Natural Sciences and Technology

Grade 4-A

(CAPS)

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basic education
Department:
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SIYAVULA
TECHNOLOGY-POWERED LEARNING

sasol inzalo foundation

Natural Sciences and Technology

Grade 4-A

CAPS

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AUTHORS LIST

This book was written by Siyavula and volunteer educators, academics and students. Siyavula believes in the power of community and collaboration. By training volunteers, helping them network across the country, encouraging them to work together and using the technology available, the vision is to create and use open educational resources to transform the way we teach and learn, especially in South Africa. For more information on how to get involved in the community and volunteer, visit *www.siyavula.com*

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THIS IS MORE THAN JUST A WORKBOOK!

In many places you will see there are “Visit” boxes in the margins. These boxes contain links to videos online, interesting websites which pertain to the content, or else games or activities for you to complete.

To access these websites or videos, simply type the link provided into your address bar in your internet browser. The links look like this for example, *goo.gl/vWKnF*

You can watch these links in your lessons, at home on a PC, laptop or on mobile phones.

To download these workbooks or learn more about the project, visit the Sasol Inzalo Foundation website at *http://sasolinzalofoundation.org.za*


Welcome to Grade 4 and to Natural Sciences and Technology!
Join the
Thunderbolt Kids
on an adventure to explore the world around us.

Hi there! My name is **Farrah.**

My favourite subjects at school are where I get to be creative and imaginative. But, did you know, this is not only in the art or drama classroom?! We can also be creative in the ways we do Science and Technology. This is especially true when thinking about new ways to answer a question with a Science investigation or drawing a design to solve a problem.

I also really love being outdoors in the natural world around me. This is why I am going to go through **Life and Living and Structures** with you. I think we are very lucky to live in such a beautiful place as South Africa, with so many colours and plants and animals. I am really excited to start learning more about the living world around us.

Sophie is my best friend and she teaches me how to think carefully and solve problems using logic, which is a very good skill to have in Science. Although we can get on each other's nerves, just like best friends do, we have so much fun together and learn a lot from each other.

Hey! My name is **Tom**.

I have two places where I am most happy! The first is in the Science lab because this is where we get to be inventive and tinker away with projects and experiments! My second favourite place is the junk yard! Do you know how many interesting objects you can find there?! I use these objects in my latest inventions.

This is why I am really excited to be going through **Matter and Materials and Structures** with you. We are going to learn about all sorts of materials around us, and especially how to strengthen materials and make strong structures.

I also really enjoy maths and thinking about how we can solve problems logically. Jojo is one of my best mates, although he can be very messy at times! But, Jojo helps me get involved with my whole body when trying to solve problems in our daily lives, and not just use my mind.

What's up! My name is **Jojo.**

I just want to dive straight into this year, and especially Natural Sciences and Technology. Sometimes though, I find it hard to sit still in class as I just want to get up and do things! My teacher often says I have too much energy and I battle to sit still in class. Maybe that's why I am going through **Energy and Change and Systems and Control** with you this year.

I am really looking forward to understanding what "energy" really is! And, we also get to make a musical instrument this year. The best part about Natural Sciences and Technology is that we get to learn actively. We have goals and questions which we want to answer and I am always the first to leap into action!

Tom and I make a very good team because he is very good at thinking and planning and then following a method. But, I think I can also help as sometimes Tom wants to think too much, whereas in Science and Technology you also have to get involved in the subject and start experimenting.

Hello! My name is **Sophie**.

One of my favourite places to be is in the school library. I love reading a new book – there is just so much to learn and discover about our world!

I am always asking questions and often these questions do not yet have answers to them. This is fascinating as we then get to make a theory about what we think the answer might be. This is why I really enjoy learning about outer Space as there is so much that we do not know. Throughout history people have been asking questions about Space and our place in the universe. This is why I am going to go through **Earth and Beyond and Systems and Control** with you as we start to learn about our planet Earth and our solar system.

I also like expressing my opinion and debating about a topic. You have to give me a very good argument to convince me of your opinion! I love exploring with Farrah as she helps me to be more creative and imaginative in the way that I think. I can also be quite sceptical and do not believe everything I read. But, this is very important in Science as we must not always accept everything as fact.

Join the
Thunderbolt Kids
by adding your details here!

My name is:

_____

My favourite subject is:

_____

On the weekends, I love to:

_____

_____

My friends' names are:

_____

_____

One day, I want to:

_____

_____

STICK OR DRAW
A PICTURE
OF YOURSELF
HERE!

Contents


Life and Living
and Structures

1 Living and non-living things

KEY QUESTIONS

- What does it mean to be alive?
- What is a non-living thing? What does it mean to be non-living?
- A river seems to move, so is a river living?
- Are the plants that I eat from Gogo's garden living or non-living?
- How can I tell if the bean seeds from Gogo's garden are living or non-living?
- A chicken egg seems to be non-living, but then it can hatch into a chicken. Is the egg living or non-living?

New Words

- process
- conditions
- oxygen gas
- carbon dioxide gas
- seedling
- excreting waste products
- sensing
- reproducing

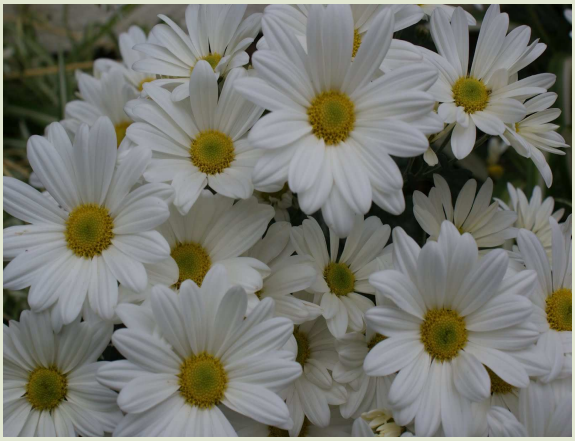
1.1 Living things

There are many different kinds of living things. It is easy to see when some things are living or non-living. It is a bit more tricky to decide with other things if they are living or not!

ACTIVITY: What is living and what is non-living?

INSTRUCTIONS

1. Look through these photos and decide whether you think they are living or non-living.
2. Put a ✓ next to the living things and a ✕ next to the non-living things.
3. When you are done, discuss your choices with your class.



Flowers and plants

Water and waves [1]

A zebra

Clouds in the sky [2]

Chicken eggs in a nest [3]

A burning fire [4]

A tropical fish [5]

Mould growing on a lemon [6]

DID YOU KNOW?

It is ok if you do not agree with everyone else's answers! It is important that you listen to everyone when they explain what they think it means to be living or non-living.

It is not always easy to say if something is living or non-living. Many times things that look as if they are non-living can become alive again. Other things like a river or soil, are non-living but people say that the "soil is alive" or talk of the "living waters". This is because there are so many living things that live in the soil or the water. This can be a bit confusing, don't you think?

Look carefully at the living things in the photos. Can you see what is the same in ALL of them? Something that they maybe all DO?

VISIT

This video shows how sunflowers follow the movement of the sun.

goo.gl/amRQE

Characteristics of living plants and animals

Although living things may look different, they all carry out seven similar processes. We call these **the seven life processes**.

Let's take a look at each of these.

MOVEMENT: All living plants and animals move

- Humans and animals use their bodies to move from one place to another.
- Some plants turn towards light or water. Roots mostly grow downwards. Many stems grow upwards.

Humans move all the time. These athletes are running. [7]

REPRODUCING: All living things make offspring (babies or seeds)

- Humans and animals have babies.
- Some new plants can grow from seeds.
- Other plants grow from cuttings or shoots.

A mother and father with their baby

SENSING: All living things respond to any change that they sense

- When you are feeling cold, you will put on a jersey or jacket.
- When it becomes winter some animals hibernate.
- In autumn the leaves on some trees change colour.
- You can use an umbrella to protect you from the rain or from the harsh sun on a hot day.
- Reptiles like to lie and bask in the sun on cold winter's days.

This chameleon is basking on the wall in the winter sun.

The leaves on some trees respond to the change of the season. These leaves are turning brown during autumn.

BREATHING: All living things BREATHE gases in and out

- Humans and animals use the gas, oxygen from the air that they breathe in. They release (give off) the gas carbon dioxide when they breathe out.
- Plants take in the gas carbon dioxide into their leaves. They use it to make food. They then release oxygen for animals and humans to use.

FEEDING: All living animals and plants need food

- Food gives all living things the energy they need.
- Green plants can make their own food for energy in their leaves and stems.
- Humans and animals eat plants to get energy.

These children are eating their lunch. [8]

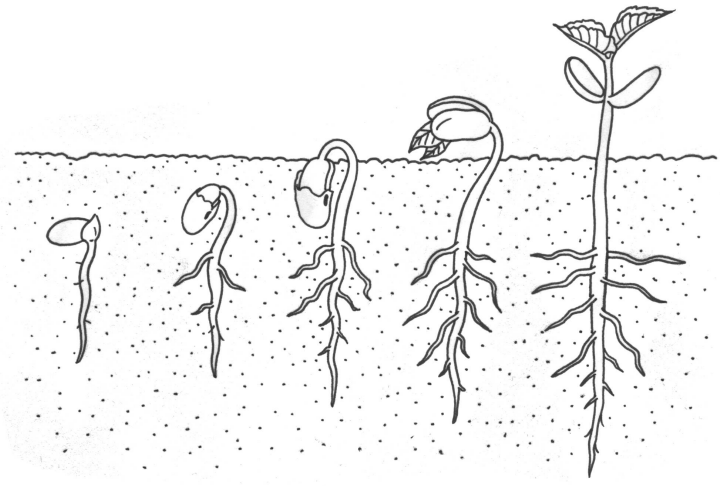
EXCRETING: All living animals and plants have to get rid of waste products

- Humans and animals have to get rid of waste products from their bodies.
- There are special organs in the body which help to get rid of waste, such as the lungs, kidneys and skin. Your kidneys take the waste out of your blood and produce urine. Also, when you sweat you are actually excreting waste from your skin!
- Plants get rid of waste water through the process of transpiration.

Do you see how shiny the horse looks? She is sweating from all that running! [9]

GROWTH: All living things grow

- Human and animal babies grow into adults.
- Seedlings grow into plants.



Growth of a seed into a seedling

All seven of the life processes must happen for something to be living. If something does not carry out all seven life processes then it is non-living. For example, if you think of a river, you may think it moves and grows, but a river does not sense or feed or excrete or breathe or reproduce so it is non-living!

ACTIVITY: Understanding the seven life processes

THE REASON FOR DOING THIS ACTIVITY:

To help you understand the seven life processes.

INSTRUCTIONS:

1. Look carefully at each photo.
2. Next to each of the seven life processes make a ✓ if it applies to the object in that photo.
3. If a life process does not apply to the object in the photo, make a X next to that life process.
4. Decide whether the object is living or non-living and write your answer in the last column.
5. The first one is done to show you what to do.

Object	Process	✓ or X	Living or non-living?
 [10] Children	Movement	✓	Living
	Reproducing	✓	
	Sensing	✓	
	Feeding	✓	
	Breathing	✓	
	Excreting	✓	
	Growing	✓	

Object	Process	✓ or ✗	Living or non-living?
 [11] An aeroplane	Movement		
	Reproducing		
	Sensing		
	Feeding		
	Breathing		
	Excreting		
	Growing		
 [12] Fish in the sea	Movement		
	Reproducing		
	Sensing		
	Feeding		
	Breathing		
	Excreting		
	Growing		
 [13] A plant	Movement		
	Reproducing		
	Sensing		
	Feeding		
	Breathing		
	Excreting		
	Growing		

Object	Process	✓ or ✗	Living or non-living?
 [14] A bouncing soccer ball	Movement		
	Reproducing		
	Sensing		
	Feeding		
	Breathing		
	Excreting		
	Growing		
 [15] Chicken eggs	Movement		
	Reproducing		
	Sensing		
	Feeding		
	Breathing		
	Excreting		
	Growing		

Some things seem to be non-living, but they are not!

Mmm, this sounds interesting! I want to find out more!

DID YOU KNOW?

In the Western Cape, some fynbos seeds wait for many years in the soil. They can only start growing after a fire has burnt their hard outer shell!

