**Scheme of work – Science Stage 3**

Cambridge Primary

# Introduction

This document is a scheme of work created by Cambridge International as a suggested plan of delivery for Cambridge Primary Science Stage 3.
Learning objectives for the stage have been grouped into topic areas or ‘units’. These have then been arranged in a recommended teaching order but you are free to teach objectives in any order within a stage as your local requirements and resources dictate. The scheme for Science has assumed a term length of 10 weeks, with three terms per stage and two units per term. An overview of the sequence, number and title of each unit for Stage 3 can be seen in the table below. The suggested percentage of teaching time to spend on each unit is provided at the beginning of each unit. You should decide on the amount of teaching time as necessary, to suit the pace of your learners and to fit the work comfortably into your own term times.

Where possible, several suggested activities have been given for each learning objective. Some are short introductory or revision activities and some are more substantial learning activities. You need to choose a variety of activities that will meet the needs of your learners and cover all of the requirements of the learning objectives. Scientific Enquiry learning objectives can be taught in the context of any of the learning objectives from the other strands. Sample activities that particularly focus on a scientific enquiry have been included in each unit where relevant. It is recommended that you include a wide variety of scientific enquiry in your science teaching.

There is no obligation to follow the published Cambridge International scheme of work in order to deliver Cambridge Primary Science. It has been created solely to provide an illustration of how delivery mightbe planned over the six stages. A step-by-step guide to creating your own scheme of work and implementing Cambridge Primary in your school can be found in the Cambridge Primary Teacher Guide available on the Cambridge Primary support site. Blank templates are also available on the Cambridge Primary support site for you to use if you wish.

|  |  |  |
| --- | --- | --- |
| Term 1 | Term 2 | Term 3 |
| Unit 3.1 Life processes | Unit 3.3 Flowering plants | Unit 3.5 The senses |
| Unit 3.2 Materials | Unit 3.4 Forces and friction | Unit 3.6 Keeping healthy |

# Unit 3.1 Life processes

It is recommended that this unit takes approximately **35% of the term.**

In this unit, learners:

* revise that plants and animals are living things
* use life processes to identify living things
* use simple features to sort living things into groups.

## Scientific Enquiry work focuses on:

* observing and comparing objects, living things and events
* making generalisations and beginning to identify simple patterns in results.

## Recommended vocabulary for this unit:

* life processes, living, non-living
* grow, move, reproduce, offspring, nutrition
* observe, group, sort
* features, feathers, scales, hair, fur, gills, fins, legs, arms, wings, beak
* fish, bird, mammal, insect, reptile.

| Framework code | Learning objective | Suggested activities to choose from | Resources  | Comments  |
| --- | --- | --- | --- | --- |
| 3Bh13Bh23Bh63Eo13Eo5 | Know life processes common to humans and animals include nutrition (water and food), movement, growth and reproductionDescribe differences between living and non-living things usingknowledge of life processesSort living things into groups, using simple features and describe rationale for groupingsObserve and compare objects, living things and eventsMake generalisations and begin to identify simple patterns in results | Learners have previously learned some of the characteristics of living things in Stage 1. In particular, living things:* can move
* can grow
* need food
* can have offspring.

Identify what learners can recall about the characteristics of living things with activities such as:* Display three pictures – an animal, a plant and a toy vehicle. Learners discuss in pairs: Which is the odd one out? Why? What features do these things have in common? Discuss and share responses as a class. Write up a list of words to describe the odd one out each time.
* Place learners in groups and provide each group with a set of cards containing pictures of a variety of living and non-living things. (Maximum 12 cards in a set). Without telling learners your reasoning, have them sort the pictures into two groups, e.g. things that move and things that do not move. Have learners explain why they have sorted them in that way.

Humans and animalsPrepare a set of cards with statements about life processes on them. These should use the terms expected of a Stage 3 learner e.g. moves, grows, reproduces, needs nutrition. Provide the cards to groups of learners. * Make sure that the learners understand the statements on the four cards.
* Learners use a Venn diagram with two intersecting circles; label the circles ‘Animals’ and ‘Humans’ and place the cards into the circles. Large hoops can be used to create the Venn diagram rather than drawing, if preferred.
* Discuss and agree that the four statements about life processes are all true for animals and humans.
* Use this to emphasise that humans are a type of animal; all the statements that apply to animals also apply to humans.

Watch a video clips, e.g. a robot moving and they watch a learner moving in class (could be while the video is playing). Learners compare ways in which a learner and a robot are alike. Learners then explain how they know the robot is not alive.Animals and plantsRepeat the Venn diagram activity; this time the intersecting circles are labelled ‘Animals’ and ‘Plants’.* Learners decide where to place the four life statement cards (moves, grows, reproduces, needs nutrition).
* If this activity identifies misconceptions that plants cannot move, then show some time-lapse footage of a plant moving (e.g. towards a light source).
* Emphasise that plants need nutrition. They get water through their roots but they make their own food in their leaves.
* Use this activity to emphasise that plants and animals are living things and so have the same life processes.

Use pictures of a lamppost and a tree.Learners compare ways in which they are similar and different. Learners then explain how they know the tree is alive. | Pictures of an animal, a plant, a toy vehicle.Set of cards including pictures of living things (humans, animals and plants) and non-living things.Life process statement cardsVenn diagrams or hoops. e.g. robot moving<https://youtu.be/sv35ItWLBBk> e.g. plants moving towards a light source <https://youtu.be/j-dZ3VKjJEw>  |  |
| 3Bh63Eo1 | Sort living things into groups, using simple features and describe rationale for groupingsObserve and compare objects, living things and events | Provide learners with pictures of different types of animals (e.g. fish, birds, mammals, insects, reptiles). Learners can spend some time identifying the features of each living thing (e.g. feathers, scales, hair, fur, gills, fins, legs, arms, wings, beak) and decide how to sort them into groups.Ask learners to describe the animals in each group and to explain why they have chosen their groups based on the features the group has in common. Similarly, provide learners with pictures of different types of plants to sort. Learners discuss how to sort them into groups and explain their decisions. | Pictures of different animals to sort (including examples of fish, birds, mammals, insects and reptiles).Pictures of different plants to sort (including examples of trees, small flowering plants, grasses). | Note: Major classifications such as vertebrate and invertebrate are introduced in Stage 4. |

# Unit 3.2 Materials

It is recommended that this unit takes approximately **65% of the term.**

In this unit, learners:

* extend their knowledge of the range of materials we use and of their characteristic properties
* develop ideas as to why materials are chosen for specific uses.

