. | **Electrical objects**  Show learners some familiar electrical objects (use pictures if electrical objects are not available to show) and discuss.  *How do these items use electricity?*  *How are they powered?*  Then discuss safety considerations we must take when using electrical items.  *Is it always safe to play with electrical objects?*  *What can we do to make sure we are safe around electricity?*  Discuss with learners the dangers of electricity (and electrical objects) and steps we can take to stay safe (e.g. the correct use of electrical outlets, the dangers of using electrical objects when wet).  Learners then sort a range of pictures showing the use of electrical items into those that are being used safely and those that are not.  *What can you see in this picture that is unsafe? How could he/she do that in a safer way?*  Learners reflect on the sorted pictures and then create their own posters about electrical safety.  **Resources:** Electrical objects,pictures of electrical objects being used in safe and unsafe ways |
| **2Pe.02** Recognise the components of simple circuits (limited to cells, wires and lamps).  **2Pe.03** Explore the construction of simple series circuits (limited to cells, wires and lamps). | **2TWSc.02** Use given equipment appropriately. | **Exploring circuit components (requires additional resources)**  Discuss the different ways that electrical objects are powered:  *Which electrical objects in our classroom need to be plugged in to work?*  *How do the other electrical objects work (i.e. those without plugs)?*  *Can you think of any other objects that need batteries to work?*  Explain that batteries are made up of units called ‘cells’. Show learners some examples of batteries. If possible, provide learners with a range of batteries that are different shapes, sizes and voltages; learners could identify the voltage of these batteries and see that some batteries contain more cells than others. Then show them a wire and a lamp; reinforce the correct terminology. Tell them that their task is to explore the electrical equipment we have to find combination/(s) that makes the lamp light.  Give learners, in small groups or pairs, sets of equipment (including lamps, batteries and wires) and allow them to explore the different ways to connect the components in order to make the lamp light up. While learners are working, ensure they are discussing what they are doing and using the correct terminology to describe the electrical components. This activity can be made less challenging by giving out the minimum amount of equipment required to make the lamp light (i.e. the number of possible combinations is reduced).  After some time exploring, ask learners who have been successful to support others to help them find an appropriate solution. When all learners have found a way to make their lamp light, discuss how this was achieved.  *What did you do to make your circuit work?*  *What changes did you have to make to your partner’s circuit to make the lamp light?*  Make it clear that a complete loop (including a battery and a lamp) is needed to make the lamp light.  Explain to learners that the equipment they are using is safe to handle but it must not be inserted into power outlets. Remind them that we must take care around dangerous electrical objects (e.g. power outlets, electricity pylons.  **Resources:** Batteries, wires, lamps |
| **2TWSp.02** Make predictions about what they think will happen.  **2TWSa.01** Describe what happened during an enquiry and if it matched their predictions.  **2TWSa.02** Identify simple patterns in results, e.g. increasing and decreasing patterns. | **Will it work? (requires additional resources)**  Show learners some batteries, lamps and wires (i.e. the components of a simple series circuit). Explain that these components need to be arranged to form a complete circuit so that the lamp will light up. Put together a demonstration circuit. Ask learners to help by explaining where to put each component, arrange the components correctly as directed by learners, but leave a gap in the circuit. Ask learners to identify the mistake you have made. Tell learners that there is more than one arrangement that will result in the lamp lighting up. Their task is to investigate other possible arrangements to find out which work.  Give learners a series of drawings (or photographs of the equipment) in which lamps, wires and batteries are arranged in different ways. Some arrangements will create a complete circuit in which the lamp will light, some will not. These can be made up of different numbers of the different components (e.g. a very large complete circuit with a number of wires and two batteries placed in a row, no batteries at all). The drawings do not need to be use conventional circuit symbols.  For each picture, ask learners to predict whether the lamp will light up and explain why they think so.  Give learners enough equipment and ask them to build each circuit and find out if their predictions were correct. After they have completed their investigation, gather feedback on which circuits made the lamp light up and which did not.  *What did the working circuits have in common?*  Make it clear that the circuit will only work if there is a complete circuit and at least one battery to provide energy to light the lamp.  Explain to learners that the equipment they are using is safe to handle but it must not be inserted into power outlets. Remind them that we must take care around dangerous electrical objects (e.g. power outlets, electricity pylons.  **Resources:** Pictures of a range of different circuits, batteries, wires, lamps |
| **2TWSp.02** Make predictions about what they think will happen.  **2TWSa.01** Describe what happened during an enquiry and if it matched their predictions. | **Will it work?**  Show learners pictures of batteries, lamps and wires (i.e. the components of a simple series circuit). Explain that these components need to be arranged to form a complete circuit so that the lamp will light up. Show a picture of a complete series circuit with the lamp lit. Tell learners that there is more than one arrangement that will result in the lamp lighting up; their task is to investigate other ways to find out which work.  Give learners a series of drawings (or photographs of the equipment) in which lamps, wires and batteries are arranged in different ways; some arrangements will create a complete circuit in which the lamp will light, some will not. These can be made up of different numbers of the different components (e.g. a very large complete circuit with a number of wires and two batteries placed in a row, no batteries at all). The drawings do not need to be use conventional circuit symbols.  Ask learners to sort the pictures according to whether they think the lamp will light up, explaining their choices as they go.  *Why do you think that one will not work?*  *How do you know the lamp will light in this circuit?*  *How could you change that circuit so that the lamp would light up?*  After learners have sorted their pictures and justified their answers, reveal which circuits would work. Reiterate that the circuits that work do so because they are a complete loop without breaks and include a battery to provide the energy.  **Resources:** Pictures of a range of different circuits |

# Unit 2.4 Growing and keeping healthy

| Unit 2.4 Growing and keeping healthy (7.5 hours) |
| --- |
| Outline of unit: |
| This unit begins with studying what humans must do in order to stay fit, healthy and well. It includes considerations of diet and hygiene. Learners can develop misconceptions about food so discussion about a healthy diet must be done carefully to prevent learners developing misconceptions around food (e.g. foods that contain high amounts of fat or sugar must never be eaten, to be healthy you must always eat less food and lose weight) so it is important that they understand that a healthy diet is a balanced one, with a range of different types of foods being eaten in moderation.  Then, learners consider what happens to the body during illness, including the common signs of illness. Discussions about illness will need to be handled sensitively as some learners may have family members who are very ill.  Finally, learners look at the different kinds of teeth humans have, what their functions are and what we can do to care for our teeth. |
| Recommended prior knowledge or previous learning required for the unit: |
| Learners will benefit from previous experience of:   * recognising and naming the external parts of the body * identifying the senses (limited to sight, hearing, taste, smell and touch) and what they do, linking each sense to the correct body part * recognising that animals (including humans) need water and suitable food to survive. |
| Suggested examples for teaching Science in Context: |
| ***2SIC.03*** *Know that everyone uses science and identify people who use science professionally.*  Learning about illness and healthy lifestyles provides a context for thinking about the work of healthcare professionals (e.g. doctors, nurses, dentists). Learners could role-play doctors and diagnose their peers, giving them an opportunity to apply their learning about human health in a ‘real life’ context. You could also invite a doctor into the classroom to discuss their work and share their advice on staying healthy. |