Yes, some things seem to be non-living for a very long time. They wait until they sense the right conditions to revive again. This means that they have to wait for something special to happen before they can revive and show the characteristics of living things. We say they need the right conditions to revive and show the seven life processes. Look at the pictures below of seeds which seem to be non-living!

Seeds from a coral tree [16]

Sunflower seeds. Have you ever eaten sunflower seeds? [17]

QUESTIONS

Why do seeds seem to be non-living? How can we show that they are living?

We say the seeds are in a "dormant state" until they are given water, warmth, air, light and soil to germinate and start growing. There are other things too which seem to be non-living, but if they are given the right conditions then they can revive and carry on living.

A dove keeping her eggs warm to hatch them.

Fertilised eggs need to be kept warm or they will not hatch. This is why a mother bird will start sitting on her eggs to keep them warm when she has laid all of them.

Yeast can cause bread dough or cake batter to raise. Yeast needs warmth to come alive and start raising the bread. Some people buy dry yeast for their baking. Dry yeast needs moisture, heat and sugar to start working. That is why you will see bakers place their dough in a warm place (near the stove for example) to get it to rise.

ACTIVITY: Can I revive living things that seem to be non-living?

MATERIALS (what you need):

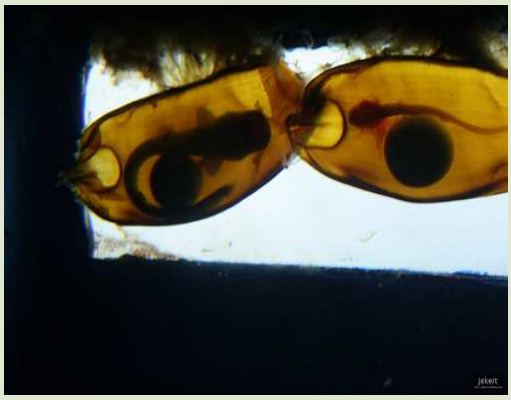
- photos of eggs hatching

INSTRUCTIONS:

1. Look at these photos carefully.

Chicken eggs hatching. [18]

Frog eggs about to hatch into tadpoles. [19]



Shark eggs. [20]

Snake eggs hatching. [21]

DID YOU KNOW?

A shark egg often looks like a see through packet. Some people find them washed up on the beach and call them a "Mermaid's Purse!"

QUESTIONS:

1. Study the photo of the bird sitting on her nest. Can you explain why she needs to sit on her eggs?

2. Farmers often do not let the mother chickens sit on their eggs. Instead they put the eggs in something called an incubator, as you see in the picture above of the chicken eggs hatching. What does the incubator provide to the eggs?

3. A snake normally lays her eggs in a 'nest'. Why does she not have to lie on top of them to hatch them?

4. Have you ever caught tadpoles or kept silkworms in a box? Maybe someone in your class has some that they can bring to school. In what season can you normally find little tadpoles or silkworms, and why?

ACTIVITY: Germinating a seed

MATERIALS (what you need):

- bean seeds
- cotton wool
- plastic lids (from empty peanut butter jars for example)

INSTRUCTIONS:

1. Place two layers of cotton wool in the plastic lid.
2. Place a few of your seeds between the two layers of cotton wool.
3. Drizzle water over the seeds. You need to water the cotton wool enough to wet it but NOT TO DROWN THE SEEDS! There should be NO WATER running over the sides of the lid or your seed will drown!
4. Place your seeds in a warm place near a window.
5. Water your seeds whenever you feel the cotton wool is almost dry. Be careful not to drown your seeds!

QUESTIONS:

1. Before you water your seeds, describe how they look and feel.

_____

_____

2. Draw your seeds between the cotton wool on the first day.

3. Check the progress of your seeds every day. How long did it take them to germinate? And what do your seeds look and feel like now?

4. What do you think made your seeds revive?

ACTIVITY: Getting yeast to grow!

MATERIALS (what you need):

- packet of dry yeast
- sugar
- warm water
- an empty yogurt tub

INSTRUCTIONS:

1. Place a teaspoon of sugar and a teaspoon of dry yeast in your yogurt tub. Mix with your spoon.
2. Add 3 teaspoons of warm water.
3. Stir your sugar and yeast mixture in the warm water to make sure it is well mixed.
4. Watch to see what will happen!

SAFETY WARNING! Don't use boiling water - it might burn you! Boiling water will also kill the yeast. You only need to use luke warm water!

QUESTIONS:

1. What does your yeast look and feel like before you mix it with the sugar and water?

---

2. When you add the sugar to the yeast, does anything change in the yeast?

---

3. What happened to the yeast and sugar mixture when you added the warm water?

---

4. How did the yeast revive?

1.2 Non-living things

Non-living things are different from living things because they do not perform all of the seven life processes.

Let's look at an example.

ACTIVITY: Do you think this car is living or non-living?

INSTRUCTIONS:

1. Let's look which of the seven life processes the car carries out. (Remember if it is not an egg or a seed, if there is even one life process that something cannot do then it is not living!)
2. Place a ✓ or a ✕ in the last column.

A car [22]

Movement	
Reproducing	
Sensing	
Feeding	
Breathing	
Excreting	
Growing	

QUESTIONS:

1. How many life processes does a car have?

_____

2. Is it living or non-living?

_____

Remember, non-living things cannot carry out **all** the seven life processes.

Changing from living to non-living

Living things can become non-living when they die. Look at the wood that your desk is made of. Where did the wood come from? What was once living?

Look around you in your class. Are there other things that were once living and that are now non-living or dead?

QUESTIONS

Discuss these things in your class and write some of your answers from the discussion below.

ACTIVITY: Distinguishing between living and non-living things

THE REASON FOR DOING THIS ACTIVITY:

To help you learn to distinguish between living and non-living things.

MATERIALS (what you need):

- 3 - 5 different objects that are living or non-living (bring them to school)
- scrap paper or cardboard

INSTRUCTIONS:

1. Divide into groups of 3 or 4.
2. Use the scrap paper or cardboard to make four labels of the following headings:
    - Living
    - Once lived
    - Seem to be non-living but can be revived
    - Never lived
3. Show the pictures or objects you brought to your group. Place each item or picture under one of the headings you just made.
4. Now complete the table below with the results. If there is time left over you can add in interesting objects from other groups into your table as well.

Living	Once lived	Can be revived	Never lived

5. Carefully look at these photos. Say which of these are living or non-living, or which was once living or can be revived. Write these labels below each of these.

 A dog [23]	 Traffic lights [24]	 Eggs [2526]
 Fire [27]	 Trees [28]	 Paper
 A dolphin [29]	 A computer [30]	 A skull [31]
 A fossil [3233]	 Yeast in packet	 A duckling

QUESTIONS

Can you now distinguish between living and non-living things? How do you know when things are living and when they are not?

Now you know that we can group almost everything in the world into two groups: living and non-living things. If something cannot carry out all of the seven life processes then it is non-living. Some things were never living before like water and oxygen. Other things can be non-living now but were living before, like wood, fossils or oil.

KEY CONCEPTS

- We can group things on Earth as living and non-living.
- There are seven life processes that all living things can carry out.
- Non-living things cannot carry out all seven life processes.
- Living things can die.
- Some things like seeds or eggs can seem to be non-living but they can revive again.

REVISION:

Read the following story and then answer the questions that follow.

The Strelitzias

When the world was made, the Strelitzia birds were among the finest of all the animals created! Their bright orange feathers and dark purple wings adorned the sky and all the other animals admired their beauty. They would glide for hours, high in the sky and only came down to feed at the river bed. They would tell the other animals of all the wonderful things they had seen from high in the sky.

They made their nests in the highest cliffs. They almost never sat in the trees or walked on the ground among the other animals. As time went by, the Strelitzia birds became proud and arrogant. They started to look down on the other animals and teased them endlessly They told the tall giraffe that her neck would never know cool breezes they have felt. They laughed at the tortoise who would always have to walk through the dust, rocks and sand. They sneered at the crocodile who always had to be near the water and mocked the monkeys for being stuck in the trees.

One day the Maker came to visit the animals. Instead of the beautiful, joyous creation he had intended, he saw only sadness and tears. One by one, the animals told him how the Strelitzia birds had teased and taunted them all. The Maker became very upset at how arrogant these beautiful birds had become.

The Maker snatched from the sky, one by one, and stuck their strong, slender legs deep into the soil. Their graceful long toes became roots and their feathers and wings turned to dull green leaves. Only their crowning plumes of orange and purple remained

as a reminder of their lost beauty.

If you find a Strelitzia flower today, look carefully and you will see how they are still reaching for the sky, trying to free their feet from the soil so they can fly again.

1. Name five non-living things mentioned in the story.

_____

_____

2. Name all the things from the story that use oxygen.

_____

_____

3. What life process in living things uses oxygen?

_____

4. Give an example from the story of:

    a) moving:

_____

    b) sensing:

_____

    c) feeding:

_____

    d) growth:

_____

5. The Strelitzia birds had nests high up on the cliffs. Why do you think birds like them like to build their nests high up on the cliffs?

6. What life process do we associate with the eggs in the nest?

2 Structure of plants and animals

KEY QUESTIONS

- Are plants all made in the same way with the same parts?
- If I cannot see leaves on a cactus, is it still a plant?
- Is the moss that grows near an outside tap a plant? How can I tell if it is?
- If a cactus, seaweed and a dandelion are all so different, how can you say they are all plants?
- Animals all look so different - how can we group different animals together?
- What makes animals different from each other?

New Words

- anchor
- absorb
- nutrients
- veins
- structures
- function
- compare
- serrated edge

We learnt that almost everything can be grouped into two groups - living and non-living. In the next section we are going to learn more about living plants and animals, how they look and what makes them special!

2.1 Structure of plants

Basic structures of plants

All plants have different parts that we call structures. In most plants you can identify the following structures:

- roots
- stems
- leaves
- flowers

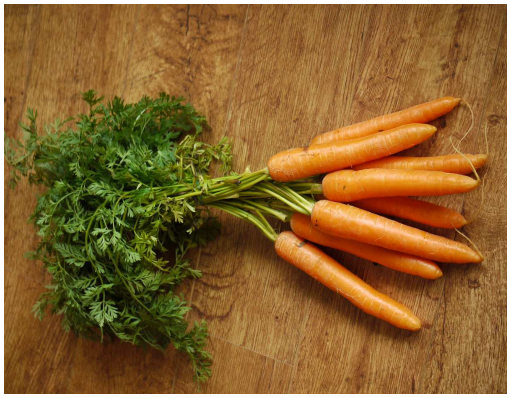
Let's take a look at the different plant structures.

Roots

Plant roots are normally found underground. Roots have very important functions (jobs):

- roots anchor the plant in the ground
- roots absorb water and nutrients from the soil, which are then transported to the rest of the plant
- some plants store the food they make in their roots, like potatoes or carrots. In Grade 5 you will see how plants make their own food!

The roots of this tree go deep down into the soil.



A carrot is a stem that stores food made by the plant.

Stems

Stems connect the roots to the rest of the plant. The stem has important functions:

- the stem supports the leaves, flowers and fruit (the stem holds these parts upright)
- the stem carries nutrients and water from the roots to the other parts of the plant
- some plants store the food they produce in their stems (like sugar cane or asparagus)

A growing plant stem.[1]

A tomato plant stem.

Leaves

Although many plants' leaves are green, leaves can have many other colours. Some leaves change colour during autumn.

