**Scheme of work – Science Stage 4**

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 4.   
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 4 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 others 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 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.

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| --- | --- | --- |
| Term 1 | Term 2 | Term 3 |
| Unit 4.1 Skeleton and muscles | Unit 4.3 Magnets and materials | Unit 4.5 Making circuits |
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# Unit 4.1 Skeleton and muscles

It is recommended that this unit takes approximately **50% of the term.**

In this unit, learners:

* are introduced to how the skeleton supports our bodies and helps us to move
* compare human bones and skeletons with those of other animals
* learn about the safe use of medicines.

## Scientific Enquiry work focuses on:

* suggesting questions that can be tested and making predictions; communicating these
* choosing apparatus and deciding what to measure
* making relevant observations and comparisons in a variety of contexts
* measuring length
* explaining what the evidence shows and whether it supports predictions; communicating this clearly to others.

## Recommended vocabulary for this unit:

* bones, skeleton, skull, jaw, ribs, spine, vertebrae, hip, pelvis, limbs
* move, muscle, muscle pairs, contract, relax, biceps, triceps
* X-ray, fracture
* vertebrate, invertebrate
* medicine, drug, antibiotic, symptom, cure, disease, illness.

| Framework code | Learning objective | Suggested activities to choose from | Resources | Comments |
| --- | --- | --- | --- | --- |
| 4Bh1 | Know that humans (and some animals) have bony skeletons inside their bodies | As a class, discuss the question: *Have you ever seen a real skeleton?* Learners may have seen pictures of dinosaur skeletons, real skeletons of rabbits in the countryside and/or cartoons of skeletons in story books.  Ask learners what they think the bones in their bodies look like and create a class discussion board. *Can you feel any of your bones?* (Most learners should be able to feel their ribs, skull, jaw, spine, hip and bones in limbs.) *What do they feel like?*  Give small groups of learners a large sheet of paper. Learners draw around one of their group to produce a life-size outline. Challenge the learners to draw in the bones where they think are in the human body. Provide learners with pictures of each type of bones to help them draw the right shapes. Make it like a jigsaw for learners to complete.  Create a collection of bones of different animals, e.g. chicken, fish, rabbit. The bones, once sterilised, can be handled by learners wearing gloves:   * Allow the learners to use magnifying glasses to look closely at the bones and describe them.   Ask the learners to describe how the bones feel. *Are they hard or soft? Can you can bend them?*  Explain that, although bones are very hard, they can break. Ask any of the learners if they have ever broken a part of their body. Discuss how doctors can use X-rays to check if bones are broken or not.  Give the learners pictures of different animals and images of corresponding skeletons, but mixed up. Ask the learners to identify which skeleton is from which animal. Give learners name cards and images of X-rays of different parts of humans and animals; ask them to identify each X-ray image by matching it to the appropriate name card.  Explain that animals with a backbone/spine are called ‘vertebrates’; animals that do not have a backbone/spine are called ‘invertebrates’. Illustrate with examples and pictures of both types.  Show the learners a plastic skeleton and identify the names of the main bones. | Large sheet of paper.  Pictures of human bones.  Collection of sterilised bones.  Gloves.  Magnifying glasses.  Pictures of skeletons of different animals.  X-rays of humans and animals, name cards associated to the X-rays.  Pictures of vertebrates and invertebrates.  Plastic skeleton. | The process of getting and sterilising bones may change their original properties, e.g. make them harder or softer. Keep this in mind when learners are describing the bones. If required, have learners use secondary information sources to support observations. |
| 4Bh2 | Know how skeletons grow as humans grow, and support and protect the body | In small groups, learners discuss what the functions of the skeleton are and then share with the rest of the class. Make sure all learners know that the key functions of the skeleton are: to protect organs, to support the body, to give shape to the body and, with muscles, to allow the body to move.  Discuss which organs are protected by the different bones (e.g. the skull protects the brain).  Give each learner a picture of a human skeleton to label with the main bones of the body and the organs that they are protecting. | Picture of the human skeleton to label. |  |
| 4Bh2  4Ep3  4Ep5  4Eo1  4Eo2  4Eo6 | Know how skeletons grow as humans grow, and support and protect the body  Suggest questions that can be tested and make predictions; communicate these  Choose apparatus and decide what to measure  Make relevant observations and comparisons in a variety of contexts  Measure temperature, time, force and length  Explain what the evidence shows and whether it supports predictions. Communicate this clearly to others | Look at an X-ray image of a child’s bone and an adult’s bone.  *What difference can you see?*  **Scientific Enquiry activity**  Demonstrate a method for measuring different parts of the body. Learners take measurements of a long bone e.g. arm or leg of a partner. Compare a long bone measurement of an adult in the room with that of a child (e.g. elbow to wrist, or ankle to knee).  *What conclusion can you make from these measurements?*  Establish that skeletons grow as humans grow. Ask the learners to compare the younger learners in the school with the older learners. Learners will need to measure the younger learners, so ensure you have co-ordinated with their teacher. This could be part of a lesson on measurement for the younger learners.  *Are younger learners always smaller?*  Explain to the class that they are going to decide on a question about skeleton growth/ size and then investigate it.   * Suggest a few questions the learners could investigate such as: *Do taller learners have longer legs? Do older learners have bigger feet?* * Allow learners time, in small groups, to create their own question to investigate. * Make sure learners know what they will measure and how they will record their results. * Learners should make a prediction and then collect results. * Their findings should be presented to the rest of the class.   Discuss with the class. *Are you able to answer your questions? What do your results show? Were your predictions correct?*  Learners can then produce a report of their investigation and the conclusions they have made. | Local hospitals ***sometimes*** can make X-ray images available or there are examples on the internet.  Equipment to measure length.  Paper, pencils. |  |
| 4Bh3 | Know that animals with skeletons have muscles attached to the bones | *How does the skeleton help us to move?* In small groups, learners discuss how they think skeletons help us to move and then share with the rest of the class. Create a discussion board of ideas.  Tell learners that skeletons, although flexible, cannot move on their own. Muscles are needed to move skeletons.  Show learners a video of how muscles move skeletons.  Explain that muscles are attached to the ends of bones by tendons. Muscles can shorten or lengthen; when muscles change they allow us to move.  Show the learners video clips of a selection of different animals moving. Ask the learners to observe how the animals move and to think about how their muscles help them to move. Learners can make notes around a picture of each animal.  Extension activity: Show learners this video of an octopus squeezing through a tiny hole. *How is the octopus able to do this?* Explain that it is an invertebrate (i.e. it has no backbone) and so is able to squeeze through the hole; a vertebrate would not be able to do so. | <http://www.bbc.co.uk/education/clips/zj2kjxs>  A selection of video clips of different animals moving, e.g. cat, frog, rabbit, horse.  Pictures of animals for learners to make notes around.  <https://youtu.be/949eYdEz3Es> |  |
| 4Bh4 | Know how a muscle has to contract (shorten) to make a bone move and muscles act in pairs | Ask learners to feel the muscles in their arms.  *How do the muscles move when you move your arm?*  Ask learners to feel what happens to the muscles when they bend their arm and stretch it out again.  *What does it feel like? What is happening?*  With the learners, observe that when they lift their arm up towards their chest the muscle of the top of their arm gets fatter. Explain to the learners that there are two muscles in their arm, i.e. the biceps and the triceps. As the arm is raised, the biceps contract while the triceps relax; as the arm is lowered, the opposite happens.  Tell the class that muscles act in pairs as they can only pull the bone. They cannot push the bone, therefore for an opposite movement to happen there needs to be a pair of muscles.  Give the learners instructions to make a model of the muscles in an arm:   * Cut two equal lengths of card from thick, strong card. * Place one strip of card on top of the other. * Push a split pin throught the cards, 5 cm from the edge. * Cut four elastic bands so that two are shorter and two are longer. * Staple the two shorter bands to the cardboard to represent the muscles on the outside of the arm. * Staple the two longer bands to represent the muscles on the inside of the arm.   Pairs of learners then take turns to demonstrate their understanding of how muscles work using their models. | Elastic bands.  Thick strips of cardboard.  Split pins.  Stapler.  Scissors. | This activity provides a cross-curricular link to physical education. |
| 4Bh5 | Explain the role of drugs as medicines | *Can you name any drugs?*  *Can you name any medicines?*  *What is the difference between a drug and a medicine?*  Explain that the word ‘drug’ has a different meaning in everyday use and when used by scientists. Introduce the definition of a drug as ‘any substance that changes the way our bodies work’.  Ask learners to look at the list of medicines they identified. Discuss whether these ‘change the way our bodies work’. Elicit the idea that all medicines are drugs. Drugs are considered medicines when they bring about a beneficial change e.g. kill bacteria causing an infection.  Show learners some examples of empty boxes or medicines used in schools. Explain that these medicines are safe to use when the instructions for their use are carefully followed. Emphasise that because they ‘change the way our bodies work’ they should only be used by the person the medicine is for; learners with inhalers should not let other learners try out their medicine, etc.  **Extension activity**: Discuss the dangers of illegal drugs. Consider inviting a health professional or a law-enforcement professional to talk to the class. | Selection of empty medicine containers found in school, e.g. inhalers, antihistamines, antibiotics. | Misconception alert: All medicines are drugs, but not all drugs are medicines.  Be aware of, and sensitive, to asthmatic, diabetic and epileptic learners in the class.  **Safety** – Ensure that medicine containers are empty. |