## Scientific Enquiry work focuses on:

* collecting evidence in a variety of contexts to answer questions or test ideas
* suggesting ideas, making predictions and communicating these
* observing and comparing objects, living things and events
* presenting results in drawings, bar charts and tables
* drawing conclusions from results and beginning to use scientific knowledge to suggest explanations.

## Recommended vocabulary for this unit:

* materials, object
* hard, soft, shiny, rough, smooth
* properties; waterproof, transparent, transparency, opaque, porous, porosity, absorbency, strength, pliable, coarseness
* insulator, conductor, insulates, conducts
* sort, group, classify.

| Framework code | Learning objective | Suggested activities to choose from | Resources  | Comments  |
| --- | --- | --- | --- | --- |
| 3Cp1 | Know that every material has specific properties, e.g. hard, soft, shiny  | Place a block of material in a feely bag so that it cannot be seen. Learners try to identify a material simply by using the sense of touch. Ask learners how they knew what the material was. Discuss the properties of materials that can be explored by touch (e.g. hard, smooth, pliable). *Are there other properties we cannot determine by touch?* Discuss. Describe a range of properties including (but not limited to): transparency, porosity, absorbency, hardness, pliability, coarseness, heat/electrical conductivity. Learners explore a range of materials for each property; they discuss what each property ‘means’.Play a question game in groups. One player has a material on a card and answers questions from the group on the material’s properties, e.g. *Is it transparent?* The card holder uses the card to answer the question. The winner is the player in the group who correctly identifies the material on the card. The winner selects a new material card.  | Feely bag - a bag made of dark cloth which objects can be placed and learners have to use their sense of touch to determine the object. A selection of blocks of different materials.A range of materials with different properties.Cards of materials. The card has an image and a summary of the materials properties to support answering questions. Use common materials the learners will be aware of for the cards.  |  |
| 3Cp33Ep23Eo13Eo33Eo4 | Explore how some materials are magnetic, but many are notSuggest ideas, make predictions and communicate theseObserve and compare objects, living things and eventsPresent results in drawings, bar charts and tablesDraw conclusions from results and begin to use scientific knowledge to suggest explanations | Learners look at, and play with, a selection of magnets. Discuss where they might have seen them before and what each is used for, e.g. fridge magnets, games. Discuss why magnets are only attracted to some items. **Scientific Enquiry activity***What materials are magnetic?* Learners will test different materials to see if they are magnetic or not. Provide learners with magnets and then identify materials around the classroom to test. Learners can make predictions on which of the materials are magnetic. Learners then test the materials. Record predictions and results in a table; the name of the object and  or x to indicate if it is magnetic or not. Compare results to predictions. Address any misconceptions learners may have. The learners can make a fishing rod by attaching some string to a drinking straw and fixing a small magnet on the end of the string. Provide the learners with some ‘fish’ with different materials as part of them; use some magnetic and some non-magnetic materials. E.g. a fish with a paperclip, a fish with a rubber, a fish with plastic etc. Have a ‘Go fishing’ competition to see who can ‘catch’ the most fish in a given time. Discuss why only some of the fish can be picked up. | A selection of magnets which can include some magnetic toys and objects.A selection of materials to test for being magnetic. Drinking straws, string, paper clips, small magnets, fish shapes, materials/objects.  | Misconception alert: Magnetic materials do not stick or attach to magnets. There is no physical interaction involved in a material being attracted by a magnet. Misconception alert: Learners may find it difficult to distinguish between a magnet and a magnetic material. Magnets cause magnetic materials to be attracted to the magnet. A magnetic material will not attract or repel another magnetic material/object.  |
| 3Cp43Ep1 | Discuss why materials are chosen for specific purposes on the basis of their propertiesCollect evidence in a variety of contexts to answer questions or test ideas | Give learners an object made of two or more materials, e.g. a saucepan with a wooden handle; a spoon with a plastic handle; a shoe with a rubber sole and leather upper. Learners draw the object and add labels that identify which materials have been used for the different parts and why these have been chosen. For example, a pair of scissors with metal blades and plastic handles has: blades made of metal (strong, hard and can be sharpened easily) and plastic handles (easy to shape, more comfortable to hold than metal). Learners carry out a class audit of objects and their materials, and why those materials have been used. Ask learners to look at objects in other information sources. Learners identify the materials the objects are made of and discuss why those materials have been used. This can introduce learners to uses of materials outside of their personal experience. For example: *What is an aeroplane mostly made of and why?*  | Objects made from two or more materials.Secondary information sources. |  |
| 3Cp43Ep2 3Ep33Eo13Eo23Eo3 | Discuss why materials are chosen for specific purposes on the basis of their propertiesSuggest ideas, make predictions and communicate theseWith help, think about collecting evidence and planning fair testsObserve and compare objects, living things and eventsMeasure using simple equipment and record observations in a variety of waysPresent results in drawings, bar charts and tables | **Scientific Enquiry activity**Learners investigate which paper is the most absorbent.Introduce the activity by spilling a cup of water and trying to mop it up quickly. *What type of paper would do the job well?* Discuss the term ’absorbency’ as the ability of a material to soak up water.Provide samples of different papers for investigation. Before the test, learners predict which they think will be most absorbent to least absorbent; they stick samples of each paper, in predicted order of absorbency, on a recording sheet.*How can we test this?* Consider all reasonable suggestions from the learners (see comments). Suggestions for the method may include: dripping drops of water on a sample and waiting to see how much drips through; placing paper in a volume of water and measuring how much water soaks up; soaking a same-sized sample in identical volumes of water, wringing it out and measuring the amount of water squeezed out. Agree on a method and make sure it is a fair test. Learners test the samples and record the results. *Which paper was the best? How do you know?*Present a familiar item made from a new (or different) material.*How could you test if this item performed better than the others? What other materials could we test absorbency for?***Scientific Enquiry activity**Learners investigate which paper is the strongest.*What type of paper will make the best paper bag?* Suggest that a bag is needed to carry potatoes or vegetables. *What property should the paper have to be able to do this?* (It has to be strong).Show the different types of paper available for testing. Label each type of paper. Learners predict which they think will be the strongest to the weakest.In groups, plan a test to find out which paper is strongest. Share ideas with the rest of the class. Agree methods and demonstrate, if necessary, how to perform the test. Discuss fair testing, i.e. same size strip of paper, same type of weight.Learners carry out the test. They draw a bar chart of results and compare their predictions with what happened.*Which paper was the strongest? How do you know?***Scientific Enquiry activity**Learners investigate which material is best for keeping a drink hot.*Have you ever let a hot drink cool down when you are busy doing something else?*Demonstrate to learners how to take the temperature of different liquids using a thermometer. Learners practise using a thermometer; they can record their results.Explain that the learners need to find out which material is best for keeping a drink hot. *What material is the best insulator?*Provide each group with a small bottle to put the warm water in. Discuss how to make the test fair, e.g. same amount of water, record temperature before and after an agreed time limit, same number of layers of wrapping.Give each group different materials to test; learners should wrap the material around the cup. They record the temperature before starting, and after finishing, for each material and a bottle with no covering for comparison (a control). Introduce the term ‘thermal insulator’ to describe something that prevents heat energy from moving; in this case the heat from the drink is prevented from moving to the air. Describe the opposite (i.e. something that allows heat to spread) as a ‘thermal conductor’. Discuss, if needed, where both properties could be useful. *Which material was the best thermal insulator? How do you know?***Scientific Enquiry activity**Learners investigate which material is best for keeping ice cold. Prior to the lesson make enough ice cubes for one per learner plus a teacher one. Any shape of mould is suitable for the investigation.*How were things kept cool before the invention of fridges and freezers?* (e.g. ice houses, marble shelves, cellars, storing things in streams).Explain to the learners that each of them will be given a ‘pet’ ice cube to look after for the remainder of the lesson; the winner will be the learner who keeps their ice pet the longest.Before giving out the ice pets ask the learners to plan what methods they might use to stop the ice from melting. *Is there anything we could wrap an ice cube in to stop it melting?*As a class discuss the observations they will make. *What evidence will we collect?**What do you think would be the worst thing to wrap the ice cube in?* Explain that there will also be one ice cube that will have nothing done to prevent it from melting, as a control, the teacher will volunteer their ice pet to be the control.Give each learner an ice cube in a transparent, sealable bag and allow them to use the method they planned to prevent their ice pet from melting.Ask the winning learner to explain what they did to prevent their ice cube from melting. Look at the last remaining ice pets. *Which materials were they wrapped in? Do the materials have anything in common*?Discuss with the learners that insulation makes it hard for energy (e.g. heat) to move from one place to another. In this ice-cube experiment, the insulation slows down heat from outside reaching the ice and increasing its temperature enough to cause the ice cube to melt**Scientific Enquiry activity**Learners investigate which material is harder. Explain that soft materials crumble and are easily scratched. Hard materials are more difficult to scratch. Rocks are classified on the basis of hardness. Granite is a hard rock; talc and chalk are soft rocks. Show specimens of each, if available.Provide a range of materials on which to carry out a scratch test to measure their hardness. Demonstrate the method to use and discuss how to ensure the test is fair. Make a class prediction for the test. Allow groups time to carry out the investigation. Provide a results table for the learners to complete.*Which is the hardest/softest material? How do you know?***Scientific Enquiry activity**Learners investigate what materials are porous. Explain that ‘porosity’ is the ability of a material to let water through it. Learners will test materials to rank them from the most to the least porous. In pairs or small groups, learners talk about how they might do this. For example:* Adding drops of water to samples and observing what happens to the drops.
* Having a material as a ‘plug’ in an upturned bottle, which is then filled with water; observing how much water gets through the material over a given amount of time.