Leaves have very important functions:

- leaves absorb sunlight and use it to make food for the plant
- some plants use their leaves to store water (cactus) or food (like spinach or lettuce).
- most leaves have veins which are like tiny pipes that carry water and nutrients from the roots (the veins carry the food the leaf makes to the rest of the plant)

Can you see the veins in these leaves? [2]

Flowers

Many plants have flowers. The flowers are very important to the plant:

- the flowers make pollen which is needed to make seeds from which new plants can grow
- flowers are often brightly coloured to attract birds and insects to spread their pollen and bring pollen from other flowers
- the flowers make fruit and seeds
- flowers come in many different shapes and sizes

QUESTIONS

1. Think of the flowers you know and write some of their names below.

_____

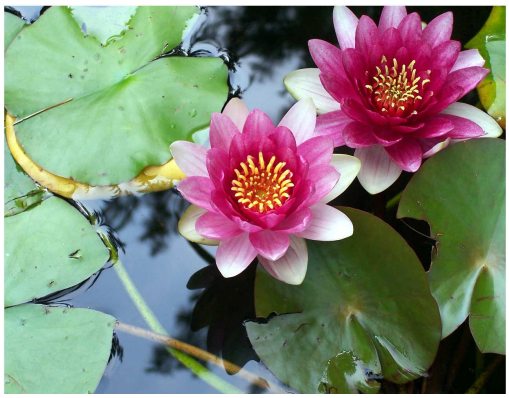
_____

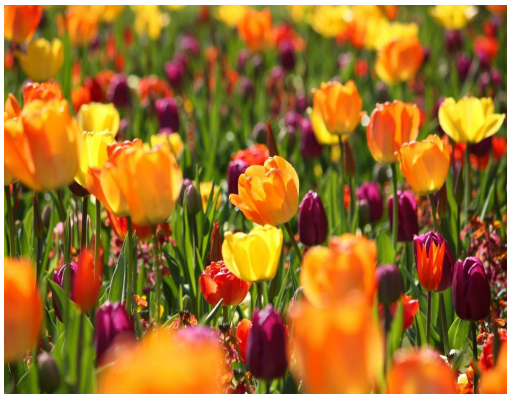
_____

2. How many different colour flowers are in your school ground or your garden at home? Do you see any flowers on your way to school? Next time look out for them and notice all the different colours!

_____

_____





Wow, flowers really make our lives more colourful, and I love colour!

Seeds

Many plants make seeds and store their seeds in different ways:

- In their fruit, like in peaches or oranges.
- In pods, like in beans and peas.
- On a cob, like a mealie or on an ear like wheat.

Other plants grow their seeds from the plant's flower, like a dandelion or the acorns on an oak tree.

Seeds are very important to plants because new plants can grow from seeds.

Dandelion seeds are light so they can blow in the wind to a new place where they can start growing.

The seeds on ears of wheat.

Pea seeds in a pod.

Peach seeds are inside the fruit.

ACTIVITY: Identifying the different parts of a flowering plant

THE REASON FOR DOING THIS ACTIVITY:

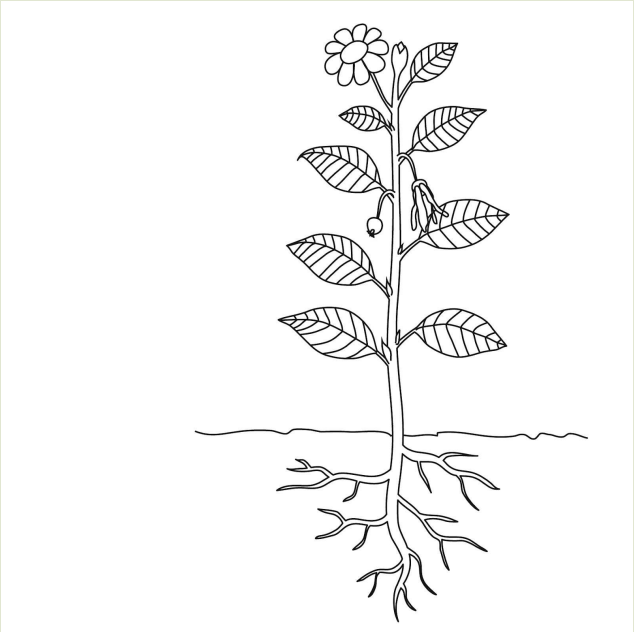
To see whether you can identify the different parts of a plant.

MATERIALS (what you need):

- a drawing of a flowering plant.

INSTRUCTIONS (what you must do):

1. Look at the drawing below. There are no labels added to the drawing. Scientists often need to label drawings and diagrams. This is a very important skill!
2. When we give labels for a drawing, there are some guidelines to follow:
   a) Draw a straight line with a pencil and ruler from the part that you want to label.
   b) Label lines must touch the part of the drawing being labeled.
   c) The line must be parallel to the bottom of your page.
   d) Write the names for each part neatly underneath each other.
3. Label the drawing of the flowering plant using these rules.
4. Write the labels on the left in the space provided.
5. Use the following labels:
   - root
   - stem
   - leaf
   - flower
   - seed



QUESTIONS:

1. When doing a scientific drawing, you need to give it a heading so that someone else knows exactly what it is. Think of a heading for the above drawing and write it below.

2. Do you think one part of a plant is more important than another part? Explain your answer.

Visible differences between plants

There are many different kinds of plants. If you look at different plants you can see many things that are different but also things that are the same. We know that most plants have stems, roots and leaves, and that many others have flowers, seeds and fruit. If we want to compare plants, we can compare these plant structures.

You can look at the different structures of plants and compare their:

- size
- colour
- shape

Or you can ask really important questions about the plants, like:

- Does this plant flower?
- Does it lose its leaves in autumn?
- Can animals eat the plant or parts of the plant?
- Can humans eat the plant?
- Perhaps you can think of other important questions that you could ask?

DID YOU KNOW?

You can start your own vegetable garden at home or at school and then bring your different crops to school to compare the differences in the food we eat!

QUESTIONS

People have studied plants for thousands of years. Can you think of reasons why people need to study plants? Think of the reasons why people use plants, and write them down.

People that study plants, like you are doing, start by looking at the plants and comparing what they see. They later move onto more complicated things to compare. We are going to compare different plants using our eyes as our guides.

Look at the photos of the banana palm and the basil plant. How many differences can you see between these two plants?

DID YOU KNOW?

All plants are grouped into two main groups - those with seeds and those without seeds.

A banana palm[3]

A basil plant.

When we compare plants, it is sometimes easier to use the different plant structures to compare the plants. We can look at the stems, for example, in the banana palm and the basil plant and compare them. The basil plant has a thin green stem while the banana palm has a thick brown woody bark covering a it's very thick trunk.

Look at the photograph below of the edge of a river. There are main types of plants growing: the waterlilies in the front and the reeds at the back. Both grow near or in water but they look completely different!

QUESTIONS

Describe the differences you could list between the banana palm and basil plant.

Waterlilies and reeds growing in water.

ACTIVITY: Comparing plants

INSTRUCTIONS:

1. Work with a friend.
2. Compare the two plants (water lilies and reeds) using the plant structures.
3. When people compare different things using a set of items (like the plant structures we are using), they often use a table to write down their ideas.
4. Study the table below. Write differences and similarities between the plant structures of the waterlilies and the reeds.

	Water lilies	**Reeds**
Stems		
Roots		
Leaves		
Flowers and/or seeds		

QUESTIONS:

1. If you look at a plant and can't see seeds, can you say that that plant falls into the group that does not make seeds? Why not?

_____

_____

DID YOU KNOW?

Some plants can hurt or poison you. Only collect leaves from plants that you **KNOW** are safe to touch or even eat.

Did you notice that it was slightly easier to compare plants if you know the different plant structures? In the next activity we are going compare the leaves of different plants. You need to collect three leaves from three different plants. It is important that you only bring leaves from plants that you or your parents know because you need to tell the class the name of the plant.

ACTIVITY: What do leaves of different plants look like?

THE REASON FOR DOING THIS ACTIVITY:

To see the difference in leaves from various plants.

MATERIALS (what you need):

1. Many different leaves (your teacher will tell you how many you need to collect)
2. The names of the plants you collected the leaves from
3. White paper
4. Crayons

INSTRUCTIONS:

How to make leaf rubbings:

1. Take one leaf and put it on a flat hard surface.
2. Make sure the veins are facing up, that means the leaf must be upside-down.
3. Place the white paper over the leaf.
4. Use the crayon on its side to gently colour on the paper over the leaf to trace the leaf.
5. Label the leaf with the name of the plant it came from.

6. Repeat this process with all the leaves.
7. Give your page a heading that describes what you did.
8. After you have made at least 4 different leaf rubbings, carefully study your different leaves. Describe the differences you noticed in the different leaves you used.

QUESTIONS:

Work with a friend and put their 4 rubbings with yours.

1. Can you see if different leaves have similar shapes?

2. Can you see if different leaves have similar edges?

3. In the spaces below, draw the different shapes of 3 leaves and the different edges of 3 leaves that you could see.

Different shapes of leaves	**Different edges of leaves**

Complete the table below.

1. Fill in the name of the plants in the first column.
2. Make a tick in the column(s) that describe how the leaf looks.
3. One has been done using roses from Gogo's garden to show you what to do.

Gogo's beautiful roses

Name of plant	Round leaf	Long, thin leaf	Smooth edge	Serrated edge
Rose	✓			✓

New Words

- vertebrate
- invertebrate
- mammal
- reptile
- amphibian
- limb
- sense organ
- compare
- classify

2.2 Structure of animals

All living things can be divided into two groups - plants and animals. Plants can be compared using the different plant structures to classify them into different groups. We can use a similar method to compare animals. In this section we are going to learn how to identify different animal structures. Then we will use these animal structures to compare some animals you might already know.

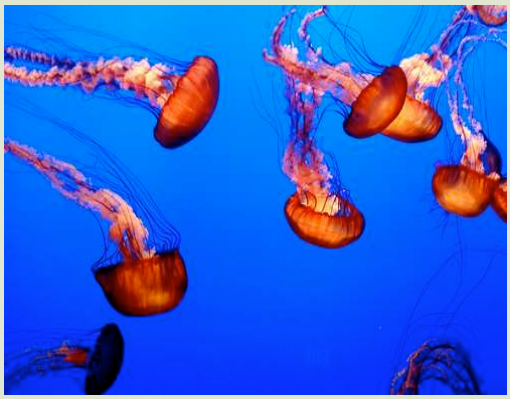
ACTIVITY: Comparing Animals

INSTRUCTIONS:

1. Carefully study the photo of the dog and the jellyfish. What differences and similarities can you see?
2. Write the differences and similarities in this table.
3. Discuss your list of similarities and differences with your classmates and see how your lists are the same or different. Maybe you have some extra things to add to your list after your discussions with your classmates.

Differences	**Similarities**

A Jack Russell standing and a Golden Retriever lying down.



Jellyfish in the sea [4]

DID YOU KNOW?

Animals are classified into those with a backbone (spine) and those without. Animals with a backbone are called **vertebrates** and those without a backbone are called **invertebrates.**

Basic structures in animals

Let's take a closer look at the body parts of animals.

Just like plants, animals also have a basic structure. The basic structure of an animal is:

- head
- tail
- body
- limbs
- sense organs

DID YOU KNOW?

When we talk about animals or plants, we use words like "Most animals" or "Many plants" because there are always plants or animals that are not like the others.

Head

Most animals have a part of their body that we call the 'head'. Even the smallest animal has a part where it's 'brain' is. In most animals the head has:

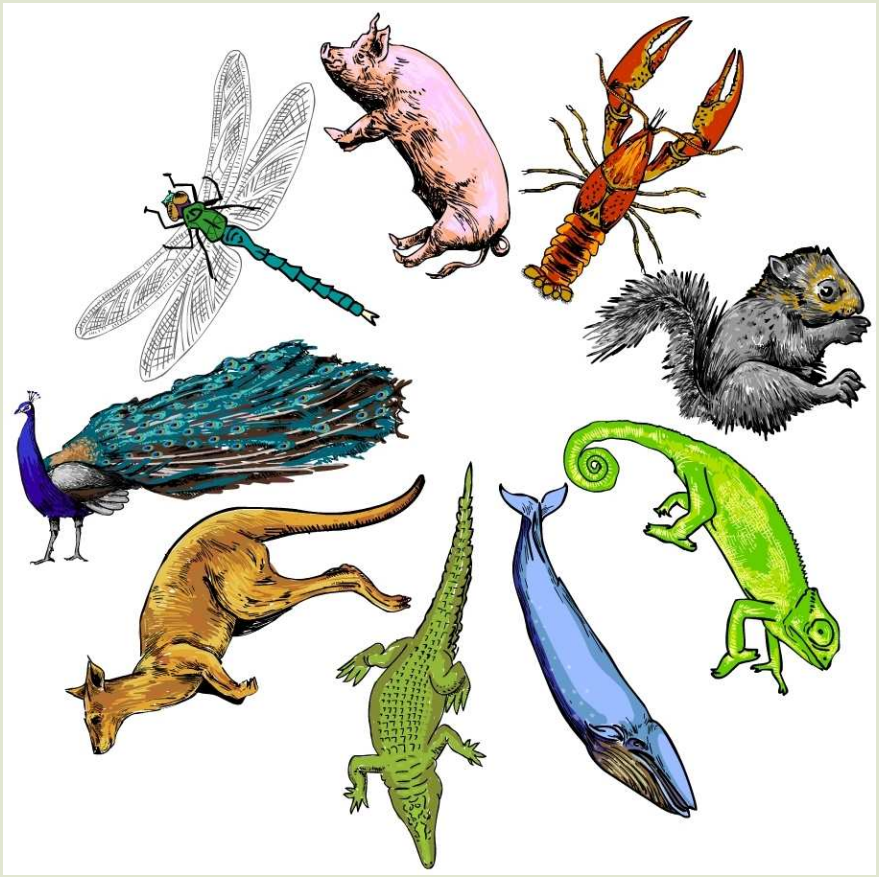
- a brain (or brain-like structure) - no matter how small
- sensory organs (like the eyes and ears)
- feeding structures (like the mouth and jaws)

Tail

Most animals have a tail at the back end of their body (have you ever wondered where a starfish or octopus' tail is?) A tail is often pointed but can have many other shapes as well.