# Unit 4.2 Solids, liquids and gases

It is recommended that this unit takes approximately **50% of the term.**

In this unit, learners:

* find out some of the differences between solids, liquids and gases
* learn how substances can exist as solid or liquid or gas, in some instances.

## Scientific Enquiry work focuses on:

* testing an idea or prediction based on scientific knowledge and understanding
* collecting evidence in a variety of contexts
* making relevant observations and comparisons in a variety of contexts
* presenting results in drawings, bar charts and tables
* identifying simple trends and patterns in results and suggesting explanations for some of these
* explaining what the evidence shows and whether it supports predictions; communicating this clearly to others
* linking evidence to scientific knowledge and understanding in some contexts.

## Recommended vocabulary for this unit:

* solid, liquid, gas
* matter, particles, powder
* melt, freeze, solidify, evaporate, boil
* temperature, thermometer
* predict, observe, collect, design, repeat.

| Framework code | Learning objective | Suggested activities to choose from | Resources | Comments |
| --- | --- | --- | --- | --- |
| 4Cs1  4Ep1  4Eo1  4Eo4  4Eo5  4Eo7 | Know that matter can be solid, liquid or gas  Collect evidence in a variety of contexts  Make relevant observations and comparisons in a variety of contexts  Present results in drawings, bar charts and tables  Identify simple trends and patterns in results and suggest explanations for some of these  Link evidence to scientific knowledge and understanding in some contexts | Ask learners, in groups, to sort a selection of objects into different groups and be prepared to explain why they have sorted them in this way. Items can be anything that is available but make sure they include a range of solids, liquids and gases (e.g. an air-filled balloon). This activity could also be completed using pictures.  As a class, discuss the ways that groups have sorted their objects.  Ask learners to look at the objects representing solids, liquids and gases. *What are the common characteristics of each group?*  Introduce the concept that everything is made of particles; they are so small we can’t see them. Explain that it is how the particles are arranged, and behave, that determine if something is a solid, liquid or gas. This can be modelled in a large space with all the learners; each learner imagines that they are a particle:   * To model a solid, learners link arms and stand as close together as possible, they can shuffle around but can’t move much. * To model a liquid, learners hold hands in pairs (or threes) but move further away from each other so there is slightly more fluidity in their movement. * To model a gas, the learners can move around the room without touching each other.   Reinforce the concept by showing a video and/or drawing pictorial representations of particles in solids, liquids or gases.  **Scientific Enquiry activity**  *What are the characteristics of the different states of matter?* Discuss how, through observation and comparison, we can determine the main characteristics of solids, liquids and gases. Learners investigate samples of each state in turn; they observe what happens to each sample when they apply force to them, push them and place them in different containers. Syringes and tubing can be used for gases; videos can also be helpful to support learners’ understanding of gases.  Learners may not notice that it is difficult to compress solids and liquids but a gas can be easily compressed. This can be demonstrated by filling a bottle with sand, a bottle with water and leaving one full of air. When each bottle is squeezed only the gas one will compress.  Learners record their investigation as drawings and diagrams of what they did and what they discovered. Discuss their results; ideally thinking about the arrangement and behaviour of particles in each state.  Create a class list of the main characteristics of each state for display.  Gases can be explored in more detail by:   * turning a bowl upside down, holding it underwater and then letting the gas out of the bowl as bubbles. What is in the bubble? It must be something? Where has it come from? Talk about how gases are all around us in our atmosphere. * holding a bit of paper out and then walking quickly or spinning around. What happened to the paper? It moved/was pushed back. What did the pushing? Something, that we can’t see, pushed back the paper; this is evidence there are particles of different gases that together make air.   Give the learners a worksheet of three boxes to draw the arrangement of particle to representing a solid, a liquid and a gas.  Show learners a cup full of water; ask them to describe the shape of the liquid inside the cup.  *What would happen if the cup was turned upside down? What would the shape of the liquid be then?*  Pour the liquid into a different shaped container. Ask the learners to describe the shape of the liquid now.  Explain that, because there is more movement between the particles in a liquid, the liquid can take the shape of the container it is held in. This can be demonstrated further by pouring a thicker liquid (e.g. honey) into various containers.  Explain that, although it is easy to measure the volume of a solid or a liquid, it is more difficult to measure the volume of a gas. Ask learners to discuss why this is the case; establish that it is because we can’t see most gases.  Demonstrate how to measure the volume of gas by:   * Turn a container upside down and hold it under water. * Gently raise one side of the container to release the gas in bubbles; capture the gas with a measuring jug (upside down, filled with water and also submerged). The gas rises because it is lighter than water and it pushes the water out of the measuring cylinder. When all the gas has been captured, seal the top of the measuring jug if there is water still ‘in’ it. Once sealed, turn it upside down and determine the volume of water displaced.   Talk about how the gas fills the shape of the container but it can also expand further.  **Extension activity**  Ask learners to classify sand.  *Is it a solid, a liquid or a gas?*  Tell the learners that, although sand is a solid, it can be poured like a liquid because it is actually made up of lots of tiny little solids. Learners look through a microscope (or magnifying glass) and pick up the sand, rub it between their fingers and describe it. Sand is, in fact, a collection of many solids that are so small they can behave a bit like a liquid when together. *Are there other materials/substances that do this?* Salt and flour are good examples of powders that are made up of tiny solids. | A selection of objects for handling by learners, to represent solids, liquids and gases.  <http://www.bbc.co.uk/education/clips/zpbvr82>  Video on the compression of solids, liquids and gases.  <https://www.youtube.com/watch?v=TAvC1gWtWJk>  A variety of solids, liquids and gases.  A variety of containers.  Syringes, tubing.  A bottle filled with sand.  A bottle filled with water.  A bottle filled with air.  Worksheet.  Bowl (or container).  Paper (or card).  Container, water.  Containers.  Honey/thick liquid.  Sand, microscope, magnifying glass.  Measuring jug (or measuring cylinder). | Misconception alert: Learners may not think of gas as a type of matter; it isn’t very tangible. With an inflated balloon, they may not connect the process of breathing with a mixture of gases. Gases will need specific attention in this unit.  Misconception alert: When first introducing the particle model, learners may think of particles as being either solid, liquid or gas particles; this is incorrect. It is how particles are arranged and behave that determine which state of matter a substance is.  Misconception alert: Learners may believe particles, when they are arranged to be a solid, are static. This is only true at absolute zero, otherwise all particles have energy and move including when they are in solids. Particles in solids are not able to move much due to their links/arrangement with other particles; they are often described as vibrating.  Misconception alert: Learners may think that air is a single gas, when it is actually a mixture of gases. This may need discussion and reference to secondary sources of information. |
