Fynbos for the Future Curriculum Supplement

Grade 4 - 7

Natural Sciences and Technology

Greenpop

JOIN THE TREEVOLUTION

Introduction

This document is intended to help you incorporate the fynbos garden into your lesson plans. By creating activities in and around the garden, your learners will hopefully stay engaged and eager to care for them long after our programme has run its course.

This packet contains an activity plan for each term linked to specific knowledge strands. The learning outcomes and scheduling are aligned with the guidelines established by the Department of Education, and many lessons were directly taken from their National Curriculum Statement Handbook and Teacher's Guidebooks. We hope this will aid you in your planning and encourage your school to remain connected to the fynbos garden!

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Term 1

Knowledge Strand	Topic	Learning Outcomes
Life and Living	Living and non-living things	• Define what it means for a thing to be alive. • Interact with the garden space and identify living and nonliving elements in the garden • Recognise the difference between being non-living and being dead

Activity - Living and Nonliving things in Garden

Notes to Teacher:

This section starts just after the introduction of the topic. The aim is to give the learners the opportunities to interact with tangible examples of living and non-living things, and more importantly, with multiple elements where the classification is not entirely clear at first glance.

Knowledge harvest - 10 mins (Class discussion):

On the boards, draw four large columns labelled **Living, Non-Living, Dead, and Unknown**. Ask the learners to give definitions of each of the first three labels as well as a couple of examples. Tell them to think of things in and around their houses. If learners give examples of things where the classification isn't immediately obvious, write them in the *Unknown* column.

Knowledge in action - 20 minutes (Garden exploration)

Ask the learners to work in groups of two. With a piece of paper in hand, each group needs to find and describe 5 examples of **Living, Non-living, and Dead** things in the garden. Encourage them to interact with their environment by using their senses of touch, sight, hearing, and smell.

Consolidation 15 mins (Class discussion):

Tell the learners to take turns to read the examples they wrote down on their papers and ask them to explain why they chose their classification. Write the new examples on the board under one of the three labels. Go through the items in the *Unknown* column, and with the help of the learners, start moving them one-by-one to one of the other three columns. Once this is completed, revisit the definitions of each of the columns that were written down earlier, and edit as necessary.

Follow-up:

After this activity, move on to listing the life processes that all living things have in common.

Term 2

Knowledge Strand	Topic	Learning Outcome
Matter, Materials and Structures	Materials around us	• Interact with and identify the different states of water • Draw a diagram of the garden as part of the water cycle

Materials Required:

- Around 12 blocks of ice
- Two tall glass glasses
- Water
- Scrap paper and pencil for each learner
- Ruler
- Something hard to press on, like a clipboard for each learner (optional)

Activity - Exploring the Water Cycle in the Garden

Notes to Teacher:

This activity takes place at the end of the topic. The aim is to consolidate the knowledge of the material covered and to act as a plenary of the chapter.

Setup - 10 mins (30 minutes before the lesson commences):

Cordon off the amphitheatre/seating so the display doesn't get ruined before the class has the opportunity to view the experiment. In the middle of the amphitheatre, **clear an area of around 1m2 of all the mulch** so that the **bare soil** is exposed. **Draw three circles in the soil**, about 30cm apart. In circle number one, place a block of ice in the centre. In the second circle, place a block of ice in the centre, but also place an inverted glass over the ice. In the third circle, place a couple of ice blocks into an empty glass (made out of glass).

This will serve as a demonstration of several changes in the state of water: A) In the first circle, the ice will turn into liquid (*melting*) and then into a gas (*evaporation*). B) In the second circle, the ice will turn into liquid and then gas, and then again into liquid (*condensation*) on the inner surface of the inverted glass. C) In the third circle, the ice will melt inside the glass and the water vapour in the air will turn into liquid on the outside of the glass. *To allow more learners to interact with the display, you could make two or more of these sets*.

Knowledge harvest - 10 mins (Class discussion):

Ask the class what the names are of the three states of material that were discussed in this chapter, and write the answers horizontally and comfortably spaced out on the boards. Ask the learners what the corresponding states of water are called. Write these in brackets under the labels. Draw an arrow to connect ice and liquid, and ask the learners what this process is called (*melting - when a solid becomes a liquid*). Do the same for liquid to gas

(*evaporation*), gas to liquid (*condensation*), and liquid to solid (*freezing/solidifying*). Don't skip states; they needn't learn this yet (*sublimation, deposition*).

Next, draw a visual representation of your three circles in the fynbos garden and **label them A, B, and C.** Then ask them to discuss in groups what they think will happen in each circle.

Knowledge in action - 20 minutes (Garden exploration)

Take the learners to the garden and ask them to **sit down on the seating**. Point to display A, B, and C (the circles) and remind them what you did in each. Ask the learners to take turns, in teams, to come closer and **inspect each of the displays (circles)**. Once everyone has had a turn to look, ask them what they saw:

A - The ice melted, leaving nothing but damp soil. If it's a hot day, the sand might even be dry.

- What happened to the ice? (*melted*)
- Where did the water go? (*into the soil, evaporated*)
- Where does the water go in soil when it's not evaporating? (*runoff into rivers and sea, sink into aquifers, taken up by plants and animals*)

B - The ice melted leaving damp soil. Some of it has evaporated and condensed on the inside of the glass

- What happened to the ice? (*melted*)
- Where did the water go? (*into the soil, evaporated*)
- What are the droplets on the inside of the glass? (*condensation*)
- What happens when a drop of condensation becomes too heavy? (*it falls to the ground*)

C - The ice melted leaving liquid water in the glass.

- What happened to the ice? (*melted*)
- What are the drops on the outside of the glass? (*condensation*)
- Where does the water go when it evaporates? (*it goes into the atmosphere*)

Consolidation 15 mins (Class discussion, stay in amphitheatre):

Ask the learners if they can remember **what ultimately happens to water vapour when it enters the atmosphere** (*it condenses into clouds and then rains*). Next, ask them **what happens to rain when it falls to the earth**. (*it goes into the soil, into groundwater, into rivers, and then the sea*). Remind them that this **constant movement of water** from the sea to the clouds and back is called the **water cycle**.

Tell learners to d**raw a diagram of the water cycle** and use the **garden as the focal point** of the drawing, labelling everything that happens to water when it falls on the garden. They need to use the following labels correctly:

- Evaporation, precipitation, runoff, sun, groundwater, clouds

Put the learners' drawing up on the wall in the classroom after they're done.

Follow-up:

This activity serves as a thorough revision of chapter 1 of *Materials around Us*. Following this, you could move to *Solid Materials*.

Term 3

Knowledge Strand	Topic	Learning Outcome
Energy and Change	Energy Transfer	• The learner will be able to understand and define what a food chain is • Learners understand that organisms ultimately get their energy from the sun • Learners can observe and sketch representations of actual food chains

Materials Required:

- Pencils (normal and colour)
- Scrap paper for each learner (to draw on)
- Magnifying glasses (**not essential**)
- Rulers
- Something hard to press on, like a clipboard for each learner (optional)

Activity - Food chains in the Garden

Notes to Teacher:

This activity takes place close to the end of chapter 1 and acts as a revision on the topics of energy transfer and the food chain.

Knowledge harvest - 10 mins (Class discussion):

Ask the class to **think of their favourite meals** and what they usually eat them with. Choose around **3 answers and write them down on the board** (pick a good mix of meals). Ask the children to name the individual **components of each of the meals** and **list them** under each of the dishes. Next, invite the class to discuss amongst themselves **where each of the components gets their energy from**. After a couple of minutes, write these answers on the board. Next, ask the class to discuss once more the individual components of the dishes above to come up with suggestions of **where else this energy can be transferred to**, e.g. *salad leaves could be eaten by snails*, or *the chicken could be eaten by a hawk*. Write the answer down on the board.

Lastly, for each of the components of the meals, ask the learners to complete these **food chains** by discussing where those components get their energy from. **(We ultimately want to show that all energy in food chains originates from the sun. However, don't tell the class this and rather guide them to the answer).** Complete these chains with the answers from the class.