ACTIVITY: The tails!

INSTRUCTIONS:



1. Work in groups of 3 or 4.
2. Look at the different tails of all the animals in the illustration - can you find similarities between the tails?
3. Discuss possible similarities between the different types of tails with your group and then write your answers below. Use some different words to describe some of the tails.

4. Tails do different jobs for different animals. What does the whale in the picture use its tail for?

5. Both the chameleon and the squirrel have tails and live mostly in trees and bushes. But their movements are very different! A chameleon moves slowly while a squirrel jumps from branch to branch and climbs up and down the tree trunks. What do each of these animals use their tails for?

6. The male peacock has a very brightly coloured tail. Why do you think this is so?

Let's look at some more functions of tails. Tails help an animal to:

- move and swing in trees - monkeys for example.
- balance - kangaroos use their tails to balance while they jump for example.
- kill their prey - crocodiles use their tails to spin them around and around when they need to drown their prey; scorpions often have poison in their tails.
- pat down the earth - beavers use their powerful tails to pat ground down hard and solid.
- swim - almost all fish use their tails to let them swim.
- steer their movement - fish, whales, dolphin, sharks and many others use their tail as a sort of rudder to steer them in a

certain direction. Birds' tails are very important rudders too.

- keep it warm - a little squirrel or fox wraps its tail around it like a blanket to keep warm!
- chase away flies - a cow or horse can swish their tail to get rid of flies.
- warn others of possible dangers - some deer flash the white underside of their tails to other deer to warn them of possible danger.
- communicate - dogs show their emotion in their tails. If they are happy to see you they wag their tails. A burglar is not always met with the same wagging tail!
- protect - an armadillo has an armoured tail to protect itself. They can roll up into the ball, with their tail protecting them.
- distract predators - if a lizard is attacked it will drop its tail and get away while the predator goes after the wriggling tail.

As you probably realised, animals' tails are very important to them!

Body

Different animals need to cover their bodies in different ways.

QUESTIONS

Can you think of at least five different kinds of body coverings that animals use? Write them down below.

_____

_____

_____

_____

_____

Just like people, animals use specific body coverings for special reasons. Let's think about reasons why people cover their bodies then we'll see how this compares to animals.

ACTIVITY: Why do we cover our bodies?

INSTRUCTIONS:

1. Think of times when someone will wear these types of clothes.
2. Write your answers in the right hand column next to the clothes.

Clothing	**Where or when would people wear it?**
Thick jacket, scarf and gloves	
Bright thin dress with thin straps over the shoulders	
A black suit with black pants and bow tie	
Grey skirt and white short sleeve blouse, black shoes and white socks	
A costume	

People wear different kinds of clothes in different environments. If they are cold people will wear warm clothes, and if they are hot most people will wear fewer and thinner clothes.

Animals also have different body coverings - which most cannot change when the weather changes. Why do you think a bird is covered in feathers and not scales? Or why does a whale have a smooth thick skin but an octopus has a slimy slippery skin? Why is it that a cat has a soft furry skin but a crocodile's body is covered in hard bone-like scales?

QUESTIONS

Discuss this in groups of three or four and write your ideas in this space.

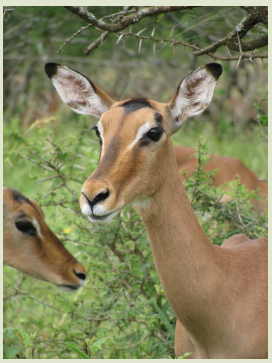
Animals need to cover their bodies in special ways for a few reasons:

1. Body coverings need to protect the animal's organs, bones and muscles from their environment, harsh sunlight, bumps and scratches, and from germs and bacteria that might cause infection. A warm, furry body protects a polar bear in the Arctic just like a scaly body protects an armadillo and crocodile.
2. Animals need to blend into their environment either to hide from predators or camouflage themselves to stop prey from seeing them (for example lions).
3. Males often use their body covering to attract female attention. A peacock boasting with his beautiful tail feathers or a lion with his mane is meant to attract females.

ACTIVITY: Animal Body Coverings

INSTRUCTIONS:

1. Carefully look at the the body covering of each animal in the photographs below..
2. Then think about where the animal lives.
3. Answer these questions by filling them in on the table below:
    - What does each animal's body covering do for it?
    - Where does this animal live?

Animal	Body Covering	Where does it live?
snail  5		
impala 		

tortoise  6		
chimpanzee 		
earthworm  7		
goldfish  8		

penguin  9		
whale 		
seal 		

Limbs

Most animals use their limbs to move. Animals can walk, run, climb or swim using their limbs. Some animals like chimps and squirrels can use their front or upper limbs to handle objects.

Look at the pictures of the different animals in the previous activity. How many different limbs can you see on these animals?

Animals can have wings, webbed feet, tentacles, fins, legs, arms, flippers and long slithery bodies.

Senses

Some animals have senses that are much better developed than those of humans. Dogs for example can sense things and help humans with this.

- Sniffer dogs help to find people who are trapped under building rubble, mudslides or snow and tell the rescue workers where the victims are. These dogs also smell drugs or bombs and alert the police.

Sniffer dogs at the airport. [10]

- Eagles, buzzards, hawks and other birds of prey have extremely sharp eyes as they have to see small rodents from very far away.
- Elephants, cats and dogs can hear sounds that human ears cannot hear.

- Bats, dolphins and some whales use a special sense called echolocation. They send out special sound waves and can find prey or objects that they might bump into from quite far away.
- Butterflies, bees and earthworms have another special sense called chemoreceptors - they taste through their skin or feet.
- Animals such as ants, cockroaches or crayfish have special sense receptors that can sense something moving from miles and miles away!

QUESTIONS

Think back to the seven life processes and why we can say that an animal is alive. Look at the basic structure of an animal, at their head, limbs, body, tail and and senses. How does the basic structure of animals help them carry out the seven life processes?

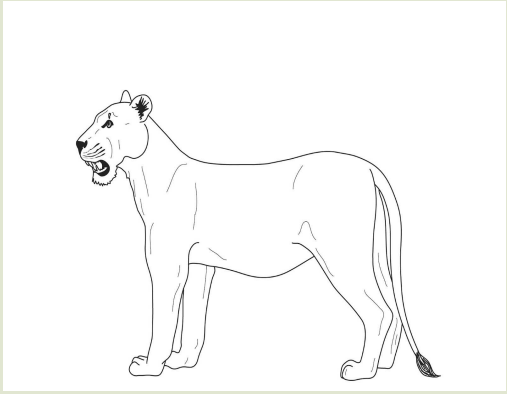
ACTIVITY: Body plans of animals

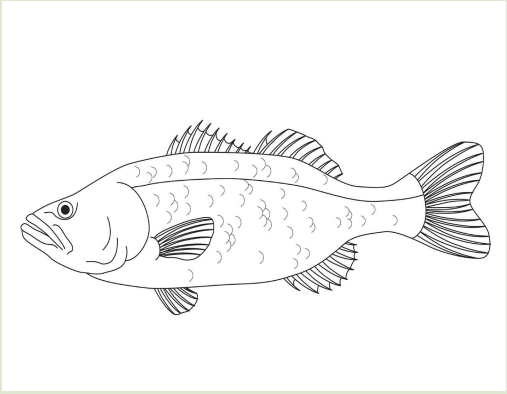
THE REASON FOR DOING THIS ACTIVITY:

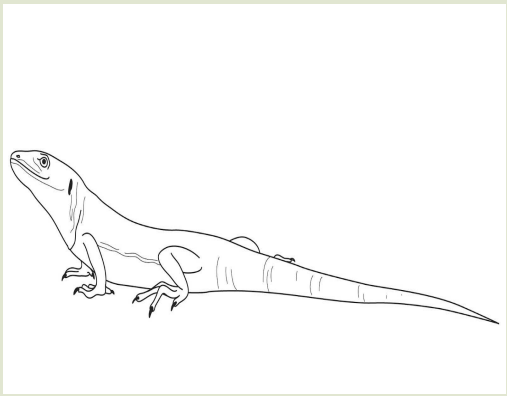
When you were learning about plants, you also learnt how to label a drawing in a scientific way. In this activity you are going to practice your labelling skills.

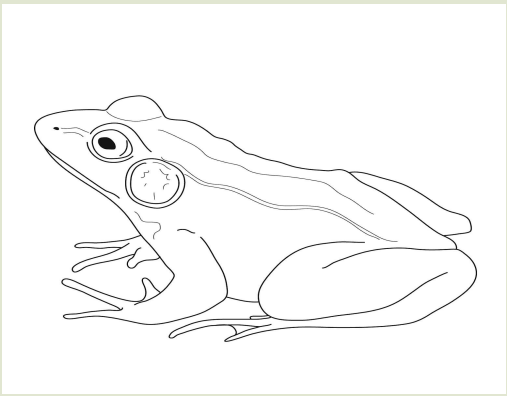
INSTRUCTIONS:

1. Study each of these drawings of different animals.
2. Use your scientific labelling skills to label each animal using the five body structures of animals.









Animals all look very different. Some have long legs and others have short stubby claws, some have big eyes and other have thousands of tiny eyes together in one big eye. They come in all shapes and sizes!

QUESTIONS

Have a look at the page that introduces Life and Living at the beginning of the term. You can see the Thunderbolt kids exploring the jungle. Can you see all the different shapes and sizes of the animals!? How many different animals can you spot?

ACTIVITY: Small, medium, large or extra large?!

Do you sometimes go shopping with your family? Have you seen that shops use the words, SMALL, MEDIUM, LARGE and EXTRA-LARGE when they compare things like pizzas, eggs or clothes for example? Sometimes people just write S, M, L and XL to show the size.

INSTRUCTIONS:

1. Let's use these letters to compare the basic body parts of the animals we just labelled.
2. Write S, M, L or XL to describe the size of the different body part of the animals in the first column.

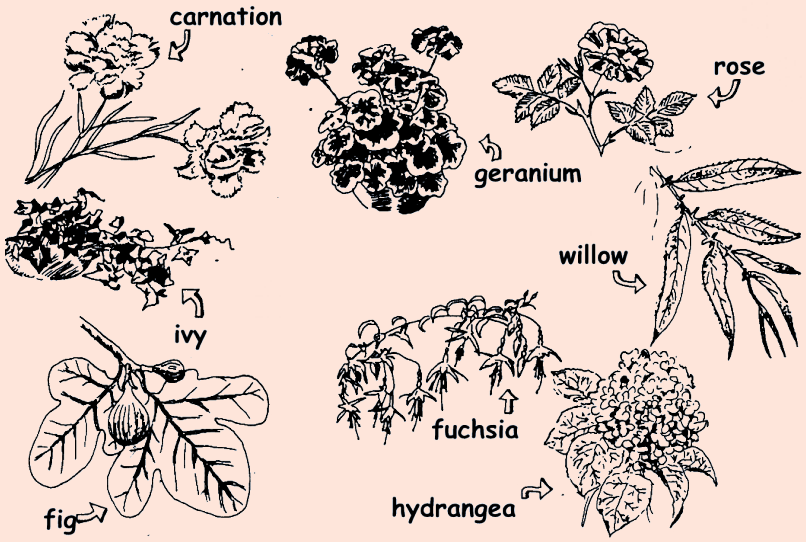
	Head	**Body**	**Tail**	**Fore limb**	**Hind limb**
Lion					
Dove					
Fish					
Lizard					
Frog					

KEY CONCEPTS

- All plants have a basic structure of roots, stems and leaves.
- Flowering plants also have flowers, fruit and seeds.
- We can see how plants are different. We compare the size, shape and colour of roots, stems, leaves, flowers, fruits and seeds.
- All animals have a basic structure: head, tail, body, limbs and sense organs.
- Animals have different body coverings, shapes and sizes and sense organs.
- We can compare the different things that we see in animals.