| Learning objective | Key vocabulary | Possible models and representations | Possible misconceptions |
| --- | --- | --- | --- |
| **2Bp.01** Know that humans need to manage diet, maintain hygiene and move regularly to be healthy. | Healthy, unhealthy, diet, hygiene, hygienic, unhygienic, clean, germs, move, movement, regular, regularly | Learners can represent their understanding of a balanced diet through diagrams and images (e.g. a balanced plate of food). | Learners can think that the word ‘diet’ refers to restricting calorie intake or omitting certain food types in order to lose weight, as this is a common use of the word. Explain the scientific meaning of the word ‘diet’ when it is first introduced and give learners lots of opportunities to hear and use the word in the correct context. Learners can think that ‘unhealthy’ foods, such as those containing lots of sugar are fat, should never be eaten. To address this misconception, be clear when discussing healthy diets that to be healthy foods should be eaten in the appropriate amounts.  Similarly, as learners are often told fruits and vegetables are healthy, they can think that a diet composed purely of fruit and vegetables would be healthy, whereas all diets require a source of protein. Explain to learners that a balanced diet is important and should include nutrients from a range of different foods. Learners can also think that the purpose of eating food is ‘to grow big and strong’. Explain clearly that food is needed for the body to move and for good health; point out that adults who have stopped growing still need to continue eating a healthy balanced diet. |
| **2Bp.02** Describe what illness is and describe the common signs of illness in humans. | Ill, illness, disease, infection, germs, signs | Labelled diagrams showing a person with common symptoms can be used. This is helpful if children find images upsetting. | Learners can think that germs are visible and so something that appears to be clean must be clean (e.g. they do not need to wash their hands if they do not have any visible dirt on, or food that has been dropped on the floor but appears clean is safe to eat). Address this misconception by telling learners that germs are too small for us to see with our eyes, and they can be present on a surface even when it looks clean. |
| **2Bs.02** Identify the different types of human teeth, explain how they are suited to their functions and describe how to care for teeth. | Mouth, gums, teeth, chew, bite, tear, rip, chop, incisors, canines, molars, premolars, toothbrush, plaque | Large-scale models of teeth (and labelled diagrams of teeth on which the different shapes can clearly be seen) can help learners understand the shape of teeth; it can be difficult for them to clearly see all the teeth in their own mouths. | Due to learners losing their first set of teeth and growing their ‘adult’ teeth around this age, they can think this will happen again in future and they will lose and grow another set of teeth. Make it clear that humans only have two sets of teeth across their lifetime when teaching this objective. |

# Unit 2.4 Suggested activities

| Learning objective | Thinking and Working Scientifically opportunities | Suggested teaching activities and resources |
| --- | --- | --- |
| **2Bp.01** Know that humans need to manage diet, maintain hygiene and move regularly to be healthy. | **2TWSc.01** Sort and group objects, materials and living things based on observations of the similarities and differences between them. | **Healthy eating**  This activity focuses on managing diet. Introduce the term ‘diet’ and explain that it means everything we eat. Discuss with learners what is in their diets.  *What foods do you eat a lot of?*  *What foods do you eat little of?*  *Why do you think this is?*  Explain that, in order to stay healthy, we need to eat the right amount of food and ensure there are a range of different types of food in our diet.  Show learners a range of familiar foods of different types (e.g. meat, fruit and vegetables, grains, dairy foods) and include foods that not healthy (i.e. contain lots of fat, sugar, salt). This could be done with actual food or with pictures. Allow learners to sort the foods into groups of their own choosing then ask them to sort the foods into those which are healthy and those which are not.  When learners have finished sorting, choose a food they have identified as healthy and ask:  *This [banana] is healthy, so will I be healthy if I only eat [bananas]?*  *If it is healthy, can I eat 100 of them for lunch?*  Discuss learners’ answers, explaining that our diet will only be healthy if it is balanced and we eat appropriate amounts of each type of food. Make it clear that it is appropriate to eat foods that contain fat, sugar and salt as long as the quantities are controlled to ensure a balanced diet.  For health and safety, make sure you are aware of any food allergies in the class before bringing in any items of food to be handled.  **Resources:** Range of familiar foods |
| **2TWSm.01** Know that a model represents an object or idea in a clear way. | **Keeping clean**  This activity focuses on maintaining hygiene. Ask two learners to wet their hands then dip them in glitter (or flour), then, before they wash their hands, ask them to carry out a range of everyday tasks (e.g. pushing a chair under a table, tidying up a desk, handing out some exercise books).  *Where has the glitter/flour ended up?*  Discuss how the glitter/flour has spread to everything that was touched. Then ask other learners to touch the objects that have glitter/flour on them and then touch new ‘clean’ objects. Discuss how the glitter/flour can be spread even further.  Introduce the idea of germs as very small things that can make us ill if they get inside our bodies. Discuss with learners how this might happen (e.g. through our nose, mouth or a cut in our skin). Explain that we used the spread of glitter/flour to model the spread of germs but be clear that real germs are too small for us to see with our eyes alone.  *How can we avoid spreading germs?*  Explain that we should wash our hands with soap as well as water to make them clean.  Display some statements about personal hygiene; include some common misconceptions (e.g. ‘I can tell if my hands have germs on them by looking’, ‘I do not need a bath or shower because I do not look dirty’). Ask learners to decide if they think each statement is true or false. They could show their answer by moving to one side of the classroom for ‘true’ and another side for ‘false’. After everyone has decided, select some learners to explain their reason for choosing true or false.  Learners then record their learning by creating posters that encourage good personal hygiene practices such as washing hands.  **Resources:** Glitter/flour, range of statements about hygiene |
| **2TWSc.03** Take measurements in non-standard units.  **2TWSc.06** Collect and record observations and/or measurements by annotating images and completing simple tables.  **2TWSa.02** Identify simple patterns in results, e.g. increasing and decreasing patterns. | **Keeping active**  This activity focuses on moving regularly. Tell learners that, in order to be healthy, we need to move regularly. Discuss different ways of keeping active (e.g. walking, playing sports, dancing, helping family members with housework) and make a list of learners’ ideas.  *How did you come to school this morning?*  *What have you done today that got your body moving?*  *Did you do any moving that made you feel out of breath?*  Explain to learners that they are going to investigate how moving affects their bodies. They will observe how they feel after different amounts of movement, measuring our movement in steps.  In a large space (e.g. playground) learners take 10 energetic steps (i.e. jog, brisk walk) and then consider how they feel.  *Do you feel any different to how you felt before you started moving?*  *What has changed about your body?*  Repeat after taking 20 steps, 50 steps, 100 steps then 200 steps. Each time ask learners to scan their body and think about how they feel and how their body is reacting to the movement. Provide learners with a simple table in which they record their results (i.e. number of steps jogged, a brief note on their observations of their own body and feelings after each amount).  *Can you see any changes in your friends?*  *How do you think you would feel after 500 steps?*  Discuss how their bodies changed while doing the different kinds of movement.  *How did you feel when you were jogging around?*  *How did your breathing change when you were moving?*  *How did your heartbeat change when you did each set of steps?*  *Did you notice any patterns in how warm you felt and the number of steps you had taken?*  Explain that it is important to move regularly, such as walking or jogging, in order to stay healthy; our bodies will become unfit if we spend too much time being still.  *What could you do if you have been sitting still for over an hour? E.g. working in the classroom, watching television*  **Resources:** Results table |
| **2Bp.02** Describe what illness is and describe the common signs of illness in humans. | **2TWSc.06** Collect and record observations and/or measurements by annotating images and completing simple tables. | **Identifying common signs of illness**  Discuss the things that happen to our bodies when we are ill.  *How do you know when you are not well?*  Tell learners that these things (e.g. high body temperature, aches, pains, stomach upsets) are ‘signs’ that we have an illness. Explain that, when we have an illness, our bodies do not work in the way they usually do and this can lead to unpleasant effects like the ones they have described.  Learners then label an outline of a human body with the possible signs of illness they have suggested. Bring learners back together to share and discuss ideas and to address any misconceptions.  *Will we feel every single one of these things when we are ill?*  *Is being ill the same as being hurt?*  *What signs did you have last time you were ill?*  Be aware that learners may have relatives who are very ill. Conversations about illness may be difficult for them and will need to be handled sensitively.  **Resources:** Outline shapes of human bodies |
| **2Bs.02** Identify the different types of human teeth, explain how they are suited to their functions and describe how to care for teeth | **2TWSm.01** Know that a model represents an object or idea in a clear way.  **2TWSm.03** Describe the difference between a diagram and a picture. | **Exploring our teeth**  This activity focuses on the different types of teeth and their functions. Ask learners to look at their teeth in mirrors to use their tongue to feel their teeth and to discuss what they notice.  *Are all your teeth the same shape?*  *How are they different from each other?*  *How many teeth do you have?*  Using a large model (or diagram) of human teeth, show learners the different types of teeth and their functions, introducing and discussing the terms ‘incisors’, ‘canines’, ‘premolars’ and ‘molars’. Ask them to use their mirrors to find these different kinds of their teeth in their own mouths.  You could give learners a piece of food to eat that is large enough to require taking a bite out of it using incisors and canines (e.g. a piece of bread, a cracker/biscuit, a piece of fruit). As they bite and chew, discuss which teeth are doing which jobs: firstly, the incisors bite off chunks or canines rip food, then the premolars and molars grind down the food so it is small and soft enough to swallow.  Explain that, as teeth are all quite small and similarly coloured, we are going to create diagrams that make clear where the four different types of teeth are inside our mouths. Explain that a diagram is not what we see exactly, it is a representation of something real. We call a diagram a ‘model’ as it helps us think about the real thing.  On a black and white drawing of a human set of teeth, learners colour in the different types of teeth different colours. Learners create a key at the side so it is clear which teeth have been given which colour. Then they label the diagram with the function of each type of tooth. Finally, highlight how the diagrams are useful as they clearly show the locations of the different types of teeth, but they differ from the real thing as our teeth are not many different colours.  This activity can be extended by looking at images of the teeth of different animals (or dinosaurs) and discussing the differences between these teeth and human teeth.  For health and safety reasons, be aware of any allergies and/or special dietary requirements learners may have before sharing food.  **Resources:** Mirrors, black and white diagrams of human teeth |
| **2TWSm.01** Know that a model represents an object or idea in a clear way.  **2TWSm.02** Make and use a physical model of a familiar system or idea. | **Caring for our teeth**  This activity focuses on caring for our teeth. Explain that it is important to take good care of our teeth and discuss the reasons why.  *What do you do to take care of your teeth?*  *What might happen if we do not take care of our teeth?*  Using the learners’ suggestions, create a list of all the things we can do to care for our teeth (e.g. regular brushing, avoiding eating or drinking too many sugary foods). Explain germs in the plaque on our teeth eat the sugar in our foods. This process produces substances that damage our teeth. Regular brushing of our teeth removes these germs (and plaque) to make sure our teeth are not damaged.  Ask learners to use their tongues to try and feel their gums and every single one of their teeth. Explain that their gums and every one of these teeth need to be cleaned when brushing. Tell them that we are going to make a model to help demonstrate a good technique for brushing teeth. Show learners an example model of a mouth made out of modelling clay. The clay should be marked (or scored) in some way to make it clear that both gums and teeth are being represented. Explain that a model is not what we really see, and so our models do not need to look exactly like our teeth, but it is a representation of something real that will help us think about the real thing.  Learners then make models of a set of teeth and gums and practise ‘brushing’ making sure they brush each tooth as well as lightly brushing the gums. To support the model making, learners could use mirrors to get a better look at their own teeth.  **Resources:** Modelling clay, toothbrushes |