Allow learners to try out their own ideas, if they seem reasonable.*Which materials are the most porous? How do we know? Could the investigation be improved?* **Scientific Enquiry activity**Learners investigate what materials conduct electricity.Set up an electric circuit with a switch and bulb. Recap Stage 2 learning from electricity. Remove the switch and talk about what else could be used to complete the circuit. Discuss how some materials have the property of being able to conduct electricity. Replace the switch with a selection of objects to see which ones can complete the circuit. Remind learners that each end of the object must touch both wires where the switch has been removed.Give each group different objects to try, or let them choose. Each group reports their findings back to the rest of the class. List the materials that bridge the gap. As a final example, ask learners to predict what will happen when the wires are put into a cup of water. Demonstrate what happens. Explain that water is a conductor. Conclude that objects made of metal can complete the circuit and water can also conduct electricity; this is why we keep water away from plugs/electronics. **Scientific Enquiry activity**Learners investigate the strength of different threads. Invite learners to suggest ways this could be investigated. In pairs, or small groups, learners will plan and carry out their investigation. Approve their plans before they begin, making sure that their suggestion is reasonable and able to be undertaken; an investigation planning sheet will help them to do this more independently.Learners predict which the strongest thread will be. They carry out the investigation and draw a bar chart using the results obtained.*Why are some threads stronger than others? What could you use each of the different types of thread for?* | Cup of water, samples of different types of paper (e.g. writing paper, newspaper, filter paper, absorbent paper).A selection of different paper bags for testing (e.g. bread shop, carrier bags, bags for holding presents in), different types of paper, weights.Investigation planning sheets.Graph paper.Thermometers, liquids e.g. water (iced, cold and hot), juice, milk, fizzy drink, plastic cups.Plastic bottles, measuring cylinders or jugs, thermometers, stopwatches, hot water, materials (e.g. fabric, cotton wool, bubble wrap, newspaper).Ice cubes in transparent sealable bags, materials (e.g. fabric, cotton wool, bubble wrap, newspaper).Rock specimens.Wood, modelling clay, rock, metal, plastic, rubber (or sponge). Something metal to perform the scratch test, e.g. a fork.Results tables.Range of materials, bottles, water, stopwatches Circuitry equipment; battery, wires, switch, bulb.Range of materials e.g. different metals, pencil lead/graphite, rubber, plastic, paper, wood.Cup of water.A range of different threads, e.g. cotton, fishing line, wool, silk.Sticks, forcemeters.A selection of objects (slotted masses are ideal).Investigation planning sheet. Paper or workbooks, graph paper, rulers. | Misconception alert: Insulating materials do not keep cold in or hot out; they prevent/reduce energy transfer between the environment and a material, so allowing cold things to stay cold and hot things to stay hot. This explains why a coat on a snowman will keep it cold as well as keep someone warm. Conducting materials are better able to transfer energy, which is why we use metals for wires as they allow electrical energy to be more effectively transferred through them. This demonstration is a good opportunity to discuss with learners why it is dangerous to mix electricity and water. |
| 3Cp2 | Sort materials according to their properties | In groups, learners sort materials on the basis of their properties. Learners write the materials and properties on sticky notes and use them as the basis for a Venn diagram. They try different ways of sorting, listing the different criteria they try. *How many ways are there to sort and group the materials?*List the properties in a table for different materials within the same group (e.g. metals) and identify what makes them all metals. Repeat for other types of materials (e.g. plastics, fabrics). | Range of materials with a range of properties to sort. E.g. plastic, a range of metals, paper, wood, rock samples, glass (if safe to handle).  | Misconception alert: Ensure there are a range of plastics available so learners understand different materials of the same type can have different properties, e.g. not all plastics are opaque; not all metals are magnetic.  |