Knowledge in action - 20 minutes (Garden exploration)

Take the learners to the garden and ask them to **sit down on the seating**. Divide them into **groups of four**. After the instructions, tell the groups to **spread out throughout the garden and observe**. They need to **write down the names of at least ten different organisms**, which need to represent a **variety of different types** of plants, insects, birds, and lizards. Variety is key. For plants, they could write *small shrub, herb, woody shrub,*

tree, flower, *succulent*.

Here are some ideas of organisms they might come across:

- Plants: bitou bush, rose geranium, wild rosemary, lion's tail, vygies, pig's ear
- Insects and invertebrates: snail, slug, honeybee, fly, moth, butterfly, wasp, beetle
- Vertebrates: gecko, lizard, sparrow, starling, dove, pigeon

Consolidation 15 mins (Class discussion in the classroom):

When back in the classroom, ask the learners to sit down in their teams. Then, instruct them to use the organisms they observed to **make at least 5 different food chains**, using **as many of their listed organisms as possible**. They are also welcome to add other creatures that one might find in the garden (ones that aren't likely to be seen with a large group of people present), like frogs, toads, birds of prey, mice, rats, moles. Tell them to try and make at least one very long one. **Write some of these down** on the board.

Follow-up:

This activity serves as a revision or teaching tool for the concepts of energy transfer and food chains. Topics not covered are: what the sun is, how the energy is transferred to earth, and what fossil fuels are.

Term 4

Knowledge Strand	Topic	Learning Outcome
Earth and Beyond	The Features of Earth	• The learner can put themselves mentally in another place and can imagine what things look like from that perspective • The learners can draw features they cannot necessarily see • Learners can draw the garden and the school from different heights

Materials Required:

- Pencils (normal and colour)
- Scrap paper for each learner (to draw on)
- Rubber
- Rulers
- Something hard to press on, like a clipboard for each learner (optional)

Activity - The garden from above

Notes to Teacher:

Here we will stimulate and develop a mental ability learners need to have, to understand models of the solar system. This task develops the learner's skill in visualising things as they look from a different point of view. You may find that only a few learners can imagine the features of the garden and school grounds as they look from the sky. For example, many learners will draw the plants and buildings as they can see them from the front.

Knowledge harvest - 10 mins (Class discussion):

Ask the class to **hold an image of the school and school grounds in their minds**. Ask them a series of questions about the **physical appearance** of the school grounds and the elements one would find therein. Write some of the answers down:

- what type of living creatures might we find here
- what type of organisms won't we find on the school grounds
- where are we likely to find birds
- where are we most likely to find small animals and insects
- where are the biggest trees
- where is the emptiest part of the school grounds
- name several non-living elements of the school grounds

Next, ask them to **describe what the school looks like from the four cardinal directions**. What can you see from certain angles and not from others? How would everything look different when viewed from above?

Knowledge in action - 25 minutes (Garden exploration)

Take the learners to the garden and ask them to sit down on the seating. Hand out the materials. Tell them to start by using the entire page to **draw the whole class sitting on the amphitheatre as if viewed from above**. This first round needn't be neat. Ask them to **use their rulers to label certain elements**, like the tyres, teachers, themselves. Remind them that a bird hovering over us will probably only see the tops of our heads, our shoulders, arms, hands, thighs and maybe shoes, but not our bodies and faces. Ask them to show you their drawings after they've completed them and give pointers and encouragement throughout.

Next, ask them to turn to a clean sheet of paper. Tell them to **"zoom out" and draw the whole garden this time (without the people in it)**. Tell them to include the pathways, fences, beds, and other elements within the garden. **Encourage them to walk through the garden** and imagine what everything looks like from the sky (sitting in the amphitheatre, they might not be able to see garden elements that would be visible if they were to float above the garden. They can also include insects and animals they think would be present when there aren't any people (remember to draw them in the correct orientation). **Encourage them to do it as neatly as possible and to use their rulers to connect labels to the various elements.**

Consolidation 10 mins (Class discussion in the classroom):

When back in the classroom, ask the learners to sit down at their desks. Using their colour pencils, ask them to **add colour to their drawings** and remind them to try and **keep the colours as accurate as possible**.

Once they've completed their drawings, ask them to put away their materials and imagine what they would be able to see if they **zoomed out even further**. What would become invisible? What would they be able to see that they couldn't see before? Write these down on the board. Progressively zoom out more and more and discuss what would become invisible and what would become visible.

Follow-up:

This activity serves as a segway into viewing the earth as a globe from space, and to better understand size ratio and perspective. Next, you will move onto continents and the ocean.

Natural Sciences and Technology
Grade 5

Term 1

Knowledge Strand	Topic	Learning Outcome
Life and Living	Habitats (Plants and Animals on Earth)	• Define what a **habitat** is • Define what **biodiversity** is • Engage with and explore real habitats on the school grounds, do a superficial study of the biodiversity and compare

Materials Required:

- Enough scrap paper for each learner (line paper would work best)
- Enough pencils for each learner
- Something hard to press on

Activity - Exploring habitats on the school grounds

Notes to Teacher:

This activity occurs right after the introduction of the topic. The aim is to give the learners the opportunities to interact with tangible examples of habitats and biodiversity and to realise how humans can positively and negatively affect habitats on Earth and the biodiversity contained within.

Knowledge harvest - 10 mins (Class discussion):

After the introduction of the topic and terms, ask the class to **divide into three groups.** Ask each group to **come up with a name** within the topic of biology/exploration. **Draw three columns on the board** and label each with the names of the three groups. In their groups, they have to **try and name as many habitats as possible**. Ask them to do it quietly and for one member from each group to write it down. After a couple of minutes, ask the learners tasked with writing down the habitats to come to the board and **read out what they have on their lists**. Discuss each of these with the class and **write down each correct habitat on the corresponding team's column** and discuss the **expected level of biodiversity** of each of the habitats they mentioned.

Next, as a whole, **identify three different habitats on the school grounds with contrasting levels of biodiversity** (one of which being the fynbos garden) and write them down on the board.* Have a quick discussion about **which habitat the learners expect to see the greatest diversity and why**. Then, hand them their s**crap paper and ask them to draw two columns**: Plants, and Creepy Crawlies (Insects, molluscs, arachnids). Divide each column into two and write the following subheadings: Name/Type, Drawing**

**Try and keep the options as close to the class and one another as possible to limit travel time. What would also save time is to have these preselected.*

***These could also be printed beforehand and given to them to save time.*

Knowledge in action - 25 minutes (Garden exploration: Biodiversity audit)

Each of the three groups will get time to **visit each of the habitats** to do a biodiversity audit: to **see how many** plant and animal **species they can find** at each of the habitats. Instruct the learners to stay in their groups and to only move to the new habitat when instructed to do so. For every organism the learners find, they need to **write a description** of it (to the best of their ability), using terms for types like grass, small shrub, tree, woody shrub, succulent, aromatic shrub, and descriptive terms denoting colour, texture, presence of flowers, fruit. Next to the description, they should **draw what they see**. (Do this in the second column). With the plants, the easiest thing might be to just draw the shape of the leaves. Terms they could use for the critters they find are butterfly, moth, fly, bee, wasp, carpenter bee, spider, woodlouse, slug, snail, worm, caterpillar, ant, aphid, beetle.

Consolidation 10 mins (Class discussion):

Before capturing their information on the board, discuss **how they think their findings differed from their predictions**:

What surprised them? What did they learn? Which findings were as they expected?

Next, ask them to confer with their groups and **write down the total number of organisms they found**. Remind them to not write down organisms twice. For the purpose of this lesson, the **number of species is more important than the number of individuals**. Write these down on the board and **rank each habitat according to biodiversity**. Next, ask them:

Do you believe the number of different insect species correlates to the number of plant species? How can I increase the biodiversity of the site that ranked the lowest? What are things that could threaten the biodiversity of the highest-ranked site?