# Unit 2.5 Make a change

| Unit 2.5 Make a change (6.5 hours) |
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| Outline of unit: |
| This unit begins with a look at how forces can be used to change the movement of objects (e.g. speed, direction). Learners then consider how different materials have different properties, how the shape of these materials can be changed by forces in different ways and for a range of purposes.  Finally, the unit looks at changes to materials in which a new material is made, such as when wood is burned or an egg is cooked.  Ensure, when carrying out activities that involve heat, that learners are not exposed to temperatures hot enough to burn themselves. |
| Recommended prior knowledge or previous learning required for the unit: |
| Learners will benefit from previous experience of:   * exploring, talking about and describing the movement of familiar objects * recognising that forces are pushes or pulls * identifying, naming, describing, sorting and grouping common materials (including plastic, metal, glass, rock, paper and fabric) * understanding the difference between an object and a material * understanding that all materials have a variety of properties * describing common materials in terms of their properties * describing how materials can be changed by physical action. |
| Suggested examples for teaching Science in Context: |
| ***2SIC.02*** *Talk about how science explains how objects they use, or know about, work.*  This unit provides learners with the opportunity to think about, and discuss, how forces can change the shape and movement of objects they are familiar with in their everyday lives. In physical education classes, you could draw learners’ attention to the forces they exert which cause balls (or other sporting equipment) to change speed (i.e. start moving, stop moving, slow down, speed up) or change direction.  ***2SIC.03*** *Know that everyone uses science and identify people who use science professionally.*  Learners could choose the best material, based on its properties, for a ‘real life’ context (e.g. a gymnast’s kit). The use of forces to change the shape of materials can also be applied to a number of contexts (e.g. sculptors moulding their clay to create art, bread dough being shaped into special celebration shapes, cars being crushed). |

| Learning objective | Key vocabulary | Possible models and representations | Possible misconceptions |
| --- | --- | --- | --- |
| **2Pf.01** Know that forces can change the movement of an object. | Force, push, pull, act on, change, movement, direction, speed up, slow down | A force acting on an object can be represented with a simple diagram: an arrow points in the direction that the force is acting, ‘push’ or ‘pull’ is added as a label. Formal force diagrams are not required at this stage. | Learners can think that the term ‘force’ refers to something that has been forcefully done due to the common use of the word. To address this misconception, frequently model the correct use of the term in this context and give learners lots of opportunities to practise using it themselves.  It is also likely that learners will assume if an object is not moving then no forces are acting on it. This misconception will be addressed in Stage 5. |
| **2Pf.03** Recognise that things will only speed up, slow down or change direction when something else causes them to do so. | Force, push, pull, act on, change, movement, direction, speed up, slow down |
| **2Pf.02** Know that forces can change the shape of an object. | Force, change, shape, push, pull, bend, squeeze, twist |
| **2Cp.03** Know that materials can be tested to determine their properties. | Material, property, hard, soft, rough, smooth, dull, shiny, rigid, flexible, bendy, waterproof, permeable, opaque, transparent | Diagrams representing the tests applied to materials can be used to support learning. | Learners can assume that ‘smooth’ means the same as ‘soft’, and ‘rough’ means the same as ‘hard’. To address this misconception, allow learners to feel a range of materials with different combinations of these properties, for example something that is ‘smooth and hard’ or an object that is ‘soft and rough’, repeatedly modelling the correct vocabulary throughout. |
| **2Cp.02** Explain why materials are chosen for specific purposes on the basis of their properties. | Material, property, purpose, suitable, hard, soft, rough, smooth, dull, shiny, rigid, flexible, bendy, waterproof, stretchy, permeable, opaque, transparent | Diagrams can show the ways in which materials are used in objects and used by humans. | Learners can assume that the term ‘material’ refers only to fabric. Ensure to use the term correctly repeatedly and give learners many opportunities to practise the correct use while carrying out activities that look at materials and their properties. |
| **2Cc.01** Know that some changes can turn a material into a different material. | Material, change different, create | Learners can create simple diagrams to represent a change of materials, e.g. the burning of paper. They draw paper, fire, and a pile of ashes and then an arrow that goes from the paper through the fire to the ashes. | Learners may think that materials do not change from one type of material from another. For example, they may think toast still has the full slice of bread underneath, or that a raw material (e.g. oil) cannot be turned into another one (e.g. plastic). Allowing learners to witness these changes first hand (or on a video) and make close observations of the materials created will help to address this misconception. |