| 4Cs2  4Cs3  4Ep2  4Eo1  4Eo5  4Eo6  4Eo7 | Investigate how materials change when they are heated and cooled  Know that melting is when a solid turns into a liquid and is the reverse of freezing  Test and idea or prediction based on scientific knowledge and understanding  Make relevant observations and comparisons in a variety of contexts  Identify simple trends and patterns in results and suggest explanations for some of these  Explain what the evidence shows and whether it supports predictions. Communicate these clearly to others  Link evidence to scientific knowledge and understanding in some contexts | The learners should be aware that some materials will melt when heated and some will solidify when cooled. Ask learners to share examples of this happening, e.g. snowman melting, water freezing into ice cubes, ice cream melting, chocolate melting.  Show the learners an ice cube and ask them to categorise it as a solid, liquid or gas. Heat the ice in front of the learners; ask them to describe what is happening.  *Can you see that when the solid ice is heated it becomes a liquid?* Discuss what has happened to the water particles in the ice. Have the learners model the change by ‘being’ particles in a solid and then changing to be in liquid arrangement when heated. Talk about what would happen if we heated the water more. The particles would go into a gas arrangement (i.e. water vapour); this is what happens to puddles on a hot day.  Pour the water into a mould and place it in a freezer; ask the learners what they think will happen to the liquid. Ask learners to model the change by ‘being’ particles in a liquid and then changing to be in a solid arrangement when cooled.  Discuss the health and safety aspects of being near hot water before heating a pan of water. Learners will observe, and comment on, what is happening to the water and, especially,  the water level. *Where is the water going? What is happening to it?*  **Scientific Enquiry activity**  *Which materials melt the quickest?*  *What variables could be changed in this investigation?*  Explain that they are only going to change the material and will keep every other variable the same. Demonstrate how they are going to put the same amount of the different materials into small cake cases. Explain that all the cases will be floated on the surface of a bowl of warm water at the same time and a timer started.  The learners will observe the different materials and make a record of the time each one starts to melt. Ask learners to make predictions based on their understanding of materials.  Allow the learners time to conduct the investigation (remember not all of the materials will melt). Discuss the results with the whole class. *Which material melted first? Which material took the longest? Did any of the materials not melt? What do you think this means?*  The learners can then construct a bar chart of their results; leave the samples in the water to cool.  At the end of the lesson, ask the learners to look at their sample materials again; by now the water should have cooled. *What has happened to the materials now?* Relate the changes back to the particle model. | Ice.  Mould/ice tray.  Pan of water, heat source.  A range of materials including some that will melt (e.g. ice, chocolate, lard, butter, wax crayon) and some that will not melt (e.g. small sweets, slices of banana, piece of paper).  Paper cake cases.  Bowl or bucket to contain hot water (about 40oC).  Timer.  Graph paper. | Misconception alert: Some learners will think water only turns into a gas when boiled or when ‘steam’ can be seen; this isn’t true. For example, puddles evaporate on a hot day. A warm bath will increase the amount of water vapour in the air (i.e. the air is more humid); the bath water does not have to be boiling.  Misconception alert: When some learners find some materials don’t melt under the conditions in the investigation they may believe they cannot/do not melt. Most materials will change state if heated to the appropriate temperature in appropriate conditions. Emphasise how the temperature may not have been high enough in this investigation. Consider using secondary sources of information to show metals melting. Also, some materials don’t melt but decompose, this is true for many organic materials like paper. |
| 4Cs4 | Observe how water turns into steam when it is heated but on cooling the steam turns back into water | Remind learners of what they have learnt over the previous lessons about what happens to water when it is heated. Discuss that heating a liquid causes it to undergo a state change into a gas. In the case of water, the liquid turns into an invisible gas known as water vapour or what scientists call steam. Explain carefully to learners that what is commonly called ‘steam’ isn’t the same as the scientific definition. The ‘steam’ we can see is actually liquid water/water droplets in the air either before they become water vapour or as the water vapour in the air cools and returns to a liquid state. Real steam is always an invisible gas.  *What happens to mirrors in the bathroom when you have a hot bath or shower?* Discuss how they become ‘misted’ or covered in water. The warm bathwater is changing state into water vapour in the air; when the water vapour meets something cooler, like a mirror, it cools back into a liquid.  Boil a kettle in front of the learners and hold a cold mirror above, angled slightly so that, as the water vapour cools, the water runs down the mirror into a container.  Explain that when the water vapour is cooled it turns back into its liquid form, i.e. water. *At what time did the water first appear on the mirror? When did you first see the ‘steam’?* Talk about how they may not see ‘steam’ in a hot room as the water vapour wouldn’t change state in the air to water droplets.  Learners write an explanation of what happens when water is heated, when water is cooled and describe the changes occurring. | Kettle (electrical, on a stove or burner).  Cold mirror (having been kept outside, in a fridge or in a freezer).  Plastic container.  Paper. | Misconception alert: The common meaning of ‘steam’ (which is visible) is not the same as the scientific meaning.  Health and safety:  Do not let learners carry out this investigation; it should be a teacher demonstration only. |