REVISION:

1. Look at the picture below and answer the following questions:



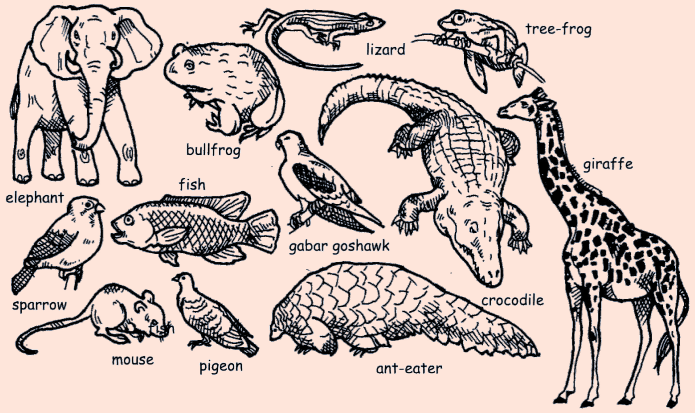
a) Describe the difference between the leaves of the fig tree and the willow tree.

b) Study the flowers. Which flowers would you group together? Use the following headings:

Many flowers close together	Single (one) flowers on a long stem

2. Think of three different plants that you know. They can be vegetables, fruit, flowers or trees - whatever you like. Each plant looks different, right? Write down what you know about each of the different parts of the plant in the table below.

Plant's name	Stem	Leaves	Flowers



3. Carefully study the animals in the picture above and find the following:
   a) Five (5) examples of different body coverings.

_____

_____

   b) Three (3) examples of different limbs.

_____

_____

   c) Which animals have soft skins and need to live in or near water to keep their skin moist?

d) Which animal in these pictures can drop its tail when it feels in danger?

e) Which animal uses its tail when it catches and drowns its prey?

f) Name the animal from this group that can use its front limbs to handle or manipulate objects or food?

g) One animal in this group specifically has very good hearing. Which one has better hearing than most?

h) Think how birds of prey hunt. Which animal in this group needs to have especially good sight to help it hunt?

i) Do you think the crocodile has a good body covering? Look at the other body coverings. Would a crocodile be able to survive with the same scaly body covering as a fish? Why does it have the hard horny scales?

3 What plants need to grow

KEY QUESTIONS

- How can I grow my own plants?
- If I plant seeds, what must I do to make sure that they grow?
- What does a plant actually need to stay alive and grow?

3.1 Conditions for growth

What do plants need to grow?

New Words

- cutting
- germinate
- sprout
- seedlings
- absorb
- oxygen
- carbon dioxide
- nutrients

Do you remember learning about living and non-living things? We said that almost all things on earth are either living or non-living. The plants and animals that are living need to carry out the seven life processes - do you still remember what they are?

Plants make all the food that all the animals on Earth need to stay alive. If all the plants were to suddenly vanish, life on Earth would be not be possible. We need to take care of the plants on our planet because they take care of us.

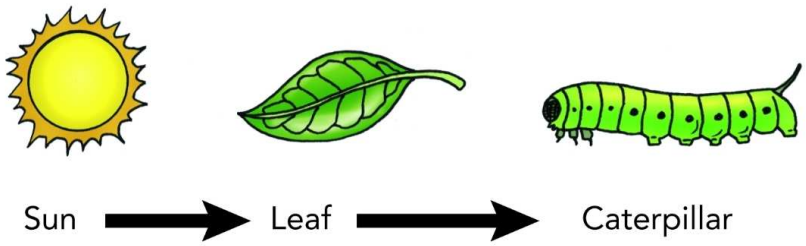
In this section we are going to learn specifically what makes plants grow and keeps them alive. We will also look at growing new plants and how you can make sure that as many of your seeds as possible grow into healthy plants.

QUESTIONS

After the activity when you planted a bean seed, how did your bean grow - did it die or did it stay alive? Discuss what you think your bean plant will need to stay alive and continue growing.

Sunlight

- Plants need sunlight to grow and live.
- Green plants use sunlight, water and carbon dioxide gas to make food.
- The plant can use some of this food to grow and develop.
- It stores the rest of the food, which animals can eat.
- When animals and humans eat plants they get energy from the plant.



The plant leaf uses sunlight energy to make food and grow. The caterpillar eats the leaf.

Air

Just like animals and people, plants also need air to live and grow. Plants use carbon dioxide to make food so that they can grow.

Water

Plants need water to grow and to make food. Some plants need more water than others. The amount of water a plant needs depends on the type of plant. If the plant does not get the amount of water it needs it will die. Some plants are able to grow in very dry areas, such as cacti in the desert. These plants have adapted (changed) over many, many years to be able to survive in these conditions.

The roots of the plant absorb water from the soil. This water carries nutrients from the soil to all the parts of the plant. In the picture, the raindrops are collecting on the leaves. They will then fall down to the ground and soak into the soil. The roots will then absorb the water for the plant.

Remember: a plant needs water, sunlight and carbon dioxide to make food.

DID YOU KNOW?

The picture of the sun, leaf and caterpillar is an example of a "Food Chain". You will learn more about food chains in Grade 5.

The rain drops are collecting on these leaves. [1]

Soil

Most plants grow well if they are planted in soil.

- Plants are anchored in the soil by their roots.
- Their roots absorb the dissolved nutrients from the soil.
- To make sure plants get enough of these mineral nutrients we often add some fertiliser or compost to the soil. We say that soil that has a lot of nutrients is rich and soil that does not have many nutrients is poor.

New plants growing in the soil. [2]

New Words

- conditions
- cuttings

3.2 Growing new plants

Plants can generally be grown from seeds or cuttings.

- Seeds grow from flowers that have been fertilised with pollen from another flower. Fertilised seeds can germinate to start growing into a new plant.
- A cutting is made when a piece of a plant (usually the stem) is cut off and planted in new soil to start growing roots and form a new plant.
- Plants can also grow from shoots which are little roots that shoot out of special places in the stem of the plant and start to grow into a new plant.

QUESTIONS

1. What three really important things do plants need to grow?

---

2. Do you remember that one of the life processes is reproduction? How do plants make new plants?

What seeds need to germinate

You have learnt that seeds are important to grow new plants. A plant needs to germinate from the seed to start growing. This means that the seed has to develop into a new plant and grow all the necessary plant parts.

In the first chapter of this term, we germinated a seed and saw that although it seemed to be non-living, it can be revived.

Have you ever wondered what seeds need to germinate and grow into new plants? Let's find out by doing a scientific investigation!

INVESTIGATION: What does a seed need to germinate?

You will be working in groups. Each group will investigate a different question. Your aim and prediction will depend on the question you want to answer in your investigation!

AIM:

An aim in a science investigation is where we state what the purpose (aim) of the investigation is. What do you want to find out by doing this investigation?

PREDICTION:

A prediction is when you predict (make a guess) what the result of your investigation will be. But it is not just any guess! You must think about what you expect will happen in your investigation. What do you think will happen to your seed and how will it change?

APPARATUS (Equipment you will need):

- bean seeds for each group
- a shallow container for each group, such as a saucer or the lid of a large jar or yoghurt tub
- cotton wool (if no cotton wool is available, use strips of newspaper instead)
- a dark cupboard
- a fridge (perhaps there is one in the staff room)
- a ruler

METHOD (what you must do):

Each group will have a slightly different method depending on what question they are investigating. Follow the instructions for your group.

Group - Control

NB! A control is where the bean seed is given everything that we think it needs to germinate. In the other investigations, one of these things will be left out.

1. Wrap your bean in cotton wool (or newspaper if you do not have cotton wool).
2. Place it in the shallow container (saucer or lid).
3. Wet the cotton wool (be careful not to flood it!).
4. Place the container with the wet cotton wool and bean in a sunny spot.
5. Water your cotton wool DAILY and make sure that it stays damp.
6. Regularly check your bean's progress.
7. Keep a diary during the next few weeks to write down what you see happening. This is called recording your observations.
8. Once the seeds germinate, measure the length of the stems each day and record your results. Your teacher will show you how to do this.

Group - No water

1. Wrap your bean in cotton wool (or newspaper if you do not have cotton wool).
2. Place it in the shallow container (saucer or lid).
3. DO NOT wet the cotton wool! You want to see if a plant needs water to germinate so you must not give it water.
4. Place the container with the cotton wool and bean in a sunny spot.
5. Regularly check your bean's progress.
6. Keep a diary during the next few weeks to write down what you see happening. This is called recording your observations.

Group - No warmth

1. Wrap your bean in cotton wool (or newspaper if you do not have cotton wool).
2. Place it in the shallow container (saucer or lid).
3. Wet the cotton wool (be careful not to flood it!).
4. Place the container with the wet cotton wool and bean in the fridge.
5. Water your cotton wool DAILY and make sure that it stays damp.
6. Regularly check your bean's progress.
7. Keep a diary during the next few weeks to write down what you see happening. this is called recording your observations.

RESULTS AND OBSERVATIONS (What you observed and found out):

Record the results from each group in the table below.

	Control	No water	No warmth
Was there a change on Day 1?			
Did the seeds germinate?			
When did the seeds first germinate?			
Did the new plants grow once they had germinated?			

Now let's focus on the data we collected from the Control Group so we can see how the plants grew over time.

In the box below, make a drawing of a bean that has just started to germinate and of the first root that appeared.

In the box below, make a drawing of the the plants that had grown further. Include the bean, the root and the first leaf in the drawing.

Use the space below to draw a table where you record the data you collected from the **Control Group** and the length of the stems each day after they germinated. A table is very useful in science investigations to record and present a lot of data. A table must also have a heading!

Date	**Average length of stems (mm)**

We are now going to draw a graph! Graphs are another way of presenting (showing) our results. They are often used by scientists to show their results. Drawing graphs is a very important skill! We will use the results from the table above to draw a graph. There are also many different types of graphs, but we will draw a line graph

to show the growth of the seedlings each day. If this is the first time you are drawing a graph, do not worry! Your teacher will help you.

CONCLUSION (What we have learnt):

When we do a scientific investigation, we always have to write a conclusion at the end. This summarises what we have learnt from the results of our experiment. From this science investigation, write a conclusion where you state what you have learnt.

KEY CONCEPTS

- Plants need light, water and air to grow.
- You can grow new plants from cuttings or seeds.
- A cutting is a stem, leaf or part of a plant that can be used to grow a new plant.
- Germinate: when seeds come alive and start to grow.
- Seeds need water, warmth and air to germinate and grow.