# Unit 2.5 Suggested activities

| Learning objective | Thinking and Working Scientifically opportunities | Suggested teaching activities and resources |
| --- | --- | --- |
| **2Pf.01** Know that forces can change the movement of an object.  **2Pf.03** Recognise that things will only speed up, slow down or change direction when something else causes them to do so. | **2TWSa.02** Identify simple patterns in results, e.g. increasing and decreasing patterns. | **Moving objects**  Show learners a ball placed on the floor (or a table).  *How can we make the ball move?*  For each suggested action from the learners, identify whether the force is a push or a pull.  Roll the ball a number of times to different learners. They change the speed, change the direction or stop the ball. Learners discuss the movement of the ball including how it changes. Explain that all these ideas are examples of forces (or pushes and pulls), which could act on the ball to make a change to its movement. Tell learners that, like the ball, objects will only speed up, slow down or change direction when something else causes them to do so.  Allow learners to explore the movement of a range of different familiar objects that roll/slide easily (e.g. toy cars, pencils), including some that are light enough to be blown (e.g. ping-pong balls). Ask them to find different ways of making the movement of the object change and to look for patterns in movement. Throughout learners’ exploration, ask questions to allow them to discuss their ideas and demonstrate understanding:  *How did you make the toy car move faster?*  *What could you do to stop the pencil from rolling off the table?*  *How is the movement different if you give a hard push or a soft push?*  *How did you make the tin can change direction?*  **Resources:** Ball, range of familiar objects that can be moved easily |
| **2Pf.02** Know that forces can change the shape of an object. | **2TWSc.01** Sort and group objects, materials and living things based on observations of the similarities and differences between them. | **Changing the shape of objects (requires additional resources)**  Give learners a small piece of modelling clay (or other malleable material) and ask them to find different ways of changing its shape.  *Can you stretch your clay?*  *What happens if you squeeze your clay?*  *How can you make it into a long, thin shape?*  Explain that we are changing the shape of our clay using forces (i.e. pushes and pulls) and tell learners that forces can change the shape of lots of other materials and objects.  *Can you think of any other objects that change shape if we use pushes or pulls?*  *Are some objects harder to change than others?*  Make clear the distinction between changing the position of an object (e.g. pushing a door open) and changing the shape of an object (e.g. scrunching up a piece of paper).  Learners then explore different ways to change the shape of materials (e.g. paper, tin foil, elastic bands, modelling clay, plastic from a carrier bag, fabric). Learners record their findings on a prepared sheet with headed boxes (e.g. bend, squash, twist, stretch) Throughout their exploration, discuss the different ways to change the shape of the objects.  *Are there any materials that can go in more than one place?*  *Is a stretch a push or a pull?*  *Are there any materials you can squash but not stretch?*  *Are there any materials you cannot change the shape of?*  After the learners have investigated the materials, reiterate that all the ways we have changed the shapes of objects have used forces (pushes and pulls).  **Resources:** Prepared sheets for sorting, modelling clay, a range of other objects with different malleability |
| **2TWSc.01** Sort and group objects, materials and living things based on observations of the similarities and differences between them. | **Can we change its shape?**  Show learners a piece of paper.  *How could we change the shape of this piece of paper?*  Have a few pieces to hand so learners can demonstrate their different ideas (e.g. scrunching, folding). Explain that all of their ideas are examples of changing the shape of something using forces. Then show learners an object made of strong metal (e.g. a pair of scissors, a chair).  *How about this object made of metal?*  *Could we change the shape of this object using forces?*  Discuss how the shape of the metal object could be changed (e.g. bending, using tools or machinery).  Reiterate that these ways of changing its shape all use forces; explain that forces can change the shape of lots of other materials and objects.  *Can you think of any other objects that change shape if we use pushes or pulls?*  *Are some objects harder to change than others?*  Make clear the distinction between changing the position of an object (e.g. pushing a door open) and changing the shape of an object (e.g. scrunching up a piece of paper).  Give learners sets of pictures of familiar objects. Include some objects whose shape could easily be changed with their hands, and some which would require machinery/tools (i.e. made of stronger material). Ask learners to sort the objects into those whose shape can be changed easily using bare hands, and those that cannot.  When learners have finished sorting their objects, discuss their choices and ask them to suggest other materials that could belong in each group.  End by showing videos of forces changing the shape of objects made of harder materials (e.g. a car being crushed, a metal shield being hammered into shape).  **Resources:** Pictures of familiar objects with different malleability |
| **2Cp.03** Know that materials can be tested to determine their properties.  **2Cp.02** Explain why materials are chosen for specific purposes on the basis of their properties. | **2TWSp.02** Make predictions about what they think will happen.  **2TWSa.01** Describe what happened during an enquiry and if it matched their predictions.  **2TWSc.03** Take measurements in non-standard units. | **Uniform for gymnasts (requires additional resources)**  Show learners a video of professional gymnasts taking part in a competition and discuss their clothing. *What properties will their clothing need to have?*  *What materials would be unsuitable to make their kit out of?*  Explain that their clothes need to be comfortable, flexible and able to stretch and then return to their original shape.  Tell learners we are going to investigate some possible materials for our national gymnastics team so we can recommend which material would be the best to make their kit out of. The range of materials should include: some stretchy materials that will return to their original shape, some stretchy materials that will not return to their original shape and some materials that are not stretchy at all; it should also include materials that are not fabrics (e.g. paper, very thin plastic or elastic) to prevent reinforcing the common misconception that the term ‘material’ refers to fabric alone. Show the learners the range of materials available to test and ask them to make a prediction about which will be best at stretching and then returning to its original form.  *Why do you think this one will be best?*  *Have you seen this sort of material used for anything else before?*  Learners then investigate the materials by stretching each, if possible, and seeing if it returns to its original shape. Learners should measure the difference in size when the material is stretched (compared to when it is unstretched) using non-standard measures (e.g. small building blocks, paperclips). They should record their results in a simple table which shows the material and the difference in size when stretched.  When learners have explored all the different materials, discuss their results and ask them to consider whether, or not, they predicted the best material correctly.  This activity can be extended by asking learners to think about other properties that the material should have (e.g. ability to be coloured to show team affiliations, resistance to rips and tears, ability to keep the athlete cool).  **Resources:** Range of materials with different stretch properties, item to use as a non-standard measure e.g. small building blocks, paperclips. |
| **2TWSc.05** Use a given secondary information source to find an answer to a question. | **Matching materials to their purposes**  Discuss how a material can have a number of different properties. Explain, using familiar examples, how materials are chosen for different purposes based on these properties.  *What properties does a fabric have that make it a suitable material for a shirt?*  *What types of material would not be suitable for a shirt?*  *What properties make them unsuitable?*  Explain that different materials have different properties and that scientists carry out tests on new materials, as they are discovered or created, to find out the properties of these materials so that they can be put to the best uses possible. Tell learners that they are going to use some scientists’ research into materials to find the best ones for a range of different purposes.  Show them images of copper and steel. Describe copper as a relatively flexible metal and steel as a very hard metal.  *Which material would be best for making tools with?*  Once answers have been discussed:  *Can you explain why copper would not be the best metal for the job?*  *Which metal would be best for making wires?*  Provide learners with a list (words or pictures) of common materials with a brief description of their properties; include more than one example of each different type of material (e.g. wool and cotton as fabrics, copper and steel as hard metals). Ask learners to decide which material would be best to make a range of ‘less familiar’ items (e.g. aeroplane, submarine). Learners should not know the answers immediately from their own experience.  **Resources:** Images of copper and steel, list of materials with a brief description of their properties, list of ‘less familiar’ objects |
| **2Cc.01** Know that some changes can turn a material into a different material. | **2TWSm.01** Know that a model represents an object or idea in a clear way.  **2TWSm.03** Describe the difference between a diagram and a picture. | **Changing materials**  Through discussion, help learners identify clear, observable changes (e.g. colour, texture) that help us tell if a material changes into another one. Show learners two pieces of iron (e.g. non-coated iron nails); they should be similar in shape and colour; one piece has rusted and the other has not. Set up the rusting of the iron beforehand, if possible, so that learners can witness the rusted iron being removed from water. This activity could also be done with pictures of two pieces of iron.  *What is the difference between the two pieces of iron?*  *How has one changed?*  *Have you seen this happen before?*  Explain that the material (i.e. the iron) changed when it came into contact with air and water, creating a new material (i.e. rust). Tell learners that it is difficult to represent this change in a picture. Explain that we are going to create a scientific diagram; it will not show exactly what has happened, but will be a clear representation that helps us think about what has happened. Demonstrate to learners how to draw a diagram showing a piece of iron, then an arrow, over which is written ‘air, water’, pointing to a piece of rusted iron.  Iron  Iron with rust  Air and water  Tell learners this clearly shows the material we had before, what change has happened and the new material.  Explain there are lots of changes where one material turns into a different material, then allow learners to observe some of these changes by watching demonstrations in the classroom, carrying out practical work themselves and/or watching videos. Examples could include paper (or bread or wood) burning, eggs being cooked, cakes being baked, cream becoming butter or leaves turning brown. After each example, ask learners to create a diagram, like the one above, that shows the initial material, the change that has happened and the resulting material.  For health and safety reasons, learners should take care with rusted metal, which should have no sharp edges. They should not come into contact with objects (or substances) that are hot enough to cause a burn (or scald).  **Resources:** Pictures, videos or first-hand examples in which a new material is formed, two pieces of iron (e.g. non-coated iron nails) |