# Unit 4.3 Magnets and materials

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

In this unit, learners:

* gain further experience of using magnets
* learn which materials are attracted to magnets.

## Scientific Enquiry work focuses on:

* testing an idea or prediction based on scientific knowledge and understanding
* making relevant observations and comparisons in a variety of contexts
* beginning to think about the need for repeated measurements of, for example, length
* presenting results in drawings, bar charts and tables
* explaining what the evidence shows and whether it supports predictions; communicating this clearly to others.

## Recommended vocabulary for this unit:

* force
* attract, attraction, repel, repulsion, poles, north, south
* magnet, magnetic material, non-magnetic material
* iron, steel.

| Framework code | Learning objective | Suggested activities to choose from | Resources | Comments |
| --- | --- | --- | --- | --- |
| 4Pm4  4Ep2  4Eo1  4Eo3  4Eo4  4Eo6 | Explore the forces between magnets and know that magnets can attract or repel each other  Test and idea or prediction based on scientific knowledge and understanding  Make relevant observations and comparisons in a variety of contexts  Begin to think about the need for repeated measurements of, for example, length  Present results in drawings, bar charts and tables  Explain what the evidence shows and whether is supports predictions. Communicate this clearly to others | In groups, learners explore the different effects magnets can have on each other. Groups report their observations back to the rest of the class. Discuss how the magnets interacted together; forces are at work when they attract and repel each other. Link attracting to pulling and repelling to pushing by drawing force diagrams with arrows showing the forces when magnets interact.  Explain that not all magnets are bar shaped; they come in a variety of different shapes. Learners explore magnets of different shapes and discover that they all act in the same way; all magnets have two poles and attract/repel each other when close enough.  Learners explore the poles of the magnets by aligning pairs of magnets: north-north, north-south and south-south. They discuss what happened and record their results.  Learners can role-play being magnets. In pairs, learners represent the poles; when they are both the same they push each other away, when they are different they pull each other together.  *Can you think of any everyday objects that use magnets?*  Create an ideas board and ask the learners to draw some pictures for a class display.  Discuss how magnets are used in magnetically levitated (maglev) trains; use video (follow link) to support the discussion.  **Scientific Enquiry activity**  *Which is the strongest magnet?*  Demonstrate the fact that magnets will attract paperclips.  Learners discuss, in small groups, how this ability of magnets can be used to investigate the question.  Before the learners begin the investigation ask them to predict which magnet they believe will be the strongest and to attempt to give a reason why (e.g. this magnet is the biggest so it must be strongest).  *Can you explain the method you are going to use?*  *How will you record your results?*  Learners investigate the strength of magnets by adding chains of paperclips of different lengths to each magnet until the paperclip chain falls off.  Create a class table of results; calculate the class average of paperclips in the chain for each magnet. Explain that repeating measurements will help to improve the reliability of the results.  Learners then draw a bar chart of the mean results and discuss whether their predictions were correct.  *Can you make a conclusion from the results?* | Sets of magnets.  A selection of magnets (e.g. bar, horseshoe, wand, floating).  Video showing maglev trains  <https://www.youtube.com/watch?v=qi1kPRfnos0>  A selection of magnets (e.g. bar, horseshoe, wand, floating).  Paper clips.  Graph paper. | Do not use magnets near mobile phones, interactive whiteboards or computers as some magnets will damage these devices.  Magnets need to be carefully stored. Two magnets need to be placed together with opposite poles near each other and a ‘magnet keeper’ (a bar of unmagnetised iron) at each end.  The learners need to be careful; they should not drop or bang the magnets together; they should keep their fingers out of the way when magnets ‘snap’ together.  Misconception alert: Some learners will say magnets ‘stick’ together or are ‘attached’ or ‘connected’ when they are attracted to one another. Make sure learners use the terms ‘attract’ and ‘repel’ when discussing how magnets interact. |
| 4Pm5 | Know that magnets attract some metals but not others | Explain that not only are magnets attracted to each other but magnets are also attracted to some materials. *What do we call an object that is attracted to a magnet? (*Magnetic.) In small groups, learners discuss any objects that they know/think are magnetic and share with the rest of the class. Record these suggestions on the board; do not correct or agree with any of the list.  Learners test a variety of objects and determine which materials are attracted and which ones are not. They create their own table of results and complete it as they go along.  Explain that all magnetic materials are attracted by a magnet but they will not be repelled by a magnet. This is a good test to find out if something is a magnet or magnetic.  As a class, identify which of the objects they tested were magnetic.  *What did they all have in common?* The fact that they were metal.  *Does this mean all metals are magnetic?*  Discuss the learners’ answers. Have some examples of non-magnetic metals (e.g. aluminium drinks can) available for the learners to test.  *Why is it useful to know that aluminium isn’t magnetic?*  In small groups, learners discuss how they think magnets may be used at recycling plants. Each group shares their thoughts with the rest of the class.  Explain that magnets are used to separate metals in other industrial places (e.g. scrap yards).  Have a sealed container of iron filings and sand. Learners separate out the iron from the sand; the iron is magnetic and sand isn’t. | Bar magnets.  A variety of objects in the classroom made from different materials (including magnetic and non-magnetic materials).  Aluminium foil or aluminium drinks can.  Video showing separation of metals in a scrapyard.  <http://www.bbc.co.uk/education/clips/zcntsbk>  Sealed, transparent, container with iron filings and sand. Magnet. | Misconception alert: Some learners may get the terms magnet and magnetic mixed up; ensure all learners have clarity between the two. |

# Unit 4.4 Habitats

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

In this unit, learners:

* use identification keys for plants and animals
* investigate how plants and animals are adapted to different habitats
* consider human impact on the environment including waste, river pollution and the impact of developments.