REVISION:

1. Explain what germination means.

2. What does a seed need to germinate?

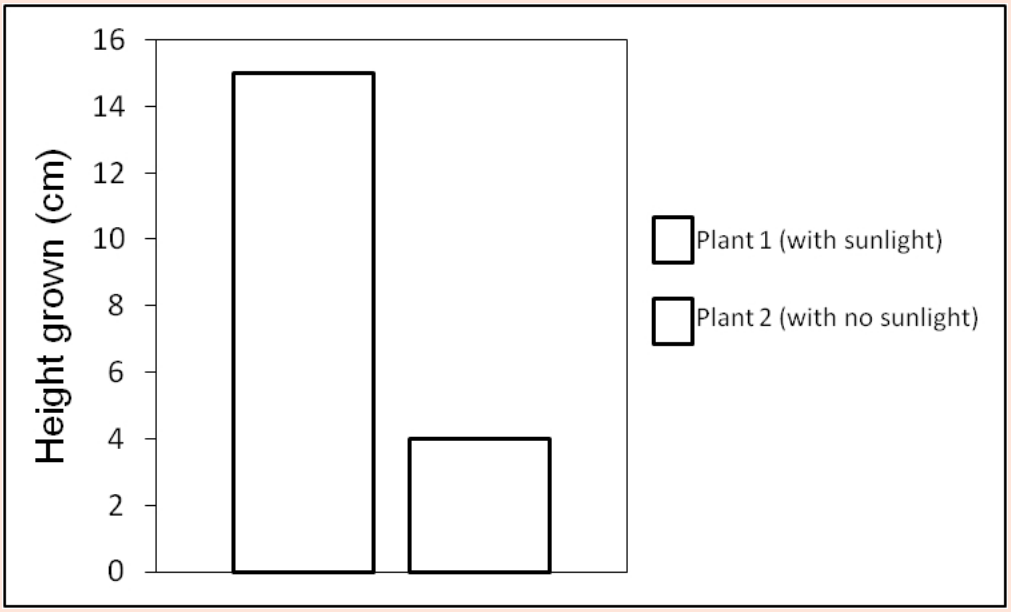
3. What does a plant need to grow?

4. Two of the same plants were grown in different places. One plant got a lot of rain and was planted where there was a lot of sunshine. The other plant also got a lot of rain, but hardly any sunshine.
   After two weeks the following measurements were taken:

Plant	**Length of plant**
Plant 1	15 cm
Plant 2	4 cm

   Which plant do you think grew in the shadowy place? Why do you say so?

5. Complete the bar graph by choosing a different colour for each plant and colouring in the bar for each plant, as well as the little boxes on the side which tell you which plant is which (this is called a legend).



4 Habitats of animals and plants

KEY QUESTIONS

- Why do you only find certain plants or animals in certain parts of the world?
- What different kinds of habitats do you get?
- How do plants and animals choose where to live?
- Why do we have the galjoen, Blue Crane and springbok as our national animals?
- Why is the King Protea and the Real Yellowwood tree our national plants?

4.1 What is a habitat?

Animals tend to live naturally in specific areas. Different kinds of plants grow naturally in different areas too. Plants and animals will choose where they live mostly because of the water, food and climate of a specific are. The physical environment also plays a part in an organism's choice of habitat, for example, plants might prefer certain types of soil to grow in. You can easily see if a plant does not like to grow in a specific area - it will stay small and have few leaves. If a plant is in an area that it likes, it will grow big and strong and have lots of leaves.

The place that a plant or animal lives in is called a ***habitat***.

A habitat is the physical area where the animal or plant lives. An organism's natural habitat has everything it needs to live.

QUESTIONS

Look at the front cover for Life and Living and you can see the Thunderbolt kids exploring a habitat. What type of habitat do you think this is? Name some of the plants and animals which live in this habitat. There are ten different animals - see if you can spot them all!

4.2 Different habitats

There are many kinds of habitats that plants and animals like to live in.

- Some plants and animals choose to live in the hot, dry desert. These plants and animals do not need as much water as other types of plants and animals.

- Some animals and plants live in a forest or cave habitat because they prefer cooler, shady areas.
- In South Africa, there are many forest areas.
- There used to be many wild elephants that lived in the Knysna forest in the Western Cape. But today there are hardly any left as lots were killed by humans. Their forest habitat has also decreased in size due to humans moving in, so the numbers of the elephants have decreased.

Some areas of the the Karoo in South Africa are semi-desert areas where plants are adapted to grow in dry, hot habitats. [1]

The plants growing on the forest floor like a shady, cooler habitat. [2]

- Other plants and animals choose to live along the shoreline where the water meets the land. This is because they prefer a wet environment, but they are also able to live on land.
- Animals that live along the shoreline need to have strong bodies and protection against the waves.
- This is why many animals have shells to cover their bodies.

QUESTIONS

Identify three animals that live at the shoreline and have shells or hard armour covering their body. If you have not been to the shoreline, choose another habitat close to your house and identify three animals from that habitat.

_____

_____

_____

A rocky shore habitat in the Knysna lagoon. [3]

- Water plants like to grow in or very near to rivers, lagoons or wetlands.
- Some animals chose to always be in the water and others are only some times in the water.

QUESTIONS

Write down the names of two animals that are always in the water and two animals that are only some time in water.

- There are even animals and plants that live in the very cold regions near the arctic poles or in very high mountains. Marion Island is an island towards the South Pole and near South Africa. Scientists study animals that live on the island to learn more about these animals and how they adapt to their habitats.

ACTIVITY: Discovering Habitats

In this activity you are going to find a habitat in your school and draw and describe the habitat.

MATERIALS:

- scrap paper
- pencil
- clipboard or something hard to press one when you draw
- paper sheets to make final drawings
- coloured pencils or crayons

INSTRUCTIONS:

1. Work in groups of 3 or 4.
2. In your group, find a habitat in your school where you think different plants and animals will live.
3. Carefully look at your habitat WITHOUT moving anything or changing anything in your habitat. Can you see any little animals in your habitat?
4. Ask one person to turn over large rocks one at a time so you can see what is under the rock. Many little bugs and spiders live under the rocks.
5. Also look under the bushes or shrubs for animals that might be hiding from you!
6. Make a drawing of the habitat you observe on scrap paper. This is your rough drawing. You will redraw your habitat on neat paper when you get back to class.
7. Add in ONLY the plants and little animals that you can see in your habitat.
8. Carefully study the colours of the different plants in your habitat.
9. Once your whole group has finished their drawings, return to your class.
10. Redraw your habitat on new clean paper. Use colour pencils or other colouring-in materials to add colour and detail to your drawing.
11. Give your drawing a heading and add in labels to name the different plants and animals that you recognised. You can stick your drawings up in the class.

QUESTIONS:

1. Explain where the habitat was that your group studied.

2. What kind of habitat did you study? Use some words to describe the habitat that you studied, such as shady, sandy, wet.

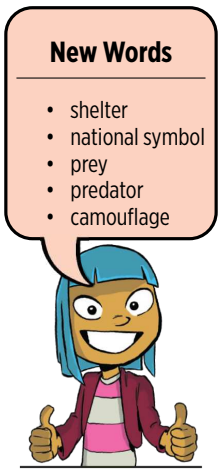
3. Name the different animals that you could see in your habitat.

4. Were there any plants that you recognised in the habitat? Name these plants.

5. If it started raining very heavily, how would the plants and animals in your habitat be affected?

6. How do you think your plants and animals are affected in winter? Will they be able to survive the cold conditions? Explain why you say so.

7. Is there any damage from people in your habitat? If so, how do you think you could prevent this damage?



4.3 Why do animals need a habitat?

Animals and plants need food, water and shelter in their habitat. Animals also need a safe place to have their young (babies) and to hide from predators and escape from other danger. Let's look at some more of the reasons why animals need a habitat.

Camouflage in a habitat

Some animals rely on their habitat to escape danger or to hide from the food they are trying to catch! To help them do this they, blend in with their surroundings. This is called camouflage.

Animals use camouflage for two reasons:

1. Animals use it to hide from **predators**. In other words, their camouflage helps them to hide from other animals that eat them.
2. Animals use it to hide from their **prey**. In other words, when they are hunting it helps them to sneak up on other animals without being seen.

Animals are camouflaged in different ways.

Let's look at some animals and the way they use their habitats to escape danger!

A chameleon can change its skin colour to blend in with its surroundings. [4]

The endangered Western Leopard Toad, found in the Western Cape, uses spots to blend into its surroundings and hide from predators. [5]

ACTIVITY: Finding hidden animals

INSTRUCTIONS:

1. Some animals are really good at blending into their habitats. Look at the pictures below of different animals and their camouflage.
2. Circle the animal in the picture.
3. Identify what the animal is and how it uses its camouflage to blend into its surroundings.

Animal	Description of animal and camouflage
	
	
	
	
	
	
	

Wow, that was fun! My blue hair is not very camouflaged is it?!

Habitats of indigenous animals in South Africa

South Africa is very well-known for its Big 5. This term is used to refer to the lion, leopard, elephant, buffalo and rhino. Many tourists visit our country to see these animals.

But how do they know where to find these wild animals?

Let's help them!

ACTIVITY: Understanding the habitats of indigenous South African animals

MATERIALS:

- a piece of A2 cardboard
- a piece of A4 paper
- information about the Big 5
- pictures of the Big 5 (from old magazines, newspaper cuttings, photocopied images)
- coloured pens and pencils.
- scissors
- glue

INSTRUCTIONS:

1. You are going to make a poster about the Big 5 and where to find each animal so that tourists will know when they come to South Africa
2. Divide the class into groups of 5.
3. Assign one of the Big 5 to every group member, so each person in your group of 5 will investigate one of the Big 5 animals.
4. Each group member must bring information from home (or from the library) about the animal that was assigned to them. This must include information like what the animal eats, where it lives etc.
5. Bring all your information and pictures to class. If you do not have any pictures, then use your pencils and crayons to draw some pictures of the Big 5.
6. In your group, plan the poster you are going to make about where to find each of the Big 5 animals on the A4 paper.
7. Once you have finished your plan, use the bigger sheet of paper to make your real poster. (Remember to give your poster a heading.)
8. Present your poster to the class.

QUESTIONS

Write down what you would tell a tourist about where to find the Big 5 animals in their natural habitat.

South Africa has five animals and plants as our national symbols. National symbols are used to identify a country.

These are animals and plants that live in habitats found in our country or our seas.

- Blue Crane

- Galjoen
- Springbok

QUESTIONS

Can you see the differences between the habitats of the Blue Crane and the springbok? Write down some of the differences below.

_____

_____

_____

_____

- King Protea

A protea[6]

- Yellow Wood tree

ACTIVITY: Research project on South Africa's National Symbols

MATERIALS:

- books and reading material of South Africa's national animals and plants
- scrap paper for making notes
- pencils for colouring and writing
- cardboard to make a poster (for example, from cereal boxes)

INSTRUCTIONS:

1. Work in pairs.
2. Find out as much as you can by reading in books or asking a family member about the plants and animals that are South Africa's national symbols.
3. Choose two of the animals and two of the plants.
4. Explain why they were chosen as National Symbols.
5. Describe each one's habitat.
6. Explain why these animals and plants can survive in their habitats - how specifically are they suited to live there?
7. Identify ways that we can protect and look after these animals and plants.
8. Present your research as a poster.

KEY CONCEPTS

- Habitat - the place where a plant or animal (mostly) lives.
- There are different kinds of habitats, such as grassland, forest, river, sea and desert.
- Animals need a habitat for food, water, shelter, raise their young and also escape from danger.

REVISION:

1. List and describe two habitats that you learnt about in this chapter.

2. Explain in your own words what a habitat is.

3. Name three animals in South Africa and the habitats that they live in.

4. In the table below, look at the list of animals in the second column. Think carefully about the types of animals and what they would need in a specific habitat. Draw a line to connect in the second column with the habitat in the first column.

A) Cape Fynbos	1) lizards, snakes, spiders, scorpions, small birds, foxes, small buck, tortoises, etc.
B) Wetlands in St Lucia (Vlei)	2) large buck and even elephant, bushpigs, some monkeys, many reptiles, big ferns, tall trees,
C) Knysna Forest	3) water birds, water snakes, small fish, frogs, terrapins
D) Karoo dry semi-desert	4) snakes, small tortoises, small frogs near little ponds, sugarbirds, many bees and butterflies,baboons, proteas and pincushions

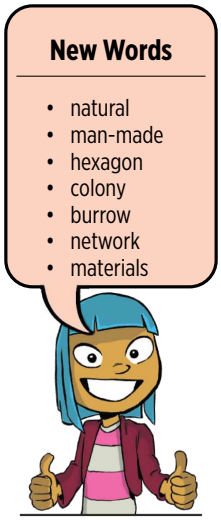
5. Do you think a large bullfrog can live in the Karoo? Why do you say so?

5 Structures for animal shelters

KEY QUESTIONS

- How does a little weaver bird or a swallow build such a complicated nest? I do not think I could even do it!
- What different kinds of animal structures do you get?
- How do I build an animal shelter?