# Unit 2.6 Polar explorer

| Unit 2.6 Polar explorer (7.5 hours) |
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| Outline of unit: |
| This unit is based around an imaginary journey to the South Pole, allowing learners to apply their science learning in a motivating ‘real life’ context. The activities could easily be adapted to a different environment (e.g. the rainforest, desert) if that better reflects your learners’ interests and experiences.  The unit is designed to be taught after the other units to allow learners to revise and consolidate their previous learning and apply it in different contexts. With this in mind, we recommend that this unit is taught last. Where a learning objective comes up that has been taught previously explicitly make the link to what was learned before and the context learners applied it in, to allow them to clearly see the connections in their learning and how the same knowledge and understanding can be applied in different contexts.  Learners carry out research into environmental conditions, plant and animal life and the practicalities of working in such a harsh environment. Learners build up a good understanding of what carrying out scientific investigations in the Antarctic would be like and how it would differ from their own everyday lives.  Then learners have the opportunities to use their previous learning on electricity and materials, applying it in ‘real life’ problem-solving contexts. |
| Recommended prior knowledge or previous learning required for the unit: |
| Learners will benefit from previous experience of:   * recognising that animals, including humans, need water and suitable food to survive * identifying things that are living and things that have never been alive * identifying, naming, describing, sorting and grouping common materials (including wood, plastic, metal, glass, rock, paper and fabric) * understanding the difference between an object and a material * understanding that materials have a variety of properties * describing common materials in terms of their properties * identifying things that are powered by electricity.   In addition to this prior learning, it would be helpful for learners to have completed the other units in this stage so that they have already had experience of the learning objectives that have been designed to be repeated within this unit. |
| Suggested examples for teaching Science in Context: |
| ***2SIC.01*** *Talk about how some of the scientific knowledge and thinking we have now was different in the past.*  Learners could see the impact that the advances in technology and scientific knowledge have made by comparing scientific exploration in the past (e.g. Ernest Shackleton’s expedition to the South Pole in 1911) with the experience of scientists involved in field research now.  Learners could also consider how, in the time before cameras and video recording equipment existed, the discovery of new plants and animals were shared with those who could not witness them first hand. This could be used to reinforce learning about the importance of scientific diagrams (i.e. clear representations of living things, objects and processes).  ***2SIC.03*** *Know that everyone uses science and identify people who use science professionally.*  The context of exploration provides many opportunities to think about scientists who carry out research in harsh environments and/or those who develop technologies associated with exploration e.g. insulated clothing designers, tent/shelter designers. Learners could find out more about investigations that are currently being carried out in the Antarctic and the scientists involved. |