## Scientific Enquiry work focuses on:

* collecting evidence in a variety of contexts
* choosing apparatus and deciding what to measure
* making relevant observations and comparisons in a variety of contexts.

## Recommended vocabulary for this unit:

* identification key, classify plant, animals
* habitat, environment
* waste, reuse, reduce, recycle, pollution, developments.

| Framework code | Learning objective | Suggested activities to choose from | Resources | Comments |
| --- | --- | --- | --- | --- |
| 4Be2 | Use simple identification keys | Explain that we can use an identification key to:   * find out what a plant or animal is * help to classify a plant or animal.   Show learners a picture of a butterfly, a snail and a spider. Ask the learners to imagine they were describing each to an alien.  *How would you describe each one?*  *What yes/no question could you ask to help identify each animal? (*e.g. *Does it have wings?)*  Give learners an identification key of some unusual animals (e.g. sloth, stoat, okapi) and plants (e.g. titan arum, tropical pitcher plant, African acacia) that the learners would be unlikely to recognise. In small groups, learners follow the identification key to discover the names of these animals and plants.  Give learners an identification key that allows the identification and grouping of familiar animals (e.g. snakes, lizards, frogs; owls, hawks, small birds):   * The key should use yes/no questions that refer to distinguishing features that are clearly visible. * Give learners pictures of more than one of each type of animal (i.e. different species of lizards, frogs and snakes). * Learners identify where each animal should be placed (or glued) on the identification key. * They should use the key to group the animals.   The same activity could be used with an identification key for plants. | Pictures of a butterfly, snail and spider.  Identification key including yes/no questions.  Example of a key (at bottom of the page): <http://archive.bio.ed.ac.uk/asab/exercises/ks2/birds_and_butterflies.html>  Identification key including yes/no questions.  Pictures of animals in the identification key.  Scissors, glue (optional). | Learners studied habitats, in Stage 2, and identified some simple differences in the plants and animals found in different habitats. Now, in Stage 4, learners start exploring how those differences make the plants and animals suited to their environment. |
| 4Be1  4Be2  4Ep1  4Ep5  4Eo1 | Investigate how different animals are found in different habitats and are suited to the environment in which they are found  Use simple identification keys  Collect evidence in a variety of contexts  Choose apparatus and decide what to measure  Make relevant observations and comparisons in a variety of contexts | Show the learners a series of pictures of a habitat and a plant/animal that is suited to this habitat. For each example discuss the environment of the habitat:   * What is the habitat like (e.g. hot/cold, wet/dry)? * What does the animal eat? OR How does the plant get light and water? * What might eat the animal or plant?   Then discuss the features of the plant/animals that mean it is suited to this environment. Help learners to focus on how the features help the plant/animal to survive.  Example 1: Polar region and polar bears  Description of the habitat:   * A polar environment is very cold.   Description of the animal behavior:   * Polar bears mainly eat seals. * No other animal will attack an adult polar bear.   Description of how a polar bear is suited to its environment:   * Polar bears have thick fur and a layer of fat; these help them to keep warm in the cold environment. * Polar bears have strong legs for swimming and running; these help them to catch seals. * Polar bears have ‘white’ fur (see comments); their camouflage helps them to get close to seals to catch them.   Example 2: Sonoran Desert and the saguaro cactus  Description of the habitat:   * The Sonoran Desert is hot and dry for most of the year. * There are rainy seasons in summer and winter when it is wetter and colder.   Description of the animal behavior:   * Lots of animals try to eat the cactus.   Description of how a saguaro cactus is suited to its environment:   * The saguaro cactus has lots of roots near the surface; these help it to take up water when it rains. * The saguaro cactus has ribs on its stems which can expand; these help it to store lots of water. * The saguaro cactus has spines; these help protect it from predators. * The saguaro cactus has a strong waxy surface; this helps it retain moisture during the hot days.   Use more examples; include a range of habitats and plants/animals:   * pond and waterlily * rainforest and orangutans * desert and camel.   **Scientific enquiry activity:**  Explain that learners will be investigating which plants and animals live in different habitats around the school grounds.  Groups of learners think of as many different ways as they can to find evidence to help them with this investigation.  *What observations and measurements will you make?*  *What equipment will you use?*  *How will you organise your results?*  This investigation could be done in several ways; for example:   * Learners list of as many different habitats as possible within the school grounds. * They list all the types of plants and animals they think they might find in these habitats; they could use an identification key to find out their names. * Learners complete a survey; they record where each type of plant or animal is found. This could involve looking for the presence/absence of each species in different habitats or trying to estimate the number of each species in particular habitats. * Extension activity: Ask learners to look for evidence of animals that have been in the habitat but are not there now, e.g. footprints, feathers, nests, spiders’ webs.   Return to the classroom and pick two of the habitats. As a class, compare the different plants and animals they found in each.  Learners explain how the plants and animals are suited to their environment. | Pictures of polar habitat and polar bear.  Pictures of the Sonoran Desert and the saguaro cactus.  A range of habitats in the school ground, e.g. log piles, stones, brick walls, leaf piles, pond, woodland, field/meadow.  Identification keys for local plants and animals. | Some learners may be interested to know that polar bear fur isn’t white; it is mostly made of hollow and transparent hair. It looks white because of the way light interacts with the fur.  If you opt to carry out this activity outside the school grounds you should adhere to your school policy re educational visits  Do not collect plant specimens.  Return any livestock to original habitat.  Health and safety:  Use gloves to handle plants and animals. |
| 4Be3 | Recognise ways that human activity affects the environment e.g. river pollution, recycling waste | Waste  Learners have studied reuse and recycling in Stage 2.  Extend this understanding by thinking about the materials in different objects:   * when an object is reused the object is used again. * when an object is recycled, the materials are extracted and used to make something different.   Learners could compare reusing a piece of paper (e.g. writing on a blank side) and recycling it to make new paper. Learners can use used papers to make new paper by making a pulp with water and drying the pulp on a screen.  Discuss the effort involved in each process.  Discuss the three stages in Reduce, Reuse, Recycle. Identify what happens to waste that is not reused or recycled. | Paper used on one side.  Equipment for paper recycling: scrap paper, warm water, screen of flat cloth. |  |
| 4Be3 | Recognise ways that human activity affects the environment e.g. river pollution, recycling waste | River Pollution  With sheets of blue paper (or tape) mark out a ‘river’ on the classroom floor.  Assign each group of learners the name of a city or town. In groups, learners discuss:   * their needs from the river (e.g. transport, water for plants, water for animals, water to drink) * things that are thrown or poured into the river (e.g. trash, dirty water, animal waste, human waste, waste water from factories, from farms * the effects of their pollution on the river downstream, on the animals, plants and people.   Each group reports their ideas to the class. Discuss why it is important to prevent river pollution and suggest ways this could be done. | Blue paper, tape. |  |
| 4Be3 | Recognise ways that human activity affects the environment e.g. river pollution, recycling waste | The environmental impacts of local developments  If possible, show pictures of the local area from many years ago; ask learners what has changed.  As a class, discuss ways in which human activity can alter habitats. For example, building houses or roads, putting waste into rivers or using landfill sites to store rubbish.  Identify any development issues in the local area. If there are no issues, give a hypothetical scenario. For example, a new road is going to be built through part of the local area.  Learners research the development. Organise a class debate for/against this development. For example, ‘The new road would mean I could get into the city faster’, ‘Part of the area is home to a rare species of animals and building here could mean they will die’. | Old pictures of the local area. | Consult the local planning office (or equivalent) for details of local developments. |