# Unit 3.3 Flowering plants

It is recommended that this unit takes approximately **60% of the term.**

In this unit, learners:

* revise the parts of a plant and their role in keeping a plant healthy
* extend their learning to understand that plants need water and light to make their own food and grow.

## Scientific Enquiry work focuses on:

* suggesting ideas, making predictions and communicating these
* thinking about collecting evidence and planning fair tests, with help
* drawing conclusions from results and beginning to use scientific knowledge to suggest explanations.

## Recommended vocabulary for this unit:

* root, stem, leaves, flowers, water, temperature
* healthy, unhealthy, wilt, pot bound.

| Framework code | Learning objective | Suggested activities to choose from | Resources  | Comments  |
| --- | --- | --- | --- | --- |
| 3Bp1 | Know that plants have roots, leaves, stems and flowers. | Learners have previously learned the names of parts of plants in Stage 1. Begin by seeing if they can identify roots, leaves, stems and flowers on a wide variety of plants such as:* roses, tulips, lilies
* trees such as almond, olive, apple
* rice, wheat, potatoes, maize.

Learners draw an unfamiliar example of a tree, a grass and a flowering plant. They label the roots, stem, leaves and flowers. | Photographs of a wide variety of plants.Pictures (internet or books) of unfamiliar trees, flowering plants and grasses. | Misconception alert: Make sure learners understand that crops, trees and grasses are all plants, even if we don’t always call them plants.  |
| 3Bp23Ep23Ep3 | Explain observations that plants need water and light to growSuggest ideas, make predictions and communicate theseWith help, think about collecting evidence and planning fair tests | **Scientific Enquiry activity**In Stage 1, learners may have taken part in investigations about plants needing water and light. These can be repeated with learners having more responsibility for the design of the investigation; different groups can complete different investigations. Learners could:* use plants that are as similar as possible (e.g. same species, similar height, similar appearance)
* describe how they can tell that both plants are growing well.
* decide what question to answer (e.g. Do plants need water to grow? Do plants need light to grow?)
* predict what would happen if a plant was grown in the dark or not watered
* decide how to make a fair test by only changing one variable at a time
* decide what results to collect (measurements or observations)
* collect their results and write a report giving their conclusion.

Learners may need support in designing a fair test. Variables to keep the same are:* type of plant
* age of plant
* size of plant
* temperature plant is being kept in
* neither plant is pot bound

AND* volume of water and frequency of watering

OR light levels. | Similar flowering plants.Water and watering can (or measuring jug).Equipment for observations or measurements (e.g. rule, digital camera). | In Stage 1, learners will have been taught that plants need water and light to be healthy. Now, in Stage 3, they extend this learning to begin to explain why both water and light are needed. |
| 3Bp53Ep33Eo4 | Know that that plant growth is affected by temperatureWith help, think about collecting evidence and planning fair testsDraw conclusions from results and begin to use scientific knowledge to suggest explanations | **Scientific Enquiry activity**Learners reflect on their previous scientific enquiry activity and identify what they have learned about fair tests.In groups, learners plan an experiment that would find out if a maize plant grows differently in hot and cold places. Ask learners to consider the following questions and then write a method for their experiment:* *How would you change the temperature?*
* *What variables would you need to keep the same?*
* *What would you measure?*