| Learning objective | Key vocabulary | Possible models and representations | Possible misconceptions |
| --- | --- | --- | --- |
| **2Be.03** Identify similarities and differences between local environments in terms of hot, cold, dry, wet, many plants, few plants, many animals and few animals. | Environment, compare, similar, similarity, difference, different, lots, many, few, temperature, hot, hotter, hottest, warm, warmer, warmest, cold, colder, coldest, wet, dry, damp | Learners could draw diagrams of different environments to help identify key differences between them. | Learners may link the term ‘temperature’ to having a fever when ill due to the common use of the word. Discuss the meaning of the word and acknowledge its scientific and common uses, highlighting how it will be used in science lessons.  Learners can also assume the word ‘similarity’ implies things are identical, rather than just alike. Ensure you make clear the difference between things that are identical and things that are similar to help learners understand the use of the term ‘similar’. |
| **2Be.01** Know that an environment in which a plant or animal naturally lives is its habitat. | Animal, plant, wildlife, environment, habitat, area, inhabit | Diagrams highlighting the key environmental features of an unfamiliar habitat can be helpful for learners. | Learners can assume that plants (and animals) are in certain places because humans put them there. Throughout this unit, highlight to learners the reasons why plants and animals can be found in certain spaces (e.g. they can survive in very cold places). |
| **2Bs.01** Compare how animals, including humans, are similar and different in their external body parts and skin covering. | Arm, leg, head, body, ears, eyes, nose, mouth, hands, claws, nails, paws, hair, fur, skin, scales | Toy and model animals can be used as scientific models to represent animals in the classroom when learners cannot observe them first hand; learners can take a closer look and refer to them when describing and comparing animals. Discuss with learners the ways in which these toy animals are accurate and how they differ from the real ones, e.g. a toy penguin may be furry and smaller than a real penguin; some toys exaggerate the features of an animal. | Learners often assume insects (and other small animals) are not in fact animals. Similarly, they do not consider humans to be animals. To support learners in overcoming this misconception, repeatedly model the correct use of ‘animal’ vocabulary to name these living things and give them lots of opportunity to experience a diverse range of animals. |
| **2Bp.01** Know that humans need to manage diet, maintain hygiene and move regularly to be healthy. | Healthy, unhealthy, diet, hygiene, hygienic, unhygienic, clean, germs, move, movement, regular, regularly | Learners can represent their understanding of a balanced diet through diagrams and images (e.g. a balanced plate of food). | Learners can think that the word ‘diet’ refers to restricting calorie intake or omitting certain food types in order to lose weight, as this is a common use of the word. Explain the scientific meaning of the word ‘diet’ when it is first introduced and give learners lots of opportunities to hear and use the word in the correct context. Learners can think that ‘unhealthy’ foods, such as those containing lots of sugar are fat, should never be eaten. To address this misconception, be clear when discussing healthy diets that to be healthy foods should be eaten in the appropriate amounts.  Similarly, as learners are often told fruits and vegetables are healthy, they can think that a diet composed purely of fruit and vegetables would be healthy, whereas all diets require a source of protein. Explain to learners that a balanced diet is important and should include nutrients from a range of different foods. Learners can also think that the purpose of eating food is ‘to grow big and strong’. Explain clearly that food is needed for the body to move and for good health; point out that adults who have stopped growing still need to continue eating a healthy balanced diet. |
| **2Cp.03** Know that materials can be tested to determine their properties. | Material, property, hard, soft, rough, smooth, dull, shiny, rigid, flexible, bendy, waterproof, permeable, opaque, transparent | Learners can represent the procedure for testing a material through a series of diagrams (or comic strip). | Learners can assume that ‘smooth’ means the same as ‘soft’, and ‘rough’ means the same as ‘hard’. To address this misconception, allow learners to feel a range of materials with different combinations of these properties, for example something that is ‘smooth and hard’ or an object that is ‘soft and rough’, repeatedly modelling the correct vocabulary throughout. |
| **2Cp.02** Explain why materials are chosen for specific purposes on the basis of their properties. | Material, property, purpose, suitable, hard, soft, rough, smooth, dull, shiny, rigid, flexible, bendy, waterproof, permeable, opaque, transparent | Learners can label an image of an object with the different materials in the object and the reason each material has been chosen. | Learners can assume that the term ‘material’ refers only to fabric. Use the term correctly and repeatedly; give learners many opportunities to practise the correct use of the term while carrying out activities that look at materials and their properties. |
| **2Pe.03** Explore the construction of simple series circuits (limited to cells, wires and lamps). | Circuit, component, complete, cell, battery, wire, lamp | Simple pictures (or diagrams) can be used to represent circuits. There is no expectation will learners will use or create circuit diagrams at this stage. | Learners can be confused about how components need to be ordered and connected in a series circuit. For example, thinking that both wires can touch the same end of the battery, or that a lamp can be lit by simply connecting one end of a wire to the lamp and the other to a battery. Misconceptions like these can be addressed by learners having lots of opportunities to experiment with this equipment so that they can see for themselves what works as a complete circuit and what does not. |