# Unit 4.5 Making circuits

It is recommended that this unit takes approximately **50% of the term.**

In this unit, learners:

* extend their previous experience of making circuits
* reinforce their understanding for the need for a circuit to be complete (unbroken).

## Scientific Enquiry work focuses on:

* designing a fair test and planning how to collect sufficient evidence
* choosing apparatus and deciding what to measure
* making relevant observations and comparisons in a variety of contexts
* linking evidence to scientific knowledge and understanding in some contexts
* explaining what the evidence shows and whether it supports predictions; communicating these clearly to others.

## Recommended vocabulary for this unit:

* circuit, cell, battery, switch, wire, bulb, lamp, connector, buzzer, bell
* electricity, current, flow.

| Framework code | Learning objective | Suggested activities to choose from | Resources | Comments |
| --- | --- | --- | --- | --- |
| 4Pm1  4Ep4  4Ep5  4Eo6 | Construct complete circuits using switch, cell (battery), wire and lamps  Design a fair test and plan how to collect sufficient evidence  Choose apparatus and decide what to measure  Explain what the evidence shows and whether is supports predictions. Communicate this clearly to others | As a class, revise Stage 2 work on circuits.  *What are the names of the different components?* Play a game of snap: learners match each component name card with the correct component image card.  Ask the learners to use a range of equipment to create a circuit where a bulb lights up or buzzer makes a noise etc.  Learners draw their circuit and label the different components, explaining the role each component has within the circuit.  **Scientific Enquiry activity**  Ask the learners to explore what happens in a circuit when more bulbs are added. Then, learners investigate what will happen in a circuit when additional cells are added.  In small groups, learners plan their investigation including how they will make it a fair test. If necessary, remind learners that only one variable is changed in a fair test. *What are you going to measure? How will you measure it?*  Discuss, as a class, the best way to do the investigation  Learners complete the planned investigation. If possible, learners take photographs of their circuits to record their results.  As a class, discuss their observations and create conclusions to the original questions: *What happens when more bulbs are added? What happens when more cells are added?*  Learners write a report of their investigation and their conclusions using pictures (or photographs) as evidence. | Cards with component names and images on.  Equipment for electrical circuits (e.g. wires, battery/cell, crocodile clips, lamp, bell, buzzer).  Electrical components (e.g. wires, cells, lamps, buzzers, motors).  Camera. | Ensure that learners understand the difference between a battery and a cell, and use the correct scientific term. A battery is formed when two or more cells are connected. One cell should not be called a battery.  It is also beneficial to the learners that lamp and battery holders are not used in Stage 4. This allows the learners to see how the different components are joined together without a break in the circuit.  There is no need to introduce circuit diagrams at this stage. |
| 4Pm1  4Pm2  4Ep4  4Ep5  4Eo1  4Eo7 | Construct complete circuits using switch, cell (battery), wire and lamps  Explore how an electrical device will not work if there is a break in the circuit  Design a fair test and plan how to collect sufficient evidence  Choose apparatus and decide what to measure  Make relevant observations and comparisons in a variety of contexts  Link evidence to scientific knowledge and understanding in some contexts | Look at a drawing of a circuit (using pictures of the different components instead of diagrams) with break between the wires. Ask learners if the circuit will work or not; establish that it will not work as the break stops electricity from flowing around the circuit.  **Scientific Enquiry activity**  Give small groups of learners a worksheet with six pictures of circuit diagrams where only some of the circuits would work. Ask learners to predict which circuits will work before building all six circuits to test their prediction. For the circuits that do not work, learners identify why they do not work and write a solution to the problem.  **Scientific Enquiry activity**  Demonstrate how to make a simple, paper-clip switch and introduce it into a circuit with a bulb.  Discuss how a switch works:   * when a switch is open (off) there is a break in the circuit; electricity cannot travel around the circuit. * when the switch is closed (on) the circuit is complete; electricity can flow around the circuit.   *Why has a paper clip been used in the switch?*  *Could any other materials be used?*  Working in small groups, learners make switches using a variety of different materials (instead of the paper clip) and test them in the bulb circuit.  As a class, discuss which materials make the best switches. Make sure that learners understand that metals will conduct electricity.  Tell the learners that the switch they made was a very basic switch; there are many different designs available.  If possible, have some examples (e.g. tilt switch, slide switch) for the learners to explore. Discuss how these switches work and the sort of circuits they would be useful in. For example, a push switch would be useful in a circuit for a doorbell.  **Scientific Enquiry activity**  Give the learners the following problem to solve: *A local shop owner has asked the class to create an automatic system to welcome customers into their shop. They want an electrical system that will switch a light on and sound a bell when customers enter their shop. Can the class help?*  Allow learners time to investigate with a range of electrical equipment to create a working circuit.  The learners can then write a report to the shop owner explaining what makes the system work and include a circuit diagram that shows where the switch is. | Circuit diagram (with pictures rather than conventional symbols) to share with whole class.  A worksheet containing six circuit diagrams.  Electrical components to make a simple circuit (e.g. wires, cell, lamp, switch).  Wires, cell, lamp,  Paper-clip switch made from paper clip, card, split pins.  A variety of other materials to replace the paper clip in the switch, including some metals and some non-metals (e.g. string, plastic, paper, copper wire, wooden stick, aluminium foil, newspaper).  Examples of switches or pictures of switches.  Electrical components (e.g. wires, cells, lamps, buzzers). |  |
| 4Pm3 | Know that electrical current flows and that models can describe this flow, e.g. particles travelling around a circuit | *What is an electric current?* In small groups, learners discuss and write down a group definition to put on the board. As a whole class, discuss each definition. This method helps to address misconceptions without drawing attention to individual learners.  To model the flow of electrical current around a complete circuit:   * Learners stand in a circle holding a rope/string loosely so it can be moved by someone else. * Identify one learner to be the switch. When they put their hands in the air they drop the rope; the switch is open and the circuit is broken. * Some other learners are components that produce a sound (e.g. a buzzer, bell).; they hold the rope more tightly so if it is moved they feel the friction. The teacher is the cell. * When the switch is closed (i.e. the learner being the switch holds the rope) the rope is moved in a loop by being pushed and pulled by the teacher (cell). These movements represent the current flowing around the circuit. When the current is flowing, learners discuss what is happening. Learners acting as components can behave like their component if they feel their hands get warmer. When the ‘switch’ opens, all sounds and the flow of the current should stop instantly. * Swap the roles (switches, devices) during the activity. Once the learners are confident, step out of the circuit and nominate a learner to be the cell. * Explain that this game is a representation of how an electrical current flows around a circuit; a representation like this can be called a ‘model’.   Use a virtual circuit to model the flow of electricity in a circuit. | Rope or string.  Virtual circuit made using  <https://phet.colorado.edu/en/simulation/circuit-construction-kit-dc-virtual-lab> | Misconception alert: Some learners will think the electric current is passed from one component to another which isn’t true.  In this virtual circuit software, the ‘grab bag’ allows a range of items to be added to the circuit including a ‘dog’ and a ‘hand’. It can also be used to demonstrate the use of switches. |