End off with a **summary of what habitats and biodiversity are** and why we must protect and promote biodiversity.

NOTES:

This lesson can also be conducted with images of the habitats and creatures displayed digitally (if resources are available) or printed out. Physical exploration, however, is preferable.

Follow-up:

This activity also serves as a good segway into the interdependence of plants and animals and the other resources needed for them to live and thrive.

Term 2

Knowledge Strand	Topic	Learning Outcome
Matter and Materials	Processed materials	• Learn about the difference between recycling and upcycling • Learn how to make an upcycled bird feeder out of an empty plastic bottle

Materials Required:

- One empty plastic bottle for each child (2-litre coke bottles, milk bottles)
- Make sure all the bottles have lids
- Scissors
- String
- Something to make holes in the lids
- Permanent marker to mark where cuts should be made
- Stickers to decorate bird feeders (optional)

Activity - Making an upcycled bird feeder

Notes to Teacher:

This activity takes place at the end of the topic after traditional processing has been covered. It shows alternative ways of processing used items as opposed to disposing of them.

Setup - 10 mins (to be conducted **before the lesson** commences):

Start tasking the learners a **couple of weeks before** the lesson to **bring you clean, used soda or milk bottles**. Make sure it's **not the hard plastic type** soda bottles (the ones that can be returned). It would also help if you have **more bottles than are needed** in case someone forgot to bring them or in case of a flop or two. Apart from having all the materials at hand, it might also save a lot of time to **precut the string and to make all the holes in the caps yourself**. You could even **make a dotted line** with a permanent marker that shows exactly where the children should cut.

On the day of the lesson, have these ready but don't place them on the learners' desks as they will immediately start playing and cutting and not listen to instructions.

Knowledge harvest - 10 mins (Class discussion):

Have a brief **plenary of all the materials discussed** during this topic: their properties, uses, traditional ways of processing. Next, ask the class to give you ideas of **what could be done with these items once they've been used** or when they are discarded. Some of the places where the waste ends up are in landfills, burnt for electricity generation, or recycled. Prompt the learners to think of **other ways that items could be reused**. Use a 2-litre bottle, cardboard box, and empty baked beans can. **Write their ideas on the board**. Now introduce the word ***upcycling***, which is the **repurposing of items**, with or without adjustment, as opposed to throwing them away. It is a great, fun way of

extending the lifespan of something that would otherwise be discarded after only having been used for a very short time.

Then reveal that you'll be making upcycled bird feeders!

Knowledge in action - 25 minutes (Making the bird feeders)

To ensure this practical part runs smoothly, it's best to do it in parts and demonstrate what needs to be done *before* the items are given to the learners:

A - Start by showing them **how to weave the string through the hole** in the cap. Next, tie **a double knot** in the rope on the bottom of the cap to prevent the rope from pulling loose. Hand them the rope and caps and let them do theirs.

B - Next, you are going to show them how to **cut along the dotted lines** on the bottles. Essentially, they'll be cutting a U (a rectangle without the top line). **Bend the part that's still attached upward**; this will serve as a little awning for the bird as it perches to eat the seed. If the flap is too long, cut it in half laterally (side to side). Hand the learners their bottles and scissors and let them repeat.*

**They might need help doing the first cut, as getting blunt scissors into hard plastic can be quite challenging. You might have to make these first holes for them.*

C - Next, show them **how to close the cap and hang the bottle**. After they've done this, they can make their bottles pretty with the materials you prepared.

D - Once they are done, ask them to **write their name** somewhere on the bottle and collect all the bird feeders (to be handed back just before they go home).

E - Demonstrate to the class where the seed or old bread (or even old pap) would go. Also, tell them **where the best place is to hang it**; it should be relatively open and birds should feel sheltered and be able to get away quickly should predators approach. The best place would be under a tree.

F - Nominate one or two bird feeders to put up in the garden (*granted the learner doesn't really want to take it home*).

Consolidation 10 mins (Plenary):

Upcycling is a fun, cost-free way of making new things out of materials that would have been discarded otherwise. Challenge the class to think of other ways in which they could employ upcycling or even ways in which they might already be doing it.

Follow-up:

This activity marks the end of Matter and Materials.

Term 3

Knowledge Strand	Topic	Learning Outcome
Energy and Movement	Elastic and Springs	• The learner will be able to understand that we can make things move using stretched or twisted elastic • Learners understand that when we stretch or twist elastic or compress a spring, we store energy in it • Learners can observe that when we release the elastic or spring again, we get movement energy

Materials Required:

- A4 Paper for folding paper aeroplanes. It needs to be symmetrical and rectangular. One per learner and a bit extra
- One paper clip per learner
- Per launchpad: 2 long nails, one flat plank (board), one scrap piece of wood, glue, elastic band
- 2 tables
- Piece of paper, clipboard and pencil (to keep score)

Activity - Making a paper aeroplane launcher

Notes to Teacher:

This activity takes place at the beginning of Chapter 3 and serves as an introduction to Elastics and Springs

Preparation - 15 mins (Making the launchpads):

This part needs to happen before the lesson starts. You will be **making two or three launchpads**, where the paper aeroplanes will be launched from. Start with the **small, flat, and rectangular plank**. Wipe the bottom of the plank as well as the scrap piece of wood. The **small piece of wood needs to be glued to one end of the plank** to create an incline. Wood glue or craft glue could be used. If glue isn't available, the plank and piece can also be attached using a nail. Once the glue has dried, **partially knock the nails into the plank in the middle of the plank** and **about 10cm** apart (lateral). Make sure they're **sturdy enough** so that the elastic band can be **spun between the nails**.

The learners will **use the launchpads to launch their paper planes across the garden** to see which plane goes farthest. The **launchpads will sit on one or two tables facing the fynbos garden**. More launchpads mean more learners being able to launch simultaneously.

Knowledge harvest - 5 mins (Class discussion):

Ask the class if **they've ever stretched an elastic band**? Ask them what happens when you pull it apart and release it again. Next, tell the class that when we **stretch an elastic band, we store energy** in it. This is because when the band is stretched it can do work when you

release it. Share with the class that you are going to look at some other ways of using stretched elastic bands to do work and produce movement.

Knowledge in action: Phase 1 - 20 minutes (Making the paper aeroplanes)

During this phase, you'll be showing the learners **how to make their paper aeroplanes** and how to attach the paper clips to them. Don't hand the materials out until after the demonstration. This is to ensure the learners pay attention and minimise mistakes.

Folding:

- First, take the piece of A4 paper and **fold it in half lengthwise**. Make sure this is done symmetrically.
- **Open up the sheet** and **fold the top left inwards** until the edge touches the fold in the middle of the paper. **Repeat with the right-hand corner** and ensure the **edges line up**. The top of your paper should now have an A-shape. The triangle at the top is a right triangle with a 90-degree angle.
- Next, **take the left side and fold it over** so that the edges **align with the fold in the middle**. **Repeat with the right side** ensuring they line up. The angle of the top is now acute.
- Now, **fold the paper in half again** with the **middle fold facing downwards**. Place it **in front of you** with the **pointed part to your left** and the bigger part to the right. Then, take the **top parts of the "wing"** on the right and **fold them down** so it lines up with the base (which is the middle fold). Flip the aeroplane over and **repeat with the other wing**.
- Make a **single hole in the side of the paper plane** to the front, where the paper is thickest. Don't make the hole too close to the edge as this might make the plane tear.

Paper clip:

- Fold the two sides of the paperclip so that it **opens into an S**
- **Hook** the bottom of the S **through the hole**. The other part of the paper clip should be the side that bends in a clockwise direction (to the right and down).

Knowledge in action: Phase 2 - 15 minutes (Flying aeroplanes)

Before moving outside, ask the learners to **write their names on the paper planes**. If there's sufficient time, they could even decorate them with coloured pencils.