Then give learners some data to analyse. Discuss the data and what it shows. *What conclusions can we make from this data?*  | Data which can be based from research e.g. <https://ars.els-cdn.com/content/image/1-s2.0-S2212094715300116-gr1.jpg> (this will need making into a table so it is accessible to learners)  |  |
| 3Bp23Bp33Bp4 | Explain observations that plants need water and light to growKnow that water is taken in through the roots and transported through the stemKnow that plants need healthy roots, leaves and stems to grow well | RootsLearners look at pot-bound plants and re-pot them. As a class, discuss why this will be good for the plant. Elicit the idea that the plant will be able to grow more roots and therefore take up more water.Show pictures of trees grown in pots and in open ground. Learners consider why the trees grown in pots are smaller.Show learners examples of plants grown to be very small on purpose (e.g. bonsai). Ask learners to explain why people who grow bonsai trees use small pots.StemShow a stick of celery, complete with leaves at the top:* Talk about the plant parts, identifying the stem, leaves and where the flowers (if any) and roots would be.
* In pairs, learners talk about what roots do for the plant (take in water and anchor it in the ground).
* Give each pair a stick of celery that has been standing in coloured water overnight. Explain that the colour has been used so that we can see the water.
* Learners observe it closely, looking at the stem and leaves; they should identify that the coloured water has moved up the stem in tubes to the leaves.

As a demonstration, you can cut a stick of celery into cross sections and give each pair a piece of the stem. Learners use magnifying glasses to observe the dots in the cross section. *‘What are these dots?’* (Explain that the dots are tubes in the stem which allow the water to travel from the roots to the leaves).Show a white flower:* Talk about the plant parts, identifying the stem, leaves and where the flowers (if any) and roots would be.
* Show learners a second flower that has been standing in coloured water overnight.
* Learners observe it closely, looking at the flower.
* They should identify that the coloured water has moved up the stem in to the flower.

Learners draw, or annotate, a diagram to show that water enters a plant through the roots and then travels up the stem to the other parts of a plant. | Pot-bound specimens.Compost and new pots.Pictures of trees grown in pots and in open ground.Pictures of bonsai (or similar small trees) in pots.Stick of celery with leaves.Celery that has been standing in coloured water (e.g. water and food colouring; blue is recommended).Magnifying glasses.White flower (e.g. carnation or lily).A similar, white flower that has been standing in coloured water (e.g. water and food colouring).Diagram of a plant.  | Misconception alert: Ensure learners understand a plant is (generally) passive. It will move/grow to face light and increase absorption of water and nutrients but it doesn’t actively drink or ‘suck up’ water or light.Prepare this the day before the lesson, ideally with the learners. The leaves may have changed colour slightly, to the same colour as the coloured water it has been standing in.At least 24 hours before the lesson, cut the flower stem at an angle whilst holding the stem under the coloured water. This prevents air bubbles becoming trapped in the stem.It can take up to 24 hours for the coloured water to travel up the stem and colour the white flower. |
| 3Bp4 | Know that plants need healthy roots, leaves and stems to grow well | LeavesShow learners a picture of a plant showing the roots, stem and leaves. Identify which parts of a plant are found underground and which are found above ground.Elicit the idea that the parts of a plant that need light are the leaves. Explain that plants make their own food, using light as a source of energy, in their green parts (especially their leaves).Show learners pictures of plants that have unhealthy leaves such as:* wilting leaves
* yellowing leaves
* leaves eaten by pests

Explain that the plant will no longer be healthy as it cannot make its own food.Give learners some scenarios of damage to plants. Learners predict whether the plant will still be healthy and explain why:* an animal eats all the leaves of a plant
* insects eat the roots of a plant
* a gardener moves a plant from one place to another and cuts off its roots
* strong winds break the stem of a plant.
 | Picture of a plant showing the roots, shoots and leaves.Pictures of plants with unhealthy leaves. | Learners from temperate regions will know that some trees lose their leaves in autumn/fall. Explain that this is because the life processes within the tree ‘slow down’ in the cold weather, and it is more efficient for the plant to lose the leaves and regrow them when it is hotter and sunnier not because they are unhealthy. |

# Unit 3.4 Forces and friction

It is recommended that this unit takes approximately **40% of the term.**

In this unit, learners:

* build on previous knowledge of forces and how they can affect the movement and shape of objects
* find out that forces can be measured, using forcemeters, and compared
* are introduced to friction, i.e. a force created between solid objects when they rub against each other and which acts against the direction of motion’
* learn that forces have direction and can vary in size.

## Scientific Enquiry work focuses on:

* suggesting ideas, making predictions and communicating these
* thinking about collecting evidence and planning fair tests, with help
* observing and comparing objects, living things and events
* measuring using simple equipment and recording observations in a variety of ways
* presenting results in drawings, bar charts and tables
* drawing conclusions from results and beginning to use scientific knowledge to suggest explanations
* making generalisations and beginning to identify simple patterns in results.

## Recommended vocabulary for this unit:

* push, pull, friction, motion, direction
* force, forcemeter
* newtons
* weight, mass, speed.

| Framework code | Learning objective | Suggested activities to choose from | Resources  | Comments  |
| --- | --- | --- | --- | --- |
| 3Pf23Pf3 | Explore how forces can make objects start or stop movingExplore how forces can change the shape of objects | Learners choose a material and then describe in drawings/writing/words:* how it can be made to move
* how to make it go faster or slower
* how to make it change direction
* how to make it change shape (if possible).