# Unit 2.6 Suggested activities

| Learning objective | Thinking and Working Scientifically opportunities | Suggested teaching activities and resources |
| --- | --- | --- |
| **2Be.03** Identify similarities and differences between local environments in terms of hot, cold, dry, wet, many plants, few plants, many animals and few animals. | **2TWSp.01** Ask questions about the world around us and talk about how to find answers.  **2TWSc.05** Use a given secondary information source to find an answer to a question. | **Researching Antarctica**  Tell learners that we will be taking an imaginary trip to the South Pole which is in a large area called Antarctica; to prepare ourselves we will do some research about what it is like there. Show learners a globe and ask if they can find where they are, then show them where Antarctica is. Encourage learners to ask their own questions about the environment, keeping a note of these so that they can be explored in future lessons if not covered today.  *What would you like to know about the weather in Antarctica?*  *How do you think the environment might be different to ours?*  *What clothing might we need to take?*  When you have gathered questions, tell learners that we will need to find the answers to some of these questions before we set off so that we know what to expect from the harsh environment.  *How could we find the answers to our questions before we go?*  Explain that, although sometimes scientists find answers by carrying out their own investigations, when we are unable to go to Antarctica to carry out an investigation for ourselves, we can answer the questions by carrying out secondary research.  Learners then use simple information texts and photographs of Antarctica to find out about the temperature, weather, number and types of plant and animal life; they also look for the answers to their own questions.  When learners have completed their research, discuss the differences between the polar environment and their local one.  *How is the temperature different in Antarctica?*  *Are there any similarities in the weather between here and there?*  *Are there any plants in Antarctica that can also be found in our local environment?*  **Resources:** Globe, information texts and photographs of Antarctic environments |
| **2Be.01** Know that an environment in which a plant or animal naturally lives is its habitat.  **2Bs.01** Compare how animals, including humans, are similar and different in their external body parts and skin covering. | **2TWSc.01** Sort and group objects, materials and living things based on observations of the similarities and differences between them.  **2TWSc.05** Use a given secondary information source to find an answer to a question. | **Researching polar animals**  Ask learners to compare their local environment with the Antarctic environment (i.e. around the South Pole) with a focus on the animals and plants they expect to live there.  *What animals do you think you would find in this habitat that do not live near to our school?*  *How is that habitat different to our own?*  *Do you think those animals would like it here?*  *What sort of plants do you think live in Antarctica?*  Explain that we are going to carry out some research into animals that live around the South Pole and make some comparisons between them. Look at some photographs of animals found in Antarctica and, if possible, watch some videos of them moving, finding food and interacting with other animals.  *How do the animals move?*  *How are they similar and different?*  Ask learners that to compare specific features of some of the animals that live around the South Pole. Model choosing two animals from this habitat and, using photographs and short fact files about the animals, complete a simple three column table;   |  |  |  | | --- | --- | --- | | First animal… | Features to look for… | Second animal… | |  | Skin covering |  | |  | Number of legs |  | |  | How it moves |  | |  | Etc. |  |   This activity can be extended by learners choosing their own criteria for comparison for the central column in the table, or making a detailed comparison of similar animals of different species (e.g. colouring, size and behaviour of Emperor and Adélie penguins).  **Resources:** Information texts and photographs (and/or videos) of Antarctic animals |
| **2Bp.01** Know that humans need to manage diet, maintain hygiene and move regularly to be healthy. | **2TWSp.01** Ask questions about the world around us and talk about how to find answers.  **2TWSc.05** Use a given secondary information source to find an answer to a question. | **Staying healthy at the South Pole**  This activity considers the things humans need to do in order to stay healthy, revisiting earlier learning and allowing learners to apply what they know in a new context.  Discuss with learners the things that humans need to do in order to stay healthy; include managing diet, maintaining hygiene and moving regularly. Ask how this might be difficult on an expedition to the South Pole. Discuss some of the challenges (e.g. freezing temperatures, the requirement to take all the food they need with them and of having to ‘move home’ all the time rather than live in one place. Encourage them to come up with their own questions about specific elements of keeping healthy, such as:  *How will I wash my hands if the water has frozen?*  *How will I pack enough healthy food into a small bag?*  *How will I have a bath/shower?*  Add in your own questions if learners do not cover the aspects of managing diet, maintaining hygiene or movement with their own questions.  Learners then find the answers to their questions using information texts, pictures and/or videos about daily life for scientists who work in difficult conditions in Antarctica. If possible, learners could also watch interviews (or live chat) with polar scientists as part of their research.  **Resources:** Information texts, pictures, videos about daily life for scientists work in Antarctica |
| **2Cp.03** Know that materials can be tested to determine their properties.  **2Cp.02** Explain why materials are chosen for specific purposes on the basis of their properties. | **2TWSc.02** Use given equipment appropriately.  **2TWSc.04** Follow instructions safely when doing practical work.  **2TWSa.03** Present and interpret results using tables and block graphs. | **Finding the best material for a coat (requires additional resources)**  Discuss the weather and temperature in Antarctica; ask learners to consider what kind of clothing might be needed for our expedition.  *What properties will our coats need?*  *What materials would not be good to use for our coats? Why?*  *How would the clothes you would wear at the South Pole be different to the clothes you are wearing now?*  Tell learners we are going to investigate which material will be best for our coat using cups of warm water (to represent us) and small pieces of different materials (to represent the coat). Show learners a data logger and explain that this equipment can be used to take measurements including temperature. Explain how to read the temperature and ask learners to use the data logger to measure, and record, the room temperature. Explain that this will allow us to see when our water has cooled down to the same temperature as the room. (If data loggers are not available, non-mercury, plastic thermometers can be used. Learners may need support in reading the scale.)  Wrap a number of identical cups in different materials (e.g. clear plastic film, metal tin foil, plastic bubble wrap and different kinds of fabrics) then add warm water to the cups and remind learners that these cups represent humans who need to keep warm, and the materials represent the coats. Place the cups into bowls of ice and explain this represents the very cold conditions in Antarctica. Explain that the best material for a coat for Antarctica will keep the water warm for longest, just as it would keep us warm for the longest. Place the data loggers’ temperature probes to the water and ask learners to observe carefully at intervals of one minute to see how long it takes for the temperature to drop down to the noted temperature of the room.  Learners then record their results on a block graph, showing how many minutes each material kept the water warm for. Use these results to discuss which would be the best material. Discuss with learners why the tallest bar on the graph would relate to the best material for keeping warm.  *Which material would not be suitable for a coat for Antarctica?*  *Why do you think this material would be the best?*  *How much longer did it keep the water warm than that material?*  This activity can be extended by discussing other properties our coats would need to have (e.g. being comfortable, being waterproof, not being too bulky).  For health and safety reasons, ensure that learners use warm water that is not hot enough to scald them.  Cambridge International does not recommend the use of glass thermometers or thermometers that contain mercury for Cambridge Primary Science. If thermometers are to be used, carry out a risk assessment for this activity and ensure learners are made aware of the health and safety considerations of using the thermometers.  **Resources:** Set of identical cups, warm water, data loggers with temperature probes, range of different materials for testing |
| **2TWSc.01** Sort and group objects, materials and living things based on observations of the similarities and differences between them. | **Clothes for cold environments**  Discuss the weather and temperature in Antarctica and ask learners to consider what kind of clothing might be needed for our expedition.  *What properties will our coats need?*  *What materials would not be good to use for our coats? Why?*  *How would the clothes you would wear at the South Pole be different to the clothes you are wearing now?*  Learners then sort a range of real items of clothing (or photographs of familiar items of clothing) according to whether or not they’d be suitable for wearing while outdoors in Antarctica. The range should include clothes and accessories (e.g. footwear, hats, gloves) some of which are suitable for cold weather and some that are appropriate for warm/hot weather. Ask learners to justify their choices using vocabulary associated with the properties of materials.  *Do you think a sunhat would be appropriate for wearing at the South Pole?*  *Which shoes do you think would be suitable? Why?*  **Resources:** Selection of clothes and accessories |
| **2Pe.03** Explore the construction of simple series circuits (limited to cells, wires and lamps). | **2TWSc.02** Use given equipment appropriately. | **Make a torch/flashlight (requires additional resources)**  This activity looks at constructing series circuits; it revisits earlier learning and allows learners to apply what they know in a new context.  Tell learners that, as there are no street lights at the South Pole, it can be very difficult to see at night time. We need to make torches (or flashlights) that will allow us to see at night time. Look at some real torches (or photographs of torches) and discuss.  *Where does the light come from?*  *There is no plug, so how is the torch powered?*  *Where do you think the rest of the circuit is?*  Point out the reflective material around the light source that reflects the light and helps us to see even more; we will put reflective material (e.g. tin foil) around the lamp in our torches. Recap with learners the components they will need to create a circuit (i.e. wires, batteries, lamps). Tell learners that the casing of torches is often made of hard plastic, but we do not have the equipment to build with hard plastic at school, so we are going to build a model using materials that are easier to shape (e.g. flexible card, plastic). Once learners have seen the materials and equipment available, give them time to create a design for a torch that incorporates a working circuit.  Support learners through the process of constructing their circuits, creating a casing and putting reflective material around the lamp. Ensure that they understand that their circuit must form a complete loop with wires attached to each end of the battery and lamp.  When the models are finished, give learners the opportunity to try out their torches in a darkened room so that they can evaluate their finished products and suggest any improvements.  **Resources:** Flexible card, reflective material, wires, batteries, lamps |
| **2TWSc.06** Collect and record observations and/or measurements by annotating images and completing simple tables. | **Fixing broken equipment**  This activity looks at the construction of series circuits; it revisits earlier learning and allows learners to apply what they know in a new context.  Discuss with learners the types electrical equipment we use in our everyday lives (e.g. hand-held gaming systems and portable music players) which we might also like to have as Antarctic explorers. Using pictures explain that scientists working at the South Pole need similar, battery-powered items to make life more comfortable as well as additional equipment to carry out their investigations (e.g. torches, portable weighing scales, calculators, cameras, microscopes).  Tell learners we would be too busy to fix equipment on an Antarctic expedition and so it is important to check all of our equipment is working properly before we set off. Show learners images of the items above, consisting of an outline of the object’s shape and a simple series circuit with an error depicted inside (e.g. incomplete circuits, both wires leading to one end of the battery, only one wire connects a battery and a lamp). At this stage, the pictures should be accurate representations of the equipment rather than conventional circuit symbols. After a brief discussion of what could be wrong with these circuits, learners annotate the pictures with explanations of how the circuit can be fixed in order to make the equipment work.  **Resources:** Pictures of battery-powered electronic equipment, pictures of the same equipment showing incorrectly-made series circuits. |

# Sample Lesson 1

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| CLASS: | |
| DATE: | |
| **Learning objectives** | **2Bs.02** Identify the different types of human teeth, explain how they are suited to their functions and describe how to care for teeth.  **2TWSm.01** Know that a model represents an object or idea in a clear way.  **2TWSm.02** Make and use a physical model of a familiar system or idea. |
| **Lesson focus /**  **success criteria** | I can create a model of human teeth  I can explain how a model helps us  I can identify the different types of teeth  I can explain the functions of the different types of teeth  Learners can describe how to care for teeth. |
| **Prior knowledge / Previous learning** | Learners should have already learned about the different types of human teeth and had the opportunity to look at their own teeth using mirrors. |