Divide the class into **two or three teams**, depending on the number of launchpads you made. Set up the **launchpads on a table in front of the garden** and ask the teams to each **line up behind a launchpad**. Each member then **takes a turn to hook their paper planes onto the elastic band** that is stretched between the nails, and **launch it into the sky**. The aim is to see who can **shoot their paper plane the farthest**.

Conclusion - 5 minutes (Class discussion)

Ask the class how they think they **could make their planes go farther**. Summarise that you saw in this activity that if you stretch an elastic band, you can produce movement. The stored energy in the band when it is stretched has the potential to do work. We call the stored energy in the elastic band **potential energy** because it has the **potential to do something for us** later.

Follow-up:

This activity serves as a tool to illustrate stored energy in elastic bands, as well as an introduction to energy potential. Another way one could use this is as a segway to other common objects that operate using stored energy, such as a slinky or a pogo stick.

Term 4

Knowledge Strand	Topic	Learning Outcome
Planet Earth and Beyond	The surface of the Earth - Soils	• The learner knows the characteristics of the main soil types (sand, loam, clay) • The learner knows that these characteristics affect how much water the different soils can hold • The learner can test the water-holding capacity of each of these soil types

Materials Required:

- Per group 2 x 2 L bottle, cut off the top and invert the bottle top into the body of the bottle.
- At least 2 different types of soil (enough to fill funnel ⅔ of the way) - 3 if possible
- 2 or 3 (depending) x cotton balls
- Permanent markers
- Measuring cup
- Answer sheet
- Timer/clock/watch
- Scissors
- Hand spade (otherwise students can use their hands and get interactive with the soil)

Activity - Water-holding capacity of different soil types

Notes to Teacher:

This activity serves to expand upon the different soil types.

Here we will be exploring different types of soil and their characteristics: the size of their grains, the amount of space in between the grains, other components, and how much water they are able to hold.

This can be quite a messy experiment, which makes it perfect to be done in the fynbos garden.

Preparation - 10 minutes (before the lesson):

Cut the top off the bottles (to where the hourglass shape ends). This will then be **inverted onto the bottom** of the bottle

Recap on soil - 5 min (Class discussion):

Discuss different soil types as well as how the **size of the soil particles** differ. Tell the class that you'll be testing the water-holding capacity of the different soil types. **Ask what they think** and to motivate their answers.

Knowledge in action - 15 minutes (Preparing the bottles - in class)

Step 1:

- Using the measuring jugs first **fill the containers with 125 ml of water** with the permanent marker, **mark the level of water**.
- Pour the water out and **repeat with 250 ml; 375ml, until a litre** (in 125 ml increments)

Knowledge in action - 25 minutes (Experiment in the garden)

Step 2:

- **Stuff the cotton ball** into the opening of the funnel (to keep soil from falling out)
- **Fill the inverted funnels ⅔ of the way** with one type of soil. DO NOT MIX SOILS
- Place one of the **funnels over the bottle**. Fill the other bottle with 1 L of water
- Gently **pour the litre of water onto the inverted funnel**
- After 1 minute, note **how much water has filtered** into the container. Repeat at 2 minutes and 5 minutes.
- **Remove the funnel filter** and pour filtered water out
- **Replace the funnel** with a funnel containing a different soil type.
- **Repeat** experiment
- Make sure to **write down all the findings**

Consolidation 10 mins (Class discussion in the classroom):

Compare results on the board and ask the class if this **corresponds to what they expected**. Judging by the amount of water left in the bottle after each experiment, ask them to **identify the soil that holds the most water**. Ask them to discuss how they would go about **working out how much water each of the soil types was able to hold**.

Follow-up:

This activity serves as a segway into the forming and names of the different types of sedimentary rocks.

Natural Sciences and Technology
Grade 6

Term 1

Knowledge Strand	Topic	Learning Outcome
Life and Living	Ecosystems and the food web	• To gain a greater understanding of the fynbos garden, of the different species present, as well as their relationship with one another.

Materials Required:

- Pens/Pencils
- Ruler
- Clipboard
- Scrap paper
- 4 sticks/tent pegs per group
- A roll of string/rope, enough to make enough one 2 x 2m square per group
- Magnifying glasses (optional)

Activity - Fynbos ecosystem on our doorstep

Notes to Teacher:

This activity occurs at the end of the *Ecosystems and Food Webs* topic. The aim is to give the learners the opportunities to interact with tangible examples of ecosystems and how these living and non-living elements depend upon one another.

Setup - 10 mins (to be conducted before the lesson commences):

Cut the string into enough **2-metre pieces** so **every group** of 5 learners has **enough to make one 2 x 2-metre square**. Put the string and sticks/pegs together so it's easy and quick to hand out.

Knowledge harvest - 10 mins (Class discussion):

Do a plenary of the following definitions at the start of the lesson:

- **Ecosystem:** An ecosystem is a **large community of living organisms** (plants, animals and microbes) that **interact with each other** as well as the non-living environments (weather, earth, sun, soil, climate, atmosphere) in a particular area. The living and physical components are **linked together through nutrient cycles and energy flows**.
- **Food web:** Food chains and food webs and/or food **networks describe the feeding relationships between species in a biotic community.** In other words, they show the transfer of material and energy from one species to another within an ecosystem.

- **Fynbos:** a distinctive type of vegetation found only on the southern tip of Africa. It includes a very wide range of plant species (around 9,700).

Next, divide the class into **groups of five** learners. Each group needs to get **four sticks/pegs and four pieces of string** to make the squares. Each learner also gets a **clipboard and paper/pen** to note everything that has been discovered. Then, explain to them that they'll be **exploring the garden ecosystem** to see what plants and animals are found there.

Knowledge in action - 25 minutes (Garden exploration)

Have the groups line up and allocate a section of the garden to each. Have them then **carefully set up their quadrats (squares)**. Tell them to **identify 3 plants and animals** in their quadrats. Next, they should **draw the plants and animals they find**. If they can, they may draw and describe additional plants and animals if they find them. Once this part is complete, they should **describe the food, water, sunlight, and shelter available**. Next, they should **place plants and animals on food webs**.

Consolidation 10 mins (Class discussion):

When they're back in class, ask each group to **name some of the plants and animals that they found**. Once some of the suggestions from each of the groups have been written down, ask the groups to discuss **how these could be connected in food webs**. Next, tell them to discuss which other organisms could be added to enlarge the food webs.

Write some of these constructed food webs on the board and close with asking the learners to give examples of things that could threaten/benefit the food webs in the garden.

Follow-up:

Using the data captured here, you could repeat this exercise in another area and compare the different data points, to show the difference between the biodiversity of the garden and another area.

This activity is intended to be used as a plenary of the topics discussed as part of *Ecosystems and the Food Web*.

Term 2

Knowledge Strand	Topic	Learning Outcome
Matter and Materials	Water Resources	• The learner has a greater understanding of what makes South African water resources sensitive in the face of climate change. • They know what an alien invasive plant is and how these plants impact water resources and soil quality in South Africa.

Materials Required:

- Blank sheet of paper
- Pencils/pens
- Book/clipboard to press on
- Printout of alien trees (these could also be displayed on an interactive whiteboard

Activity - Spotting Invasive Trees

Notes to Teacher:

This activity takes place at the end of the topic, after the *Importance of Wetlands* concept. This activity is about being able to identify different alien invasives on the school grounds as well as learning about the effect they have on ecosystems

Preparation - 10 mins (Before lesson commences):

Have the **form with examples of alien invasives printed out** before the lesson commences. You could also **add or subtract species**, depending on what is growing on the school grounds. Also, before the lesson, **identify suitable spots** on the school grounds to explore.

Introduction - 10 mins (In the classroom):

Start a discussion around **how water is used**. Start in the context of the **home**, and then the neighbourhood, city, and country. Ask the class **where they think the water comes from** and how it gets to us. **Where is the water stored** after it falls as rain? How does it get there? Ask the learners to discuss/hypothesise all the things that could **hinder the water getting to the dams**. What would help to get more water to the dams and make sure it's clean?