A worksheet designed for this purpose may be helpful for some learners.Have some modelling clay and discuss why it can be used to make objects. Explain that when a force is applied it changes the shape of the object; the change occurs where the force is applied and also beyond that. Learners manipulate the clay; they describe to each other when they are applying forces and the effect it has. Learners roll a ball between them, as a class/. Discuss how they start the ball moving (pushing or pulling on it) and how they stop the ball (they block it and their hand pushes on the ball stopping it). Present diagrams of the ball with force arrows to show how forces can be applied to start and stop motion. When discussing ‘stopping’, highlight how one force acts in the opposite direction to the movement. | Range of materials (including metals, wood, paper, rock samples, modelling clay.Worksheet.Modelling clay. Ball. | Misconception alert: A force, if large enough, will always move a mass. This includes when a mass changes shape as the mass is moving around the force. |
| 3Pf13Ep2 3Ep33Eo23Eo3 | Know that pushes and pulls are examples of forces and that they can be measured with forcemetersSuggest ideas, make predictions and communicate theseWith help, think about collecting evidence and planning fair testsMeasure using simple equipment and record observations in a variety of waysPresent results in drawings, bar charts and tables | Describe how particular toys move using pushes and/or pulls. Write and/or draw a diagram to describe how the toys move; use the word ‘push’ or ‘pull’ and arrows to describe the direction of the push or pull. Explain that when anything begins to move it is the result of a force being applied.A learner pushes and pulls a large box (large enough so a learner can sit in it). Discuss how it moved because a force was applied. Ask another learner to sit in the box. Ask another learner to try and push and pull the box now that the learner is inside. *Was it easier or harder to push/pull the box when there was someone in it?* *Which push/pull required more force? Why?* Explain that the heavier an object is the more force is required to move it.**Scientific Enquiry activity***How can we tell how big a force is?*Give out a variety of forcemeters to pairs (or small groups). Compare similarities and differences between them. *Why might they have different markings on them?* Explore how they work.Demonstrate how to use a forcemeter to measure a force. Attach the forcemeter to an object and read out the force (in newtons) as you pull. This is the force required to pull this object on this surface at this speed.Hand out a few objects to each pair. Learners measure the force (in newtons) required to make each object just start to move. Discuss. *Which object required the most force to start it moving? Why?* Weigh the objects and link the mass of the object to the force required. **Scientific Enquiry activity***How can we change the distance we catapult a marshmallow?*Learners make marshmallow catapults; they launch marshmallows outside by flicking them from a rubber band. (Suspend the rubber band between your thumb and index finger, place a marshmallow on the band and pull/release to make the marshmallow fly through the air.)Learners investigate how to change the distance the marshmallow travels. *Who can send the marshmallow the furthest?* *How did you do it?* *What effect does the size of the force have?* Learners predict how the size of the force affects the flight of the marshmallow. They measure the force applied, by using forcemeters to pull back on the elastic bands, and then compare the forces to the distances travelled. Record the results in a class table.**Scientific Enquiry activity**Investigate the force required to break a cotton thread. Show a piece of cotton thread and discuss how learners can find out the force required to break it. Have learners come up with different ways of carrying out the investigation. Discuss how they will know the size of the force applied when the thread breaks.Learners carry out the investigation.Spend time reflecting on their results and looking at any variation within them; discuss how there can be variation in the strength of thread that has come from the same cotton reel.  | Selection of toys.Large boxForcemeters with different scales.Objects of any sort (e.g. bricks, potatoes).Marshmallows, elastic bands, forcemeters.Cotton reel/thread, forcemeters. | Misconception alert: Some toys use electrical (or wind up) motors to move which can make it difficult for learners to recognise where the push or pull is being applied. Use toys that only require a push or pull by hand |
| 3Pf23Pf43Ep23Ep33Eo13Eo23Eo33Eo43Eo5 | Explore how forces can make objects start or stop movingExplore how forces, including friction, can make objects move faster or slower or change directionSuggest ideas, make predictions and communicate theseWith help, think about collecting evidence and planning fair testsObserve and compare objects, living things and eventsMeasure using simple equipment and record observations in a variety of waysPresent results in drawings, bar charts and tablesDraw conclusions from results and begin to use scientific knowledge to suggest explanationsMake generalisations and begin to identify simple patterns in results | **Scientific Enquiry activity**Make a tray of ice (large enough to slide an object on). Show learners the tray of ice; discuss the difference in the surface of the ice to the surface of a carpet, floor, wall, etc. Push an object on the ice; discuss how it moves compared to the same object pushed on the floor. *Why does the object go further on ice?* Explain that this has to be connected to a difference in forces (on the floor/on ice) because forces make things move or stop. Describe ‘friction’ as the force between solid objects rubbing against each other that acts against the direction of motion. Show this with a diagram.Have a range of different objects available, some smooth and some rough. Learners rub pairs of objects against each other in the combinations: rough-rough, smooth-smooth, and rough-smooth. Discuss which combination took the most force and which one the least. Explain that friction acts between the objects and is a force against the force they apply. *Which combination has the most friction? Why?* Highlight how rough-rough has the most friction as the materials catch on each other and there is more surface to rub against. Explain that this is why people who go to icy places have spiked shoes, and why you have grips on shoes; in each case the rough surface helps to prevent slipping.**Scientific Enquiry activity**Learners will test the effectiveness of grip on footwear. The one with the best grip will produce the most friction when pulled over a surface. Look at the soles of the shoes the learners are wearing. Compare these with sports footwear, e.g. trainers, plimsolls. Discuss the differences in the grip on the soles of the footwear.Learners make wax crayon rubbings of the patterns on the soles of footwear. They place a piece of thin paper over the footwear and rub with a wax crayon (or gently with a soft pencil) to reveal the pattern. Display the rubbings.*Which shoes do you think will have the best grip? Why?*Learners then predict the force (in newtons) required to make each piece of footwear move on the surface.Test footwear on a ramp (this takes greater force than testing on a flat surface). Pull the footwear up the ramp using a forcemeter and measure the force required to just get the footwear moving. Use footwear of similar size, with different amounts of tread on the soles. As a class, decide why good grip is important for some sport shoes. *Which footwear had the best/worst grip? How do you know?* Link the size of the force to the grip and remind learners that this force is just more than the force of friction which is acting against the movement. Watch a video clip of a child on a slide in a park. *What can make a difference to how fast a person travels down a slide? Is the surface of a slide smooth or rough?* Explore how this relates to the friction produced when someone goes down a slide. **Scientific Enquiry activity***What would happen if someone went down a slide sitting on a fabric mat?*Learners investigate which fabric reduces friction the most. One method is to place a piece of weighted-down fabric at the bottom of a ramp with a mass, and pull it up the ramp, recording the force applied with a forcemeter.Carry out the investigation to discover which fabrics produce the highest/lowest friction.**Scientific Enquiry activity**Explain that speed is a description of how fast something moves between two points. If a ball takes 5 seconds to travel one metre, and another ball takes 10 seconds to travel the same distance, the first ball is travelling faster. *Can we link the speed an object moves with the force applied to it?* *Will a bigger force move objects faster?* Discuss how this can be investigated by setting up a start point; a finish point; a moveable object and then varying the force applied. Discuss the need to use a forcemeter to measure the force. In pairs, learners consider the advantages and disadvantages of a world in which friction didn’t exist, e.g. doors would always open easily, people and vehicles would struggle to stop! Think of examples where friction is useful or a hindrance, e.g. road surfaces are rough, the blades of ice skates make minimal contact with the ice. | Tray of ice, range of objects; some rough and some smooth.A range of footwear with different soles, forcemeters, ramp (plank).Wax crayons or soft pencil, thin paper.Video clip of a child on a slide.Fabric samples, masses, ramps, rulers, forcemeters, recording sheets.Balls, timers, forcemeters. | Misconception alert: Many learners may not realise that it is the thin layer of water on top of melting ice that greatly reduces friction. This doesn’t need to be explored but, if learners notice the ice is melting, then investigating the effect of water on friction could be an extension activity. Misconception alert: Grip is not the same as friction. An object with ‘good’ grip produces more friction as it is a rougher surface.  |