# Unit 4.6 Sound

It is recommended that this unit takes approximately **50% of the term.**

In this unit, learners:

* learn that sounds are produced by vibrations
* understand sound vibrations travel from their source through a range of materials before they reach the ear
* use musical instruments to explore different ways of producing sounds and how pitch and loudness can be changed.

## Scientific Enquiry work focuses on:

* testing an idea or prediction based on scientific knowledge and understanding
* suggesting questions that can be tested and making predictions; communicating these
* designing a fair test and planning how to collect sufficient evidence
* presenting results in drawings, bar charts and tables
* making relevant observations and comparisons in a variety of contexts
* identifying simple trends and patterns in results and suggesting explanations for some of these
* linking evidence to scientific knowledge and understanding in some contexts.

## Recommended vocabulary for this unit:

* sound, vibrate, travel, insulate
* volume, loud, soft
* pitch, low, high.

| Framework code | Learning objective | Suggested activities to choose from | Resources | Comments |
| --- | --- | --- | --- | --- |
| 4Ps1 | Explore how sounds are made when objects, materials or air vibrate and learn to measure the volume of sound in decibels with a sound level meter | Set up a series of carousel activities for learners to explore. For example: rice on a drum, a tuning fork and a bowl of water, a ruler, glasses filled with different amounts of water and yoghurt-pot string telephones.  Learners complete the different activities following the instructions at each station:   * What happens to the rice when you tap the drum? What happens if you tap it harder? * Tap the tuning fork on the table and gently place it into the water. What happens? * Hold the ruler flat on the table so part of it is over the edge, hit this bit. What happens? What happens if the bit off the table is longer? * Gently tap the glasses with the different amounts of water in. What happens? * Using the string telephone, ask a partner to hold the yoghurt pot to their ear and say something into the other yoghurt pot. Can your partner hear it? What about if you say it very quietly?   As a class, discuss the learners’ observations.  *What did all the different activities have in common?*  They all show that sound is made by vibrations.  Ask the learners to find their voice box on their throat, put their fingers on it and then hum.  *What can you feel?* Explain that the vibration of our throats causes the air to vibrate, which is then detected as sound.  Watch a video showing slowed down examples of sound being made by vibrations.  Show learners a bell. *How can we make the bell louder?* (ring it harder, ring it closer to their ears). Explain that:   * When the bell is closer to our ears the vibration doesn’t have as far to go so is louder. Show this by using a device to play a sound at different distances from the learners. Discuss how the further away it is the quieter it is. * When the bell is rung harder the vibrations are stronger so can travel further. Show this by looking at a water in a large container when a small ripple, and then a big ripple, is made; the same principle holds for sound.   Then challenge the learners to explain how they know the bell is louder. Tell the learners that they could measure the volume of sound in decibels with a sound level meter.  In small groups, learners discuss different sounds they might hear every day. List these on the board adding some less everyday sounds (e.g. train whistle, drill or whisper).  As a class, put these in order from quietest to loudest and ask the learners to guess how many decibels each sound is.  Show the class an example of a decibel comparison chart and compare the learners’ answers.  If available, show learners how a sound level meter can be used to measure sounds in decibels. Measure the sound level of different objects that make a sound (e.g. stapler, door shutting, whistle). Draw a table to record the results. | Rice on a drum.  Tuning fork and bowl of water.  Ruler.  Glasses filled with different amounts of water, a small drumstick.  String telephones (two yoghurt pots joined with a piece of string).  High-speed film of some sound sources showing the vibrations such as: <https://youtu.be/26qvYE-w8Eo>  A bell.  Water in a large container.  An example of a decibel comparison chart.  Sound level meter or an equivalent app for a mobile phone (if available). | Hearing impaired learners will need particular support here. Give visual demonstrations of the properties of musical instruments and draw attention to the vibrations as sounds are produced.  Help other pupils to be sensitive to the needs of such pupils.  **Safety** – loud sounds can hurt ears! |
| 4Ps2  4Ep2  4Ep3  4Ep4  4Eo1  4Eo7 | Investigate how sound travels through different materials to the ear  Test an idea or prediction based on scientific knowledge and understanding  Suggest questions that can be tested and make predictions; communicate these  Design a fair test and plan how to collect sufficient evidence  Make relevant observations and comparisons in a variety of contexts  Link evidence to scientific knowledge and understanding in some contexts | *How does sound get to our ears for us to hear it?* Explain that the sound is travelling through air to our ears. This online video is a good model of how this happens.  **Scientific Enquiry activity**  *Can sound can travel through anything else? How do you know?*  Show the learners an object that makes a constant noise (e.g. a ticking clock, a small radio). Ask learners to predict if the sound of the object will travel through glass, paper, metal, water, air and wood.  Learners create a table and write down their predictions. Then, demonstrating to the class, put the object into a series of containers (e.g. paper bag, glass jar, in a plastic bag placed in water, a shoebox filled with newspaper and a metal can).  Learners make observations about each one; they say whether they could still hear the noise and if it was quieter or louder. For added accuracy, a sound level meter or app (if available) could be used to measure the sound levels in decibels.  Confirm that sound can travel through solids, liquids and gases; some are better at allowing sound to travel through them than others.  Demonstrate this further by using the starter activity on this website.  **Scientific Enquiry activity**  An investigation to make the best string telephone. Discuss the variables learners could change (e.g. the material the “receivers” are made from, the material the ‘string’ is made from and the length of string). Remind learners to ensure the investigation is a fair test by only changing one variable.  Allow learners to create a series of string telephones to investigate what makes the best telephone. Provide equipment to measure the volume of sound (optional, see comments).  Ask learners to discuss which string telephone is the best, in their opinion, and to use their scientific knowledge to explain why. | Model of sound waves  <https://www.bbc.co.uk/education/clips/ztwkjxs>  A small object that makes a constant noise (e.g. a ticking clock, a small radio, or a simple electrical circuit including a bell or a buzzer).  Paper bag, glass jar, plastic bag, bowl of water, shoebox, newspaper, metal can.  Sound level meter or equivalent app for a mobile phone (optional).  <http://resources.hwb.wales.gov.uk/VTC/16022007/sound_travels/lesson.html>  Example of a string telephone.  A collection of different materials that the learners could use (e.g. yoghurt pots, cardboard tubes, polystyrene cups, string, wire, a plastic clothes line).  Sound level meter or equivalent app for a mobile phone (optional). | Although more accurate results could be obtained by using a sound level meter it is not essential for this investigation as the focus of learning is on planning a fair test. |