Most of SA's water storage occurs in dams which are prone to high levels of evaporation and silting. The high temperatures across the country, which are expected to increase with climate change, means that these important resources are increasingly exposed to the elements.

Secondly, **landscape transformation and loss of vegetation and topsoil** have resulted in widespread soil erosion which eventually finds itself in rivers and dams, silting these storage facilities and altering the quality of water.

Alien invasive plants* are often very water-intensive plants that take water away from naturally occurring vegetation therefore, there is less water in the system overall.

*Explain what alien plants are, and what it means for an organism to be invasive. Give some examples of a variety of different alien/invasive organisms, including plants and animals.

The **draining of wetlands** also causes a great loss of biodiversity and can lead to poorer water quality as well as flooding in the winter. For this reason, it's very important not to allow alien invasive plants become a problem

Knowledge in action - 25 mins (School grounds):

Start by **taking the class on a walking tour** of the section of the school that you identified so they can have a closer look. Once they're done, have them sit down in the garden and **divide the class into pairs** and instruct the learners to **draw a bird eyes view** of the school or a section thereof) and **mark off alien invasive trees** that you can identify from the picture table below.

Consolidation 10 mins (Plenary and discussion):

Ask the learners to **share their findings** with the rest of the class. Ask them **whether they've seen any of these other trees in places** other than the school grounds and whether they know the names of other invasive plants. Ask them what could be done to remedy the problem of alien invasive trees by **painting different scenarios**, making sure to include nuanced situations where the solution isn't so clear.

Follow-up:

This activity forms a good segway into the next topic: *Clean Water*.

Spot the Alien

Tick off which ones you saw and how many of each you counted:

Rooikrans - *Acacia cyclops*	
Black Wattle - *Acacia mearnsii*	
Port Jackson - *Acacia saligna*	

Long-leafed wattle - *Acacia longiphyllodinea*	
Stink bean - *Parkia speciosa*	
Silky hakea - *Hakea sericea*	
Australian myrtle - *Leptospermum laevigatum*	

Spider gum - Eucalyptus conferruminata	
Blackwood - *Acacia melanoxylon*	
Cluster pine - *Pinus pinaster*	

Term 3

Knowledge Strand	Topic	Learning Outcome
Energy and Change	Electricity	• Learners know what constitutes an electric circuit • Learners understand what components a circuit is made up of

Materials Required:

- Any objects that can quickly be passed around between children (like lego blocks). These will indicate the electric charge passing through the conductors. Around 30 pieces should suffice
- A heavy object to help illustrate poor conductors. A rock from the garden should suffice.
- 2 Plastic containers. One will be for the powers source to grab from, the other will be for the device to put blocks into
- 1 Paper of piece of cardboard for each of the following concepts:
    - Switch (Open printed on one side, and closed on the other. Be sure to include the symbol on each side)
    - An energy source (Full/Depleted. Be sure to add the symbol on both sides)
    - A device (Light bulb on/off. Be sure to add the symbol on both sides)

Activity - Circuit in Action (2 parts)

Notes to Teacher:

This activity takes place at the beginning of *Electric Circuits* and serves to teach learners about circuits, switches, conductors, energy sources, and insulation.

<u>Knowledge in Action 1 - 15 mins (Fynbos garden):</u>

A:
Divide the class into two equal rows. Each row needs to **face the same direction** and the learners' **toes need to touch one another**. Tell them that **they represent a conductor** and that they're going to **pass an object**, which represents an electric charge, from one end of the line to the other. During this game, the learners' **feet aren't allowed to move**, but they are **allowed to pass the object** (maybe a ball) from one person to the other as quickly as they can. They're **not allowed to throw the object**.

Explain that a **conductor is something through which electricity can pass**. Have the **learners at the end of each row hold the object** until you've counted down from three. They then need to **pass the object to the other end** and see who can **get it there first**.

B:
Ask one of the rows to expand and **stand as far from each other as possible**, making sure that the tips of their **toes still touch** one another's. Now explain that **some conductors are better than others** and that something can be a **good conductor** of electricity **or a poor conductor** of electricity. Ask them to **give examples** of good and poor conductors. The row standing **further apart are the poor conductors**, and the **other row is the good conductors.** Tell them that the one row will pass on something light and that they will be using something heavier. Ask them to **guess which conductor**

will get the electric charge (pass on their electrons) from one and to the other first. Count them down and let the race commence.

C:
After the good conductors have won, **use the example of a power cord to illustrate the importance of both good and poor conductors** (in terms of the insulation provided by the poor conduction by the plastic).

Knowledge in Action 2 - 20 mins (Fynbos garden):

Now, ask the class to get into **one large circle** and remind them to make sure their **shoe tips always touch**. Tell them that this **circle of good conductors form a circuit**. Give the definition and point out the **similarity of the words *circle* and *circuit***. Tell them that as it stands, no electricity will be moving through the circuit and ask them what one could add to the circuit to make it functional; to give it energy.

Guide them towards **suggesting a power source**, like a battery. Choose a learner to be the battery and hang the sign around their neck (with the *full power* side facing outwards). Hand the "battery" a container filled with your objects of choice and **ask the battery to start passing on the *electrons***. As the **electrons start moving around the circle** and back to the power source, the person next to the battery needs to **place the object into the container** the battery is holding.

Point out that the circuit needs something that can turn it on or off; the **circuit needs a switch**. Identify a learner to be the switch and hang the sign around their neck. Then, explain that when the **circle is unbroken, that it is a closed circuit**. Ask the switch to step with their **one foot towards the centre of the circle**. Explain that this **circuit now represents an open circuit**, and that **power wouldn't be flowing** through it as long as the switch is in the off position. Ask the switch to **complete the circuit and start passing the electrons around the circle once more**. Ask the switch to **periodically break the circuit**, which causes the flow of electrons to stop.

Ask the class **what else could be added to the circuit**, and guide them towards suggesting a device, preferably a **light bulb**. Identify a learner to represent the light bulb and hang the sign around their neck. In addition, also **hand the light bulb an empty container to place within reach**. Ask the switch to **close the circuit again and let the electrons flow**. Ask the class what the light bulb does once the circuit is flowing. Instruct the **light bulb to periodically drop one of the objects into the empty container**. As the objects that are passed around get fewer and fewer, ask the learners to discuss what they think is happening. If they can't guess, **continue with the circuit until there aren't enough objects to keep creating an uninterrupted flow of electrons**. Ask them to guess again. The **light bulb is using the electrons to create light**, so a **little bit of energy is continually lost.** Eventually, the **battery becomes depleted** and the **light bulb will no longer function**.

Conclusion - 10 minutes (Class discussion)

When back in class, **display the different symbols** and ask the learners if they can **remember what each of those symbols means**. Ask the class to suggest some **other devices that could be added to the circuit**. Let them discuss what would happen to the battery if other devices are added - it will become depleted at a faster rate. Ask them what could be done to **ensure the circuit stays active for a longer time** - this could be taking a device away, or adding other batteries.

Follow-up:

After this activity, the learners can then progress to building their own circuits and testing the efficacy of various conductors.

Term 4

Knowledge Strand	Topic	Learning Outcome
Planet Earth and Beyond	Movements of the Earth and Planets	• To help students have a better understanding of the rotation of the earth around the sun over the course of the day, as well as the rotation of the earth around the sun over the course of a year. • Learners will know that changes in the direction of the sun are caused by the Earth spinning on its axis

Materials Required:

- Paper plates/cardboard/scrap paper
- One nail and one long, straight stick per sundial
- Scissors
- Markers/colouring in pens/pencils
- Accurate clock

Activity - Making a sundial

Notes to Teacher:

This activity investigates the effects of the Earth spinning on its axis and how this gives rise to night and day. We will also look at ancient ways of telling time before modern clocks were present.