# Unit 3.5 The senses

It is recommended that this unit takes approximately **35% of the term.**

In this unit, learners:

* revise the human senses
* explore how senses allow them to detect things happening outside of their body.

## Scientific Enquiry work focuses on:

* collecting evidence in a variety of contexts to answer questions or test ideas.

## Recommended vocabulary for this unit:

* sight, hearing, smell, touch, taste
* detect, sense, source, external.

| Framework code | Learning objective | Suggested activities to choose from | Resources  | Comments  |
| --- | --- | --- | --- | --- |
| 3Bh53Ep1 | Explore human senses and the ways we use them to learn about our worldCollect evidence in a variety of contexts to answer questions or test ideas | Check that learners can recall the five senses and name the parts of the body most associated with each one.Introduce the idea that our senses allow us to detect things happening outside our body.Sensing forcesExplain that in our skin there are parts that can detect forces (e.g. pressure, stretching). We use them to find out about objects we touch.Learners make touch detectors by attaching samples of different fabrics to small sticks (e.g. lolly sticks). * Demonstrate how to use these to test the ability of different body parts to detect that they have been touched; touch the body part with the touch detector, e.g. the sole of the foot, back of the hand, forehead.
* In pairs, learners do the touch detection test.
* Discuss how well, or badly, different body parts can detect touch.

Sensing food by taste and smellDiscuss what foods learners like to eat. Elicit the idea that different foods have different tastes. Explain that on our tongues there are parts that can detect different flavours.Explore how the sense of taste interacts with sight and smell:* Volunteers can eat a variety of foods blindfolded to find out if they taste different when they cannot see them.
* Volunteers can eat the foods while holding their nose.

Use food colouring to make some food a dramatically different colour (e.g. mashed potato made to look blue). Ask volunteers to try the food and see if it tastes different.Explain that our experience of food is influenced by smell, appearance and taste.Sensing lightIn Stage 2, learners found out about sources of light. Reinforce that light travels into our eyes where it is then detected.Explore the difference in vision when using one eye or two eyes:* Learners practise catching a ball with both eyes open.
* They shut their right eye and try again.
* They open their right eye, shut their left eye and try again.
* They try again shutting both eyes.

Look for patterns in the results. *Was there a difference when you had one or two eyes open? When was it easiest to catch the ball? What made it easier?* Discuss how the ability to sense/detect light can be important.Sensing soundExplain that sound travels from a source to our ears where it is then detected.Perform some simple, everyday activities whilst learners have their eyes closed. Ask learners to guess what you are doing, e.g. turning the pages of a book, pouring water, clapping your hands.Learners listen with eyes closed for a minute and then recall all the sounds they have heard.Play a game about detecting the location of a sound source:* Learners sit in a circle; one learner sits with their eyes closed, in the centre.
* Someone in the circle rings a bell or makes a sound.
* The centre person has to point in the direction they think the sound came from.
* Repeat the activity; this time the centre person has their eyes closed and one ear covered.
* Record findings and look for patterns in results.

**Extension activity**Throughout this unit learners can compare human senses to those of animals e.g. bats, sharks, owls. | Fabric samples, lolly sticks, scissors, glue.A selection of different foods – sweet, sour, salty or bitter, blindfolds.Mashed potato that has been coloured blue with food colouring.Soft balls (one for each pair of learners), open space for throwing and catching balls. | In Stage 1, learners were taught that both humans and animals have the senses of sight, hearing, touch, smell and taste.Throughout this unit, be aware of the needs of learners with sensory difficulties.Be aware of food allergies and intolerances for any activities involving food.Misconception alert: A common misconception is that different parts of the tongue are responsible for different tastes. Instead all parts of the tongue can detect all tastes.The brain can compensate for impaired vision to a degree; it is possible for someone to see, and operate well, with one functional eye rather than two but it does take time. As with all of the activities in this unit, deal with any visual impairments sensitively. Misconception alert: Talking about light travelling from a source and then sound travelling from a source may confuse some learners. Both light and sound travel from sources to detectors (i.e. our eyes and ears), but they do so in different ways (e.g. sound doesn’t travel in straight lines). You may need to highlight the differences as well as how they both come from a source. |

# Unit 3.6 Keeping healthy

It is recommended that this unit takes approximately **65% of the term.**

In this unit, learners:

* explore the components of an adequate, varied diet
* find out about the effects of eating too many fatty and sweet foods
* learn how to keep their teeth healthy
* investigate the effect of exercise on heart rate and recovery time.