**Plan**

| **Timing** | **Planned activities** | **Notes** |
| --- | --- | --- |
| **Introduction** | Begin the lesson with a brief discussion of previous learning about the different types of teeth.  *How are the teeth inside your mouth shaped differently?*  *Why are they different shapes?*  *Do all our teeth do the same job?*  Then discuss how humans have two sets of teeth only. The first set fall out, typically, between the ages of 4 and 6 years old and are replaced with adult teeth.  *Have you ever lost a tooth?*  *Have you got any adult teeth yet?*  Explain that the second set of teeth will not be replaced so if it is vital that we keep good care of them. In addition to this, problems with our teeth can be very painful. Tell learners that today we will be learning about how to take care of our teeth. Discuss ways in which this can be done.  *What do you do to take care of your teeth?*  *What might happen if we do not take care of our teeth?*  Using the learners’ suggestions, create a list of all the things we can do to care for our teeth, making sure to discuss the importance of regular brushing and avoiding eating too many foods that are high in sugar. | A discussion about oral hygiene will need to be carried out sensitively as learners may have different personal hygiene habits. |
| **Main activities** | Ask learners to use their tongues to try and feel every single one of their teeth and their gums. You could give them mirrors to take a really good look at their teeth.  *Can you count your teeth?*  Explain that every one of these teeth and their gums need to be cleaned when brushing. Tell them that we are going to make a model to help demonstrate good technique for brushing teeth, brushing every one including those far at the back of our mouths and lightly brushing our gums.  Show learners a model of a mouth made out of modelling clay, on which there is a clear difference between the teeth and gums. This can be done by using two different colours of modelling clay (or mould and mark the clay in some way to make it clear that both gums and teeth are being represented). Explain that a model is not exactly what we really see, and so our models do not need to look exactly like our teeth. A model is a representation of something real that will help us think about the real thing. Discuss how the model is similar and different to our real teeth.  *Are our teeth made out of modelling clay?*  *In what ways is our model the same as your real teeth?*  Learners then use modelling clay to make their own model of a set of teeth and gums. Encourage them to make their models as close to ‘real life’ as possible.  *Are all of your teeth the same shape?*  *Do you have any gaps in your teeth?*  *Could you show this in your model?*  To support the model making, learners could use mirrors to get a better look at their own teeth. | Plaque-disclosing tablets and solutions could be used to clearly show which areas have been missed when brushing teeth; they are available from pharmacists and they temporarily stain plaque bright colours.  To avoid learners feeling embarrassed, this may sensitively done by an adult who has intentionally missed an area when brushing that morning or who has eaten some food recently. |
| **End/Close/ Reflection/ Summary** | Learners practise brushing their completed teeth models, making sure they brush each tooth as well as lightly brushing the gums. Ask others to observe and point out if any areas have been left unbrushed.  Discuss the length of time it takes to ensure every tooth and the gums are brushed, highlighting that it cannot be done in a few seconds and it takes time to get it right.  To ensure understanding, ask learners to describe how they can take care for their teeth and explain what may happen if they do not take proper care of their teeth. |  |

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| **Reflection Use the space below to reflect on your lesson. Answer the most relevant questions from the box on the left about your lesson.** |
| *Were the learning objectives and lesson focus realistic? What did the learners learn today? What was the learning atmosphere like? What changes did I make from my plan and why?*  *If I taught this lesson again, what would I change?*  *What two things went really well (consider both teaching and learning)?*  *What two things would have improved the lesson (consider both teaching and learning)?*  *What have I learned from this lesson about the class or individuals that will inform my next lesson?* |
| **Next steps**  **What will I teach next, based on learners’ understanding of this lesson?** |

# Sample Lesson 2

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| --- | --- |
| CLASS: | |
| DATE: | |
| **Learning objectives** | **2Cp.03** Know that materials can be tested to determine their properties.  **2TWSp.02** Make predictions about what they think will happen.  **2TWSc.02** Use given equipment appropriately.  **2TWSa.01** Describe what happened during an enquiry and if it matched their predictions. |
| **Lesson focus /**  **success criteria** | Learners followed a given investigation method.  Learners determined the properties of a range of materials by testing them. |
| **Prior knowledge / Previous learning** | Learners should be able to understand that all materials have a variety of properties, and be able to describe common materials in terms of these properties.  Learners should also have begun to understand that materials are chosen for different purposes based on their properties, following recent lessons on this subject. |

**Plan**

| **Timing** | **Planned activities** | **Notes** |
| --- | --- | --- |
| **Introduction** | Show learners an image of a quarry worker and discuss.  *What do you think this person’s job is?*  *Where do you think they are?*  *Why might they by wearing a helmet?*  Tell them we are going to carry out an investigation to solve a problem this person has. They need a new lunchbox as their old one has broken, and they need to know the best material to make the new one out of. Show them a paper bag and say this is what they have been using to take their lunch into work.  *What might be the problems with using a paper bag to carry lunch in?*  *What would happen to their lunch of it was raining heavily?*  *Or if they dropped their lunch by accident and someone stood on it?*  Explain we are going to help by carrying out an investigation into which material will be best for the job.  *What properties will this material need to have?*  *What types of materials might be good for this purpose?*  *What types of materials do you think would be unsuitable for this purpose?*  Tell learners that the most important thing to this person is that their lunch does not get wet, as they often have to work outside in the rain. *How could we test our different materials to see which are waterproof?*  Gather learners’ ideas, discussing how each may or may not be effective. |  |
| **Main activities** | Demonstrate to learners how to test to see whether a material is waterproof by covering a small, clear container with a material that water passes slowly through (e.g. paper, thick fabric) and using a pipette to drop water onto the top. Learners observe if the water goes through the material and drops into the container beneath; explain that this can be a slow process for some materials so they may need to wait. Link this to the ‘real life’ context of the investigation; the worker’s food will need to be in the lunchbox for several hours before it is eaten, so the material must keep out water over a long period of time.  Show learners the range of different materials that they will be testing. Ask them to make a prediction about which materials will be waterproof and which will not.  *Why do you think that material will be waterproof?*  *Have you seen it used for any other objects that need to be waterproof?*  *Why do you expect that material not to be waterproof?*  Allow learners to carry out the investigation themselves. While they are working, discuss their investigations with them in relation to their predictions, allowing them to practise using scientific vocabulary.  *Was that material waterproof like you predicted?*  *How do you know?*  *Are there any other tests you would like to do to be sure?*  This activity can be extended by asking learners to consider other material properties that would be beneficial for a lunchbox (e.g. relatively strong so the food does not get squashed, light so it can be easily carried, not porous so it would be easy to clean). | Resources for the investigation include: Clear container (or cups), pipettes, range of different materials to test (e.g. card, paper, fabric, wood, metal, rock, rigid plastic and thin, flexible plastic). |
| **End/Close/ Reflection/ Summary** | When learners have finished their investigation, come back together to discuss findings and see if their predictions were correct.  *Was that material waterproof as you predicted?*  *Did any of your results surprise you?*  Discuss which of the waterproof materials would be best for a lunchbox, highlighting that just because the material is waterproof does not necessarily make it the most suitable (e.g. a lunchbox made of rock would be too heavy to carry around all day). | You could end the lesson with a look at some real lunchboxes and the different materials they are made of; discuss which would be the most suitable for our quarry worker’s needs. |

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| **Reflection Use the space below to reflect on your lesson. Answer the most relevant questions for your lesson.** |
| *Were the learning objectives and lesson focus realistic? What did the learners learn today? What was the learning atmosphere like? What changes did I make from my plan and why?*  *If I taught this lesson again, what would I change?*  *What two things went really well (consider both teaching and learning)?*  *What two things would have improved the lesson (consider both teaching and learning)?*  *What have I learned from this lesson about the class or individuals that will inform my next lesson?* |
| **Next steps**  **What will I teach next, based on learners’ understanding of this lesson?** |

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