Knowledge harvest - 10 min (Class discussion):

Ask the class if they know **what day and night is**. Next, discuss **how these changes come about**. Explain that even though it looks like it, it's the **earth spinning** and that the **sun is in actual fact standing still** (for all intents and purposes). Tell them that planet Earth is spinning, and **how long it takes for the earth to complete one rotation**. This we experience as **day and night**. During the rotation, the side of the earth facing the sun experiences day and the opposite side, night.

Next, let them know that they will be **making a sundial** so that they can **track the movements of the sun throughout the day**, which can be placed in the garden or their garden at home.

Knowledge in action - 15 minutes (Preparing the sundials)

Step 1:

- **Divide the class into pairs** and hand out the materials to each pair.
- Using a marker, make a **dot in the centre of the round plate/cardboard.** If it's not round, ask the children to try their best to cut it into a circle.
- Take a ruler and **draw a line from the circle outwards** until around 2cm from the edge of the plate

- **Write *12* at the top of the line**. This will represent **noon** (this could be at another time as well, depending on what time the lesson occurs). Try to stick to hours and avoid minutes.

Knowledge in action - 25 minutes (Experiment in the garden)

Step 2:

- Instruct the pairs to take their materials and find a spot in the fynbos garden (on the pathway)
- **Put the plate down** on the ground and **make a hole with the long stick** in the centre of the plate. **Push the stick further into the soil** to ensure that it is not going to fall over
- Spin the plate until the **shadow of the stick falls directly on the line they drew**.
- Take the nail (or possibly another stick) and stick it through the plate into the ground, just under the number of the chosen hour. Make sure that this stick is barely visible. This second stick will **keep the sundial from accidentally spinning**.
- **Return at other hours and draw a line** with a ruler from the inside of the circle to the outer edge, **following exactly the line of the shadow of the stick**. Write the correct hour on top of the new timeline.
- Repeat this as much as possible.
- When enough hours are added, ask the learners to look at the sundials and tell you what time it is.

Consolidation 10 mins (Class discussion in the classroom):

Have a plenary on what has been discussed, paying attention to helping the learners understand the terms **rotation, axil, day, and night**.

Follow-up:

This activity is followed by discussions on revolutions of the Earth, as well as the rotation and revolution of the moon.

Natural Sciences
Grade 7

Term 1

Knowledge Strand	Topic	Learning Outcome
Life and Living	Biodiversity - Requirements for sustaining life	• Learners are familiar with the basic building blocks of life, such as light, water, nutrients • Learners understand that living things require energy, gases, water, soil, and favourable temperatures • Learners have a basic understanding of what succulents are • Learners are confident in their knowledge of what plants need to survive

Materials Required:

- 12 x 2-litre plastic bottles
- Cuttings from lobster flower, sour fig, or Pelargonium
- Soil
- Salt
- Small candle
- Scissors
- Matches/lighter
- Insulation tape
- Marker
- Lamp with optional grow light
- Small jugs with water
- Drip trays for the bottles

Activity - Exploring optimal living conditions of plants

Notes to Teacher:

This activity exposes plants to different living conditions in order to explore what is optimal and what isn't. The class will be divided into 4 groups, each exploring a different requirement of plants to thrive: light, soil, water, air. This experiment needs to run for around 3 weeks, possibly more, so it's going to require constant upkeep.

Setup - 10 mins (to be conducted before the lesson commences):

Each group will need 3 x 2-litre bottles which they will use to plant their cutting in. The 2-litre bottle can be cut **15-20cm from the cap**, to make a **plastic pot for the plant**. **Small punctures can be carefully made into the bottom** of the now upcycled bottles, 4-8 holes are adequate for drainage. All of the bottles can have these drainage holes **EXCEPT for one to be used for the water experiment**. For the air experiment, two

bottles need the top section which was cut off, to be taped back, once the plant has been potted into the bottle.

After the holes have been made, use the **permanent marker to indicate where the pots need to be filled with soil**. Also **write which element a specific bottle will focus on**, like soil, light, water etc

Knowledge harvest - 10 mins (Class discussion):

Ask the class to **list the things needed by us humans to live**. Introduce different **scenarios involving too much/too little** of a certain element and explore what the consequences would be. Next, move to the topic of plants and ask the class to list the various **requirements of plants to survive** and how it differs from ours. Tell them that you'll be starting an **experiment to look at 4 elements that are essential to plants' survival**: water, soil, air, sunlight.

Knowledge in action 1 - 25 minutes (Garden exploration)

Divide the class into four groups and let them know that **each group will be exploring each of the four elements mentioned above**. Our experiment will take the *Goldilocks approach* - Too much, too little, and just right. Explain that we'll be **taking cuttings from the fynbos garden** and that **each element will be explored three times**. Use the element of soil as an example: one of the experiments will have too little soil, one too much, and one just right.

Next, instruct the class to **take three cuttings for each group from the garden.** The cuttings need to be from the **lobster flower plant** (*Coleus neochilus*) and need to be **10cm** long. Instruct them to make the **cut on a node** (the part where the leaves meet the stem). They also need to **remove any flowers from the cuttings**, making sure that when the flowers are removed, the cutting should still be 10cm long. Removing the flowers helps the plant focus on growing roots instead of putting its energy into the flower. Then, r**emove the leaves closest to the bottom**. After, **remove the soft tip of the cutting**; cut right above the node of the first set of strong, well-formed leaves. You are now left with **two leaves on an empty stem**.

After they made their cuttings, tell them to **fill their containers with soil to the line**. The best would be for **all the groups to get their soil from the same spot**, preferably from **outside the fynbos garden**. Once they're done, instruct them to **bring the bottles inside**.

Knowledge in action 2 - 15 minutes (Experiment begins - In classroom)

For the cuttings that need to be planted, **make a little hole in the soil with your finger**. Next, place the **end of the cutting in the hole** and then make sure to **fill the hole**. After all the space is filled, **gently water the cuttings**; take care not to let the soil wash away. Here is how the experiment is going to be conducted:

Group 1: Light

1. No or too little light.
    - Plant cutting can be hidden in a cupboard or a dark corner
2. Perfect conditions.
    - Placed on a sun-facing window sill
3. Too much light.
    - Placed under a grow light and leave the light on 24hrs a day.

Group 2: Soil

1. No or too little soil
    - The plant is left in the container with little to no soil
2. Too much soil
    - Cover the plant under a thick layer of soil
3. Perfect conditions
    - The plant cutting is planted with an appropriate amount of soil

Group 3: Water

1. Too much water
    - The plant is overwatered or left in water. This bottle does not have drainage holes.
2. Salty water
    - The plant is watered with salty water
3. Perfect conditions
    - The plant is watered a small amount daily

Group 4: Air

1. No air
    - This bottle needs the top section taped back on and the lid of the bottle closed.
2. No O2
    - Plant the candle with this plant and light the candle and place the rest of the container back. The candle will not be alight for very long but it will absorb all the O2 in the container. The lid for this bottle will also need to be tightened back on.
3. Perfect conditions
    - The plant can be placed on a table near a window and can just be left to do its thing.

Consolidation 10 mins (Class discussion):

After the experiment has been set up, ask the learners to use a **page in their workbooks** for each experiment. **Draw two columns** and label the left one ***Actual Observation*** and the one on the right, ***Predictions***. Divide each column into **Week 1, Week 2, and Week 3**. In the **predictions column, ask the learners to write down what they think** is going

to happen at the end of each week. Write down the actual **observations into the observations column at the end of each week**. At the end of the experiment, **bring all the experiments together**, putting the Goldilocks scenarios next to one another so they can be contrasted. On the next page in their book, have them write the **final conclusion for each of the element**s. At this point, the **plants can be removed from the containers to look at root growth** as well as to be able to look at the plants more closely.