## Scientific Enquiry work focuses on:

* observing and comparing objects, living things and events
* measuring, using simple equipment, and recording observations in a variety of ways
* presenting results in drawings, bar charts and tables.

## Recommended vocabulary for this unit:

* diet, adequate, varied, nutrition
* carbohydrate, protein, dairy, vitamin, mineral, fat, sugars
* exercise, pulse, rest
* incisors, canines, molars and pre-molars.

| Framework code | Learning objective | Suggested activities to choose from | Resources  | Comments  |
| --- | --- | --- | --- | --- |
| 3Bh3 | Explore and research exercise and the adequate, varied diet needed to keep healthy | *What can we do to be healthy?* Learners discuss in pairs and share responses.*What makes us unhealthy?* Learners discuss and decide what makes a healthy lifestyle: an appropriate diet, exercise, personal hygiene, keeping warm and safe etc.Show a film clip about someone who needs to keep healthy during a round-the-world expedition. Learners watch, and list, the different ways in which she keeps healthy.A visit from a health practitioner could be arranged during this unit to talk about healthy eating and lifestyles. | <https://www.youtube.com/watch?v=7DKLv0GAGjU> |  |
| 3Bh13Bh33Bh4 | Know life processes common to humans and animals include nutrition (water and food), movement, growth and reproductionExplore and research exercise and the adequate, varied diet needed to keep healthyKnow that some foods can be damaging to health, e.g. very sweet and fatty foods | Adequate dietRemind learners of the life processes. *What happens if someone does not have enough of the right nutrition in what they eat and drink?*Look at the World Food Programme website for some examples of people around the world do not have sufficient food and/or water. Discuss possible reasons for this, e.g. climate, disasters.Conclude that it is vital to have enough of the right nutrition in the food water we consume; what is eaten and drunk must be appropriate for the needs of the person.Varied dietLearners discussed healthy eating in Stage 1. Ask learners to make a mind map of everything they know about healthy eating.Use the mind maps to identify the different types of food that we need to eat.Introduce the names of some of the main food groups:* carbohydrates containing starches for energy
* protein for growth and repair
* milk and dairy for vitamins and minerals
* fruit and vegetables for vitamins, minerals and fibre
* fats for fatty acids which, among other things, help absorb vitamins
* sugars for an immediate source of energy.

Learners sort examples of foods into the main food groups.Learners can plan the types of food that would be suitable for different scenarios such as:* for a long walk
* for an Olympic athlete
* for someone recovering from a broken leg
* for a person who can’t eat dairy.

Learners can keep a food diary for a week and analyse whether they are eating an adequate, varied diet.Learners can use information sources to find out why eating too many fatty foods is damaging to health.Learners can look at drinks labels on snack foods and compare the amounts of fat they contain. | <http://www.wfp.org/photos>Examples of each food group, or images of food/drink from each food group.Secondary information sources.Snack food packaging with food labels intact. | Be aware of food allergies and other dietary requirements. |
| 3Bh43Eo1 | Know that some foods can be damaging to health, e.g. very sweet and fatty foodsObserve and compare objects, living things and events | Ask learners to write down two foods they like and two that they do not like. Learners label (or group) the food choices according to whether they eat it often or rarely. Then consider if these are foods that should be eaten often or rarely (i.e. are the foods healthy or more of a ‘treat’). *Why should some foods be more of a treat?**How do you look after your teeth?* Encourage regular brushing, avoiding sugary foods and drinks, and visiting the dentist regularly. Explain that tooth decay is caused by plaque-forming bacteria. These bacteria feed on sugar and produce acid which causes tooth decay.Learners use mirrors to inspect their own teeth. They count, name and look at the shapes of different types of teeth. Noting there are: incisors, canines, molars and pre-molarsLook at drinks labels on fizzy drinks and compare the amounts of sugar they contain.Look at pictures of gum disease and tooth decay.Leave an egg, chicken bone (or tooth) in a fizzy drink, or vinegar, overnight. Observe the results. Explain that chicken bones are made of a material similar to our teeth. Explain that the fizzy drink, or vinegar, is acidic; plaque produces an acidic environment in our mouths.Discuss the importance of brushing teeth to remove plaque. Look at different toothpastes and discuss how many contain fluoride to make teeth less likely to decay. | Mirrors.Drinks packaging with food labels intact.Pictures of gum disease and tooth decay.A chicken bone/egg.Glass of sweet fizzy drink or vinegar.Variety of toothpastes. | Misconception alert: Sugar doesn’t directly cause tooth decay; bacteria feed on the sugar, creating plaque; this produces acid, which decays teeth.  |
| 3Bh33Eo23Eo3 | Explore and research exercise and the adequate, varied diet needed to keep healthyMeasure using simple equipment and record observations in a variety of waysPresent results in drawings, bar charts and tables | Discuss why exercise is important and what types of exercise the class take part in. Make a tally chart.**Scientific Enquiry activity**Investigate the effect that exercise has on heart rate:* Demonstrate to learners how to take their own pulse.
* Learners take their pulse at rest.
* They do one minute of moderate exercise (e.g. jogging on the spot).
* The pulse is taken again immediately after exercise.
* The pulse is then taken again after one, two and five minutes of rest.

*What happens?*Learners draw a table of results and discuss the conclusion.Explain that during exercise our muscles need more blood so our hearts beat faster. Once we stop exercising the heart rate decreases again. The more fit we are, the less the heart needs to speed up and the more quickly it goes back to normal. | Stopwatches or other method to take the time.Graph paper. | Healthy and safety:Make sure that you have a safe space for learners to jog on the spot.Misconception alert: It is possible that some learners will think the heart produces blood, and by pumping harder it makes more blood to get to the muscles. Ensure learners understand that the amount of blood in the body stays the same; it is the speed the blood goes around the body that the heart affects.  |