5.1 Natural and man-made shelters



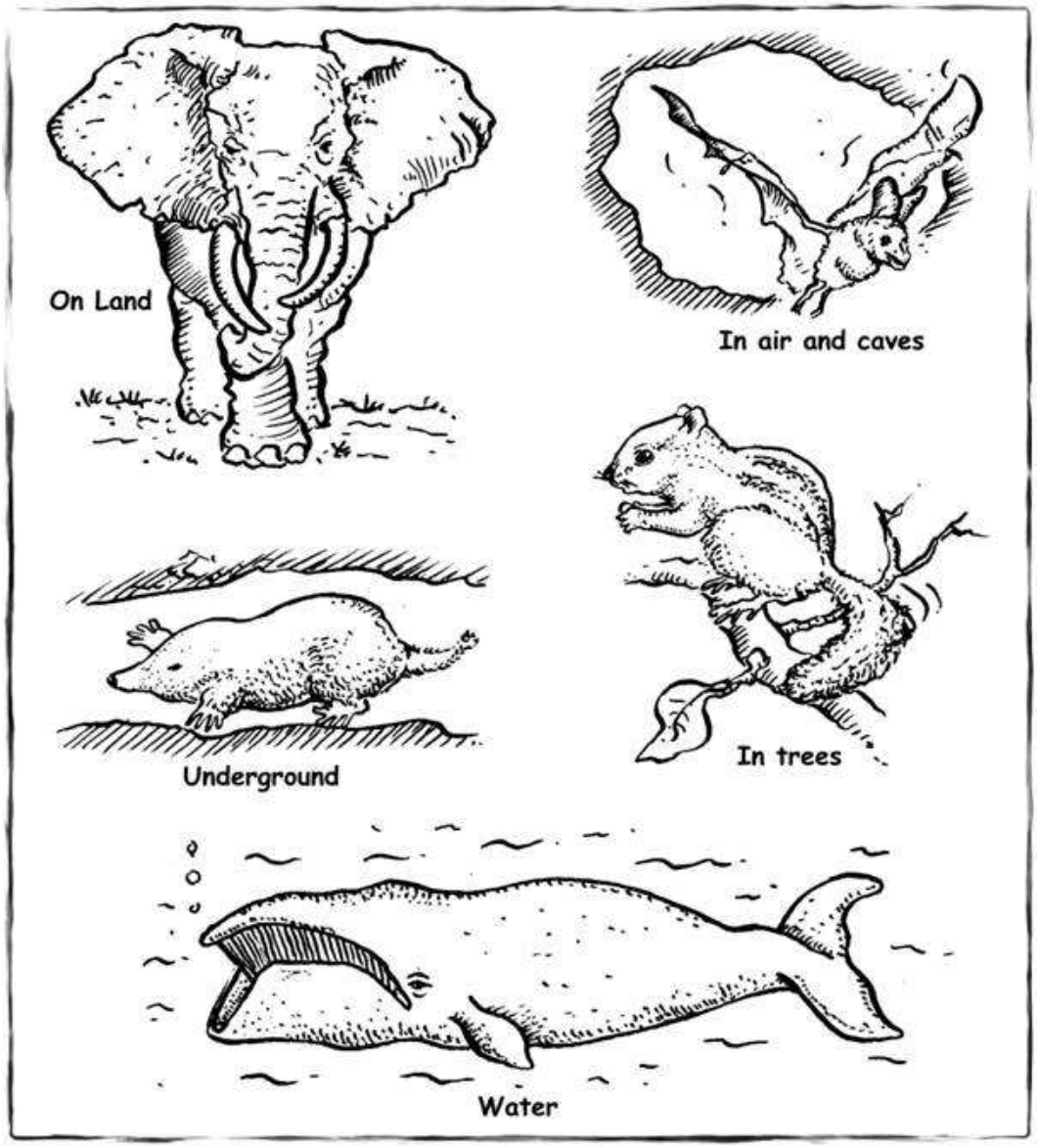
Natural shelters

Remember earlier you dealt with living and non-living things. Living things need some shelter to protect them from harsh weather conditions.

Some animals live in natural habitats for their homes. Other animals build their own homes. Some animals even live in other animal's homes. A natural shelter is a home that the animal has made for itself. Animals live in different kinds of homes like:

- holes in the ground
- caves
- nests
- trees

Look at the following picture of a few places where animals live.



Let's take a look at a few shelters that animals build and the materials they use.

Nests are built by birds and other animals in trees, on the ground and even in buildings. This is used as a home for them and especially for their eggs. Nests are usually bowl-shaped and made of twigs, leaves and grass held together by mud or saliva (spit).

DID YOU KNOW?

Some people believe it is a sign of good luck if a swallows builds its nest at your home or school. The swallows return year after year to their nest.

Bees live in very large colonies. The hive is made up of many six-sided cells (hexagons) stuck together. The queen bee lays all the eggs in a hive and each egg is put in a cell.

A natural bee hive in a tree [1]

Meerkats burrow and dig huge networks of tunnels underground to live in. [2]

DID YOU KNOW?

Ants build shelters to save their colonies from drowning. When water floods their nests they hold onto each other and can float like that for many weeks at a time.

Small rodents such as squirrels, rabbits, mice and moles dig burrows in the ground or under logs and rocks to provide them with shelter. These burrows often form a underground network of tunnels in which these animals live.
Ants and earthworms also live in the ground.
Spiders spin webs from silk that they make in their bodies. The web isn't only a home for the spider, it also helps the spider to catch it's prey.

Man-made shelters

Other animals live in shelter that were built by humans. These shelters are normally for our pets or animals that we farm.

QUESTIONS

Below are the names of three types of animals which we keep as pets or farm. We have to build shelters for them. Write down the name of the shelter next to each animal and describe it briefly.

Dog:

_____

_____

Bees:

_____

_____

Pigs:

_____

_____

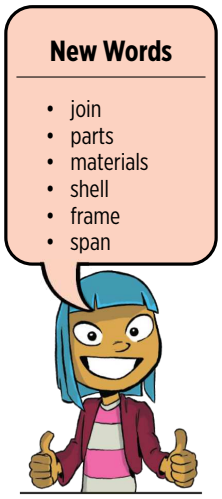
ACTIVITY: Describing man-made animal shelters

INSTRUCTIONS:

1. Look at the examples of man-made shelters on the next page.
2. Complete the table by filling in the answers.

	 3	 4	 5
Animal that will live in this shelter			
Materials that the shelter is made of			
Why will it be a good shelter for this animal?			

5.2 Structures and materials for animal shelters



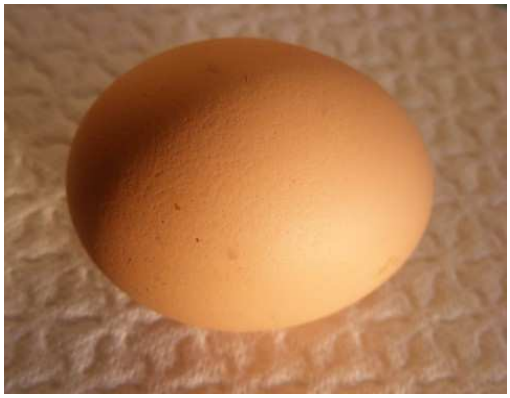
Structures are built by joining different parts together. Different materials are used to make structures. These structures come in different sizes and shapes.

Structures do four kinds of jobs (functions):

- protect
- contain
- support
- span a gap

Each of the structures shown in the following pictures do one or more of the functions or jobs of structures. They are made from different materials. Carefully look at the different shapes that are used in the structures.

A bridge is an example of a structure that spans a gap. [6]



The shape of an egg shell is an example of a protective shell structure. [7]

A support structure holding up a water tower. [8]

A bird cage is an example of a structure that contains an object (the bird). [9]

The way structures are put together or constructed depends on the type of materials used.

ACTIVITY: Looking at structures

INSTRUCTIONS:

1. Work in pairs.
2. Look at the photographs of structures above.
3. Discuss each photograph with your partner.
4. Look at the shape, size of the structure and the materials used to construct it. (Use the S, M, L and XL to describe the size as you did in the previous activity on animals.)
5. Record your findings in the table provided.

	Size of the structure	**Shapes used in the structure**	**Materials used in the structure**
Water tower			
Egg in a shell			
Bridge			

Bird cage			

Let's learn more about different kinds of structures.

Shell and frame structures

Shell structures mainly contain and/or protect the contents. A **bird's egg** protects the little chick growing inside it. A car gives some protection to its passengers. A pot holds the food inside it.

A **frame** structure gives **support**. There is a frame structure inside your body! Your skeleton supports your body! Your knees and elbows are places where the bones join.

A frame structure must carry a load in the right places without it collapsing or falling over.

Frames are made of **members** and **joins**. The members are the long parts and the joins are where the long parts get together. Sometimes longer tubes can be joined to make triangles. The tubes are called the members. Where the tubes come together that is called the join.

QUESTIONS

1. List three types of structures.

2. What is the difference between shell and frame structures?

3. What kind of functions do shell and frame structures serve?
   a) Functions of Shell Structures:

   b) Functions of Frame Structures:

Designing an animal shelter

The Technology Process

When we design and make products and structures we use a special way to do this. It is called the Technology Process. The Technology Process helps you to design and make products.

We use the Technology Process to investigate a specific problem. We then use this information to design and make something to

help us solve this problem. While we work on the design and make the product, we constantly evaluate it to see if it is working and if it does what it is meant to do. We also talk to our friends or the other people working with us to tell them what we plan to do and to explain how we want to design or make the product.

Many people use the technology process every day. If you want to design and make something to solve a problem, you can also use it!

The Technology Process has 5 steps:

1. Investigate
2. Design
3. Make
4. Evaluate
5. Communicate

Whenever we do a Technology project in Natural Science and Technology, we will be following these steps!

Let's use the Technology Process to help some birds in your area! Remember you need to start by first identifying the problem and then you can start to design and make a solution!

This sounds like fun! I am excited already to see how to follow the Technology Process to design and make something!

ACTIVITY: Design and make a shelter for wild birds

HELP! THE BIRDS NEED YOU!

Many of the trees in your town have been chopped down to make space for homes and other buildings. The birds that used to make their nests in the trees now have nowhere to safely lay their eggs! There are many more rats, mice and other pests in the city because their are fewer and fewer birds to catch them! This is because many birds left to find safe places to build their nests and raise their chicks. Some of the birds that stayed behind tried to make nests on rooftops but the people did not like the mess they made on their buildings and destroyed the nests. Other birds tried to build their nests on tall radio and television towers. But then the people could not get their televisions or radios to work properly so they also broke their nests and chased the birds away. The people are complaining about all the pests that are in the city and the birds want to come back but do not have a safe place to build nests - they need your help!

In the previous section we learnt about animal homes. We need to help these birds by making homes or places for them to roost.

DESIGN BRIEF:

A design brief is a short description of what you plan to do. an example of a design brief for this project could be "Design and make an animal shelter that can be used by wild birds."

INVESTIGATE:

The next step in the Design Process is to investigate and do some research about the shelter that you are going to make. We have actually already done this in the activities in this chapter when we looked at different man-made animal shelters.

So let's get on to designing!

DESIGN:

We now need to design the animal shelter. In your groups, discuss the following questions which will help guide your design and make you think about what your bird shelter should look like.

1. What is the purpose of the bird shelter?

2. What shape and size will the shelter be?

3. How will the birds get inside?

4. What are the best materials to make the shelter from?

5. Will there be a place to provide the birds with food and water?

When we design something there are some things that the product or structure you are making need to do or some things that it cannot do. We call these specifications (what it must do) and constraints (limitations of the design).

We need to show the specifications or things that your product must do or have before we start to design or make it. You have to

make a list of all the specifications otherwise you might not make your product in the proper way.

When we list specifications and constraints, we answer certain questions. you answered some of these questions above.

Specifications

1. Purpose of bird shelter:

---

2. Size of bird shelter:

---

3. Materials used to make bird shelter:

Constraints

Some constraints for your bird shelter could be:

1. The materials used must be able to withstand the weather outside, such as wind and rain.
2. A constraint could even be that you have to design and make it in class.

Drawing the Design for the Bird Shelter

In this step you draw what you want your bird shelter to look like. You might need to make many drawings until you decide which design you want to use. It is a good idea to use scrap paper for this. Label the different parts of your design and say what material each part is made of.