Term 2

Knowledge Strand	Topic	Learning Outcome
Matter and Materials	Sorting and Recycling Materials	• The learner has a greater understanding of what recycling is and why it's important • Learners know what type of materials can be recycled and which can't • Learners are familiar with other ways in which materials can be used without having to end up in a landfill

Materials Required:

- 5 bins/ big containers
- Signs that read plastic, paper, tin, glass and nonrecyclables.
- Waste materials - glass bottles/containers; tin cans, newspaper, waste paper, cardboard, laminated paper; plastic bottles, chip/sweet packets etc
- Blindfold (a piece of fabric)
- 4 x 2-litre plastic bottles
- 4 x stuffing sticks
- 4 x black refuse bags

Activity - Sorting our Recycling

Notes to Teacher:

This activity takes place at the end of the *Separating Mixtures* topic. It's fun, high-energy, and a perfect example of Knowledge in Action in the fynbos garden.

Preparation - 10 mins (Before lesson commences):

Have all the materials ready before the lesson starts. You could also **ask learners to bring various recyclable materials from home** for the purpose of this game. **Non-recyclables can be collected by the learners themselves after break time**, which will help shed light on any possible rubbish problems on the school grounds. **Have a good mix of an equal number of all 5 materials in 3 refuse bags**, i.e. bags 1, 2, and 3 need to have an equal number of items.

Introduction - 10 mins (In the classroom):

Use this time to **introduce them to the topic of recycling** and what it entails. Spark a discussion on what **everyday waste materials they think can be recycled**. Write these suggestions on the board and explore the origin of these elements. Ask the class **what would happen to these if they weren't recycled.** This includes waste ending up in landfills, in sewers, in streets, in rivers, in the ocean. Ask the learners to expand upon the impact of all of these.

In an effort to **reduce our waste, we need to learn how to recycle**, which includes knowing which materials can be recycled as well as the fact that **these need to be washed before they're discarded into the recycling bin**. Inform the learners that you'll now be playing a **game to help you familiarise yourself with the sorting of waste.**

Knowledge in action - 30 mins (School grounds):

The **class is divided into 4 groups**. In these groups, **the materials need to be sorted and recycled into their relevant bins**. **One person** from each group needs to recycle a **single item at a time**. They **need to make their way to the bin** in various ways: **blindfolded** and verbally guided by team/ hop on one leg/crawl/ three-legged race/walk backwards. The recycling bins can be placed on the second layer of tires in the garden. For **every correctly recycled item, the group gains points**. The g**roup that recycles all of their materials correctly wins** the first leg of the recycling challenge. **Once everything has been sorted** into the correct bins, the **non-recyclable plastics need to be stuffed into an eco brick**. The group to finish this part of the recycling challenge **earns 20 points**. The team with the **most points overall wins.** The groups need to check their plastic materials and sort them further into recyclable and non-recyclable materials.*

*See chart below for more information on the types of plastic that can be recycled.

Consolidation 10 mins (Plenary and discussion):

Once the game is done, move back into the class and discuss the following:

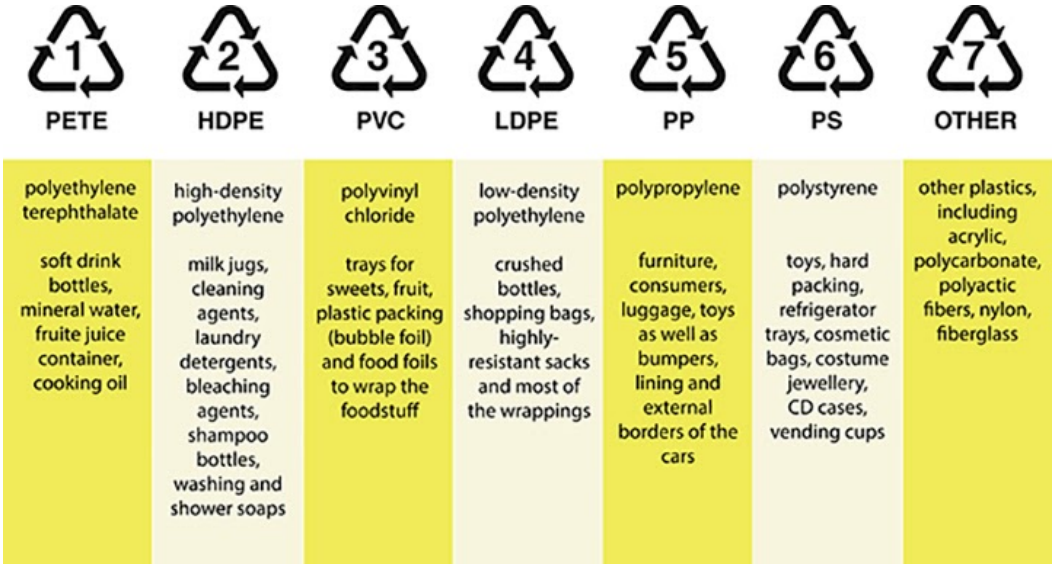
- 5 ways why recycling is beneficial.
- 5 ways poor waste management is a problem.
- 3 ways South Africa can improve recycling and waste management

Follow-up:

This activity concludes the *Separating Mixtures* topic

How to check if the plastics have been recycled correctly.

The well-recognized "chasing arrows" symbol we see on plastic containers and products does not mean the product is recyclable. The little number inside the triangle tells the real story. Within each chasing arrows triangle, there is a number that ranges from one to seven. The purpose of the number is to identify the type of plastic used for the product, and not all plastics are recyclable or even reusable. There are numerous plastic-based products that cannot break down and cannot be recycled.



#1 – PET (Polyethylene Terephthalate)

PET is a favourite of soft drink manufacturers. It's also used for bottled water and a wide variety of food products are packaged in it. **PET is recycled into …**

Hollow-fibre filling for jackets, duvets, pillows and sleeping bags is the main use for clear PET bottles in South Africa. Green bottles are turned into building insulation (Isotherm); PET is also recycled in geotextiles for road stabilisation and dam linings, and Plastiwood.

#2 – HDPE (High-Density Polyethylene)
HIGH-DENSITY POLYETHYLENE

You'll find this logo on milk bottles, cleaning products, cosmetics and toiletries, crates and motor oils, among others.

HDPE is recycled into …

Recycling bins, compost bins, buckets, detergent containers, posts, fencing, pipes, plastic timber and plastic chairs.

3 – PVC (Polyvinyl Chloride)

PVC is a soft, flexible plastic used to make clear plastic food wrapping, cooking oil bottles, teething rings, children's and pet's toys, and blister packaging for myriad consumer

products. It is commonly used as a sheathing material for computer cables, and to make plastic pipes and parts for plumbing. PVC is relatively impervious to sunlight and weather. Products made using PVC plastic are not recyclable.

#4 – LDPE (Low-Density Polyethylene)
LDPE is often found in shrink wraps, dry cleaner garment bags, squeezable bottles, and the type of plastic bags used to package bread. The plastic grocery bags used in most stores today are made using LDPE plastic. Some clothing and furniture also use this type of plastic. Products made using LDPE plastic are reusable, but not always recyclable.**LDPE is recycled into …**
Bin liners, pallet sheets, irrigation piping, a variety of containers, and construction and building film.

#5 – PP (Polypropylene)
Polypropylene plastic is tough and lightweight and has excellent heat-resistance qualities. It serves as a barrier against moisture, grease and chemicals. When you try to open the thin plastic liner in a cereal box, it is polypropylene. This keeps your cereal dry and fresh. PP is also commonly used for disposable diapers, pails, plastic bottle tops, margarine and yoghurt containers, potato chip bags, straws, packing tape and rope. Polypropylene is recyclable. **PP is recycled into …**
Pegs, bins, pipes, pallet sheets, oil funnels, car battery cases and trays.

#6 – PS (Polystyrene)
POLYSTYRENE

There are two kinds of polystyrene: high-impact, from which products like coathangers and yoghurt cups are made, and expanded polystyrene, from which meat and vegetable trays are made. Polystyrene is recyclable in South Africa.

PS is recycled into …

Picture frames, curtain rails, finials, skirting boards, cornices, stationery eg, rulers, seedling trays, coathangers. Demand far outstrips supply in South Africa.