| 4Ps3  4Ep4  4Eo1  4Eo4  4Eo7 | Investigate how some materials are effective in preventing sound from travelling through them  Design a fair test and plan how to collect sufficient evidence  Make relevant observations and comparisons in a variety of contexts  Present results in drawings, bar charts and tables  Link evidence to scientific knowledge and understanding in some contexts | As a class, discuss the potential consequences of listening to some louder sounds (temporary/permanent hearing problems). Ask for situations where it is good to prevent sound travelling: *Can you give practical, everyday examples?* (Ear defenders.)  Use the main session of this website to introduce that sound travels better through some materials than others as an introduction to the investigation. *What materials are best at preventing sound from travelling through them?*  **Scientific Enquiry activity**  Give each group of learners a shoe box and a selection of materials to test. Learners insulate the box by wrapping the different materials around the outside. Place an object that makes a continuous noise inside the box and then describe (or measure) how much sound is able to pass through the box.  *How will you make sure this is a fair test?* (By only changing one variable, i.e. the insulating materials; all other variables are kept the same.)  Allow learners time to complete their investigation and draw a bar chart using the results.  *What type of materials make the best insulators?*  *Why do you think this?*  *What did the materials have in common?*  Learners could write a report of their conclusions. | <http://resources.hwb.wales.gov.uk/VTC/16022007/sound_travels/lesson.html>  An object that makes a constant noise (e.g. a simple electrical circuit including a bell or a buzzer).  A shoe box per group.  A selection of insulation materials such as plastic, paper, tissue paper, furry material, wool material.  Sound level meter or mobile phone app (optional). | **Safety** - Avoid objects that can be put inside ears.  Misconception alert: Some learners will only link the terms conductor and insulator to heat. Make sure they have a broad definition of a conductor being a material that allows the passage of energy (in this case sound) and an insulator being a material that limits, and possibly prevents, the passage of energy. |
| 4Ps4 | Investigate the way ***pitch*** describes how high or low a sound is and that high and low sounds can be loud or soft  Secondary sources can be used | Play a piece of music to the learners; the music should have a range of obvious high and low sounds. Ask learners to describe in their own words what is happening to the different sounds.  Explain that pitch describes how high or low a sound is; volume describes how loud or soft the sound is.  Ask learners to make a variety of sounds, e.g. high and soft, low and loud.  Invite a musician (or a group of musicians) into the school to talk to the class about their instruments and to demonstrate how they can make high/low pitch sounds and loud/soft sounds. As the musician plays a series of sounds the learners indicate how the pitch changes by standing up (if the pitch goes higher) and sitting down (if the pitch goes lower). | Recorded piece of music with a variety of obvious high and low sounds.  A musician or a group of musicians. | Misconception alert: High or low sounds can be loud or soft. |
| 4Ps5  4Ep3  4Ep4  4Eo5 | Explore how pitch can be changed in musical instruments in a range of ways  Suggest questions that can be tested and make predictions; communicate these  Design a fair test and plan how to collect sufficient evidence  Identify simple trends and patterns in results and suggest explanations for some of these | **Scientific Enquiry activity**  *How does the length of an elastic band change the pitch of the sound it makes?*  Ask learners to plan a fair test by thinking about which variables they will keep the same and which variable they will change.  *How will you measure the sounds? How will you record your findings?*  Before starting the investigation, learners make a prediction about which elastic band will produce the lowest sound using the scientific knowledge they learned in the previous week.  Learners investigate the question using the equipment and record results in a table.  As a class, look at the different results and create a class conclusion to the original question: *How does the length of an elastic band change the pitch of the sound it makes?* For example, the longer the elastic band, the higher the sound.  Show a picture of a guitar and ask what sort of instrument it is. Explain that the pitch of the sounds produced by a guitar can be changed in the same way as the learners changed the pitch of the sounds produced by the elastic bands.  **Scientific Enquiry activity**  Show the learners a picture of a recorder.  *What sort of instrument is this?*  *How can we change the pitch of an instrument with no strings?*  Demonstrate how to make a basic straw buzzer by cutting the flattened end of a straw to a point and blowing hard into the flattened end. Ask the learners to investigate: *What happens when you alter the length of the straw?*  The learners will cut straws to different lengths and investigate the effect this has on the pitch of the sound.  As a class, discuss what the learners found out. Work together to create a conclusion that fits the results, e.g. the longer the wind column the lower the sound.  Remind the learners of the picture of the recorder.  *How can we use this conclusion to explain how the pitch is changed in a recorder?* Discuss how the shorter the length of the wind column, the higher the pitch of the sound; this is similar to the string and to the drum. Less vibration produces a higher-pitched sound. | Enough rigid containers (e.g. plastic food boxes) for one per group.  Elastic bands of different lengths  Picture of a guitar (or a guitar if available).  Picture of a recorder (or a real recorder or flute, if available).  Drinking straws.  Rulers.  Scissors.  Examples of straw buzzers  <https://www.youtube.com/watch?v=8i5CdH1G4_g>  or  <https://www.youtube.com/watch?v=5V_hWBRZKuk> |  |