Term 3

Knowledge Strand	Topic	Learning Outcome
Energy and Change	Conserving Electricity at Home	• Learners know that South Africa has a finite supply of electricity • Learners know the importance of conserving electricity at home • Learners are familiar with several ways of conserving electricity at home.

Materials Required:

- For each wind turbine:
  - 2 x plastic cups
  - 4 x wooden ice cream sticks
  - Hobby motor
  - Small LED light
  - Small piece of small (insulated) copper wire
  - Super Glue/tape
- Wire cutters
- Pliers
- Drill and drill bit
- Scissors

Activity - Building a mini wind turbine

Notes to Teacher:

This activity takes place at the end of the *National Electricity Supply System* topic.

Introduction - 10 minutes (Classroom):

The lesson kicks off with a question of which **ways electricity is generated in South Africa**. Ask **why South Africa is seeing load-shedding so often**. Ask them to conclude whether **electricity is a finite or infinite** source of energy. Does this warrant conservation of electricity? Continue the discussion by asking the learners **what we use electricity for at home**. On the board, **draw four columns** and write *High Consumption*, *Ways to Reduce,* and *Low Consumption*, *Ways to Reduce*. Let them **sort their answers into one of these two columns**. In brackets next to each appliance/use, write down what time of year these are most likely to be used. Ask learners to suggest ways in which consumption can be reduced.

Knowledge in Action - 30 mins (Classroom):

Ask the learners to **give you examples of renewable energy sources**, as well as the **pros and cons** of each. Then, reveal that they'll be constructing their own renewable electricity generator: a homemade wind turbine.

Method:

1. Cut the sides of the small cup into four equal parts. Remove the base to create four curved pieces that will be the blades of the wind generator.
2. Use hot glue/craft glue/tape to attach two craft sticks together at the centre so they make a plus sign.
3. Once the glue is dry, drill a small hole the size of the motor shaft in the centre of the craft sticks. This will serve as the frame for your blades (see below).

4. Glue a blade to each of the craft stick ends, as shown. The blade design has the greatest impact on the efficiency of the wind generator; this is just one way to do it. Feel free to try materials other than a cup to construct something you think will best utilize the wind to yield the most rotations per second.
5. The hobby motor should have two small prongs sticking out of the back that serve as the terminals where you would normally attach a power source. Instead, attach an LED to the back of your motor by twisting each leg of the LED through a different terminal on the back of the motor. The correct orientation of the LED will depend on whether the blades spin clockwise or counterclockwise, so you will know if you need to switch it once you test the windmill. Slide your blade frame onto the shaft of the motor (see below).

6. Glue one end of each of the other two craft sticks on either side of the larger cup to make a stand that holds the motor above the cup-like chopsticks. Glue the other ends of the craft sticks directly to opposite sides of the motor to hold it in place. Make sure the motor is positioned so that the stand does not obstruct the ability of the blades to turn freely.

7. Take the wind turbines out into the fynbos garden to see them in action. Make sure the glue is dry before testing it. The learners might also need to hold it to keep the wind from blowing it over.

Conclusion - 5 minutes (Plenary and discussion)

Do a **recap on all the topics** discussed, including what dynamos are. Ask the learners what the **limitations of the homemade wind turbine** are.

Follow-up:

This activity marks the end of this topic.

Term 4

Knowledge Strand	Topic	Learning Outcome
Planet Earth and Beyond	The Relationship of the Moon to the Earth: Gravity	• To help students have a better understanding of Earth's gravity and the force it exerts on an object on it • To demonstrate that all objects dropped to the earth, fall at the same rate no matter what their shape or size if air resistance can be ignored • To encourage learners to think more critically and to explore different assertions with simple tests they can do themselves

Materials Required:

- hammer
- feather
- apples (one and a half per pair)
- knife (if needed to cut the apples in half)
- two balls of the same mass, different volumes (one set per pair)
- two balls of the same volume, different masses (one set per pair)

Activity - Which falls fastest?

Notes to Teacher:

This activity comes into play at the start of the topic, right after discussing the position of the moon relative to the earth. The fynbos garden is the perfect setting for this activity, in which we look at gravity through looking at falling objects. In this activity, learners drop a variety of objects and try to predict which will fall first.

Knowledge harvest - 10 min (Class discussion):

Ask the class if they know **what gravity is**. Have a discussion about **what they think the effect of gravity is on objects** of different sizes and weights. You can take a **vote from the class** to see whether learners think that an **apple or bag of sugar would hit the ground first**. (Answer: they would hit the ground at the same time as long as air resistance is negligible.) It is very likely that learners will have the **preconception that heavier items fall faster**. It is not important at the moment that the learners' answers are correct and do not try to lead them to the correct answer. They will hopefully discover it for themselves in the following experiment.

In this investigation, learners need to **work in pairs**. They will initially **drop a whole apple and half an apple** from the **same height at the same time**. They will then further experiment with **balls of different masses** (but the same size) and **balls of the same mass** (but different volume [size]). It is very **hard to drop objects at exactly the same time** so that they hit the floor simultaneously so **let the learners repeat the experiment several times** until they are **confident that they are dropping the objects at the same time**. If it is hard for them to see which object hits the ground first, suggest to the learners

that they **listen for the number of sounds they hear** - one or two - when the objects hit. Learners **might need to repeat this investigation many times** since it most **likely contradicts their preconceptions**! Safety tip: It is probably a good idea to have the apples cut in half ahead of time.

Once the learners have **finished their experiment** you can **demonstrate the effects of air resistance** by dropping a **hammer and a feather**. Before you do that, have the learners **take a vote on what will happen** when you drop the hammer and feather. Be ready to explain to learners that **air resistance slows the fall** of the feather and that if there were no air resistance the two would fall at the same rate and hit the floor at the same time.

Knowledge in action - 25 minutes (In the fynbos garden)

1. Work in pairs, take it in turns to be the person who drops an object (experimenter) and the person who observes the object dropping (observer).
2. Fill in the "prediction" column in the table below.
3. Experimenter: stand on top of a chair or desk and take an apple in one hand and an apple half in the other hand.
4. Experimenter: hold the two up at the same height in front of you and drop them at exactly the same time.
5. Observer: note what happens, in particular, which lands first.
6. Swap positions and repeat the experiment using two balls that have the same mass but different volumes.
7. Swap positions and repeat the experiment using two balls that have the same volume but different masses.
8. Your teacher will now do a demonstration for you and drop a hammer and a feather. Before your teacher drops the hammer and feather, fill in the prediction column for the hammer and feather drop.
9. Write down what happened with the hammer and feather and answer the questions below.

RESULTS AND OBSERVATIONS

In the table below, fill in what you think will happen in the "prediction" column before you conduct your experiment. Assuming that you drop each pair of objects from the same height at the same time, what do you think will happen? Which do you think will land first?

Objects	**Predictions**	**Observation**
Apple and half apple		
Balls: same mass, different volume		
Balls: different mass, same volume		
Hammer and feather		

Consolidation 10 mins (Class discussion in the classroom):

Ask the class the following questions: What were you keeping **constant** in this experiment? (The height at which objects are dropped.) What are you **changing** in this experiment? (The type of objects that are being dropped, in particular, the mass and volume of the objects.) Then, ask them the following: How **reliable** was your experiment? How could you improve your method? Example answers could include: It is difficult to drop objects at exactly the same time. It would be better to drop the objects from a greater height. Air resistance could have affected the results and it would be better to drop the objects in a vacuum.

Learners should have found that the **apple and half apple hit the floor at the same time**. They should also have found that the **balls of the same mass hit the floor at the same time** and also the balls of the **same volume hit the floor at the same time**. From this, they should conclude that all objects dropped, **fall at the same rate** no matter what their shape or size if air resistance can be ignored. (Advanced: they accelerate at the same rate). In the case of the hammer and feather drop, learners should have found that the hammer landed first. This is because of the effects of **air resistance slowing** the feather's fall.

Follow-up:

This activity is followed by how gravity plays a role in keeping the Earth in orbit around the sun, the moon in Earth's orbit as well as its effects on Earth's tides.