EVALUATE:

Once you have a design drawing that you are happy with, you can proceed to make the shelter. We are not going to do this now. Later in the year you will get a chance to make some of the designs that you do.

For now, let's evaluate the design that you did. This means you must decide whether your product will be able to solve the problem you identified at the beginning.

To do this you go back to the problem and ask the following questions:

1. Has my design solved the problem and how?

2. Did I stick to the specifications and constraints? (Ask this question of all your specifications separately.)

3. If you changed some of the specifications, such as the size or materials, why did you do so?

4. Is there any way you think you could improve your design?

That was fun! I am going to try make my bird shelter at home and put it up outside our house!

KEY CONCEPTS

- Natural structures are made by animals, like nests and shells.
- Human-made structures are made by people.
- There are different kinds of structures, like frame and shell structures.
- Structures can have different shapes and sizes.
- Structures can be made from different materials.
- Humans can make shelters for animals, especially pets and birds.

REVISION:

1. Name four types of natural animal shelters.

2. Explain the difference between man-made and natural shelters.

3. Why do rabbits, pigeons and tuna fish have different habitats and shelters?

4. Do you think it is fair to keep a pet rabbit in a cage where it cannot burrow? Give a reason for your answer.

5. Use the table below to compare the shelters of rabbits, pigeons and tuna fish.

Criteria	Rabbits	Pigeons	Tuna fish
Where will I find the shelter?			
What is the shelter made of?			
Does the animal have to make the shelter?			
Does the animal use a naturally occurring shelter?			

I loved learning about the plants and animals that we share our world with. I hope you did too? Next term, join Tom as you start to investigate the materials that make up the physical world around us.


HOT
WET
CEMENT


Matter and Materials
and Structures

1 Materials around us

KEY QUESTIONS

- What are solids, liquids and gases?
- How can water be a solid, a liquid and a gas?
- Why does my ice cream melt in the sun?
- Why does water start bubbling in the kettle when it gets hot?
- What change of state takes place when a substance melts?
- What change of state takes place when a substance evaporates?
- Why does the amount of water on the Earth remain the same?
- What is the water cycle?

New Words

- solid
- liquid
- gas
- properties
- common properties
- fixed shape

Everything around us is made up of matter. All solids, liquids and gases in the universe are matter. Matter takes up space and has mass, this means we can weigh matter. When we use one kind of matter to make something such as a wooden or plastic chair we say the material used was wood or plastic.

1.1 Solids, liquids and gases

Materials are all around us. Some materials are solids, some are liquids and some are gases. A material will always be one of these three things. But what exactly are solids, liquids and gases?!

Let's investigate the properties of solids, liquids and gases!

When is a material a solid?

The word "property" has different meanings. We say this house is the property of Mr Mabusa (he is the owner of the house). When we use the word "property" in science we look at what makes that kind of matter special; how does it behave differently from other kinds of matter. For example when you shift a chair to another place, it will still have the same shape. This is because the chair is solid. So we can say that all solids keep their shape. We say that keeping its shape is a **property** of a solid. Let's look at some of the properties of solids.

A chair is made of solid materials. [1]

ACTIVITY: Exploring the properties of solids

MATERIALS (What you will need):

- a stone
- cloth
- paper
- a table or chair
- pen or any solids around you

INSTRUCTIONS (What you have to do):

Work in pairs.

1. Use the questions below to investigate each solid.
    - Does it feel hard or soft?
    - Does it make a sound when you knock on it?
    - Does it break easily? Can it break?
    - Can you put your finger through it?
    - Is your hand dry or wet after handling the object?

- Does it change its shape when you put it in something else?
- How would you describe the shape? Is it fixed? Does it remain the same?

2. Use the table below to fill in some of your answers about each of the objects.

3. There are some empty rows at the bottom for you to fill in any other solid objects that you might have investigated.

Object	Your observations
Stone	
Cloth	
Paper	
A table or chair	

QUESTIONS:

1. Which properties were the same (common) for all the solids you investigated?

---

2. List some other solid objects in your classroom. Give at least 4 examples.

So, we have learned that a substance in a solid form will have a fixed shape and takes up a definite space. Let's now look at liquids.

What is a liquid?

There are liquids all around you and you use them in your everyday lives. Some examples are water, paraffin, baby oil, fruit juice, petrol or methylated spirits. What are the common properties of liquids?

When a scientist wants to know more about something they set up questions and then they try to answer the questions by doing experiments.

ACTIVITY: Exploring the properties of liquids

MATERIALS (What you will need):

- water
- paraffin
- baby oil
- fruit juice
- methylated spirits
- 5 small pieces of cloth
- 5 containers for each of the 5 liquids
- 5 other clean and empty containers, such as a glass, cool drink bottle or tin
- 5 saucers

INSTRUCTIONS (What you have to do):

1. Work in groups. Each group MUST test a different liquid.
2. Select someone in your group to collect a liquid in a container from the teacher. Each group must also collect another empty container and a saucer from your teacher.
3. Answer these questions while you are studying your liquid. Write your answers in the table that follows. DO NOT TASTE THE LIQUID!

    - How does it smell?
    - Can you put your finger through it?
    - Is your hand dry or wet after feeling the liquid?
    - Can you soak the liquid up with a cloth?

4. Put a small amount of the liquid in the saucer and leave it for a while in a warm place.

    - Was it easy to pour the liquid from one container to another?
    - Can the liquid flow or spread out on a saucer?
    - How will you describe the shape of the liquid, is it fixed does it take the shape of the container?
    - Did the amount of the different liquids remain the same after leaving them in a warm place?

5. WASH YOUR HANDS AFTER HANDLING THE LIQUID.

Observation	**Answer**
What did your liquid smell like?	
Was your hand dry or wet after touching the liquid?	
Did the shape of the liquid change when you poured it into another container?	
What do you think happened to the liquid when you left it in a warm place?	

QUESTIONS:

1. Write down the safety rules for this investigation. Why must these safety rules be followed?

2. Write down those properties that were the same (common) for all the liquids investigated.

After doing this activity where we investigated the properties of liquids, we can say that a liquid:

- can flow,
- it has no fixed shape,
- and it takes the shape of the container that it is in.

This is different to a solid. Remember a solid has a fixed shape and you cannot pour a solid!

What is a gas?

Do you remember in the first term when we spoke about breathing as one of the seven life processes of living things? When we breathe, we are taking in and giving out gases. But we cannot see the gas!

Gases are a bit more difficult to understand as we usually cannot see gases. We can see places where gases are used and the containers that a gas is kept in.

Can you name any gases? What about the gas used in a stove to cook food? Have you seen the gas coming out of the exhaust of a motor car? In hospitals, there are cylinders filled with oxygen gas for patients with breathing problems. The air you breathe in has oxygen gas. The air you breathe out has more carbon dioxide gas.

Look at the following pictures of where a gas is being used.

Cooking using a gas stove. The gas is in a cylinder and is used to cook food ot.

A patient in hospital with an oxygen mask on. The oxygen gas is given to her in a tube attached to the mask. [2]

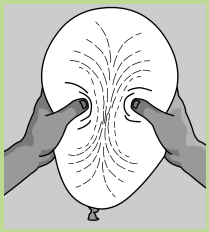
These balloons are filled with helium gas. You cannot see the gas it is there as the balloons are blown up and floating. [3]

Scuba diver with an oxygen tank on his back to breathe under water. [4]

ACTIVITY: Learning about gases from pictures

INSTRUCTIONS:

1. Study the pictures below. Each of the pictures shows a different property of a gas.
2. The properties are listed in the first column of the activity below. Decide which picture is showing the property and give it a tick. Make a tick under the right picture for each property.
3. The first one has been done for you.

Property illustrated			
A gas moves without something that pushes it - it diffuses through the air.		✓	
A gas has no definite shape and fills the container it is in.			
A gas can be pressed to fill a smaller space.			

Comparing solids, liquids and gases

The states of matter are solids, liquids and gases. We have carefully investigated these three states of matter.

Here is a summary:

Solids	Liquids	Gases
Have a definite shape	Have no definite shape	Have no definite shape
Takes up a definite space	Takes up a definite space	Takes up all the space available
Do not flow	Can flow	Can flow
 Big boulders of rock are solids.	 Milk and orange juice are liquids.	 These balloons are filled with helium gas.

QUESTIONS

On the front cover for this term for Matter and Materials, you will see the Thunderbolt kids are at a construction site for a soccer stadium. Can you see that Sophie is carrying a tray of refreshments for all of them? On her tray, there are refreshments in the different states of matter. Identify what state of matter each refreshment is.

In the next activity, we are going to study examples of different substances and sort them as solids, liquids or gases.

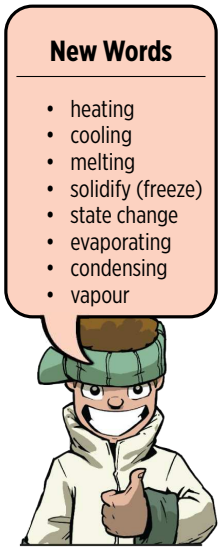
ACTIVITY: Identifying solids, liquids and gases

INSTRUCTIONS :

1. Work in pairs
2. Look at the pictures of the different substances below and decide if they are solids, liquids or gases.
3. Use the table below place a tick in the right column.

Substance	Solid	Liquid	Gas
Glass of water			
Ice blocks			
Steam from kettle			
Rock			

Lava from volcano			
Gold bars			
Wind			



1.2 Change of state

Remember that we spoke about the states of matter? These were solids liquids and gases. A substance can change from one state to another. For example, a solid can change into a liquid.

For example, water can be a liquid in your glass or turn into ice in the freezer. Ice is a solid. But what makes these substances change from one state to another?

What causes a change of state?

We know that matter can be in the solid, liquid or gas state. Let's use water as an example.

QUESTIONS

1. If you place tap water into an ice tray and put this in the freezer, what will happen to the water?

_____

2. If you now take ice cubes and place them in the sun, what happens to the ice cubes?

_____

The difference between a freezer and the Sun outside is that one is hot and the other is cold. If we place the water in a place that is cold enough, it l freezes. If we place the ice cubes in a hot place, they melt.

This is because the state of matter can be changed from one to another by adding or removing heat.

Let's read a story to try understand this a bit more.

ACTIVITY: The Story of Mashadu

INSTRUCTIONS :

1. Read the story below about Mashadu.
2. Answer the questions which follow.

Mashadu is a boy in Grade 1 at a primary school in a small village which gets very hot in summer. He loves to play soccer. After school he often goes over to The Thunderbolt School of Learning to play with the Thunderbolt Kids. They really like having Mashadu to play with them even though he is a few years younger, because he is very talented and also fun and caring. Mashadu especially likes Jojo and they play well together as a team.

One day after school, Mashadu thought he would do something nice for his friends, the Thunderbolt Kids and surprise them with ice lollies for when they were finished playing. Mashadu bought 5 ice lollies, one for himself and one for each of the Thunderbolt Kids. He put the ice lollies in a bowl and placed some ice blocks around them to keep them cool. Mashadu then ran off to join the others playing soccer.

After the game, Mashadu ran back to the bowl to get the ice lollies. But he got such a shock when he got there. They were all gone! He was so upset and started to cry. The Thunderbolt Kids saw the Mashadu was upset and ran over to see what was wrong.

"Hey Mashadu, what's wrong?! Did you hurt yourself while playing?" Jojo asked.

"No, I didn't. I bought some ice lollies for all of you as a surprise and when I came back now to get them they were all gone! I think someone stole and ate them and just left the sticks! Look!"

Mashadu cried out.

"Oh no, don't cry Mashadu! It's not your fault, and no one stole them or ate them either," Farrah said while rubbing Mashadu on the back.

"Yes, Mashadu, actually we learnt in class today about what happened to your ice lollies," said Sophie, "and I can explain it to you too. Do you see that your bowl is actually not empty? There is a liquid in it. And it also has a red colour, which was the colour of your ice lollies."

"Yes, I see that," answered Mashadu, "but then how did that happen?"

Tom then answered, "Your ice lollies melted from the heat from the air around us. Even if the sun was not so hot, they would have melted! For something to stay frozen it needs to be at a very cold temperature, like in a freezer."

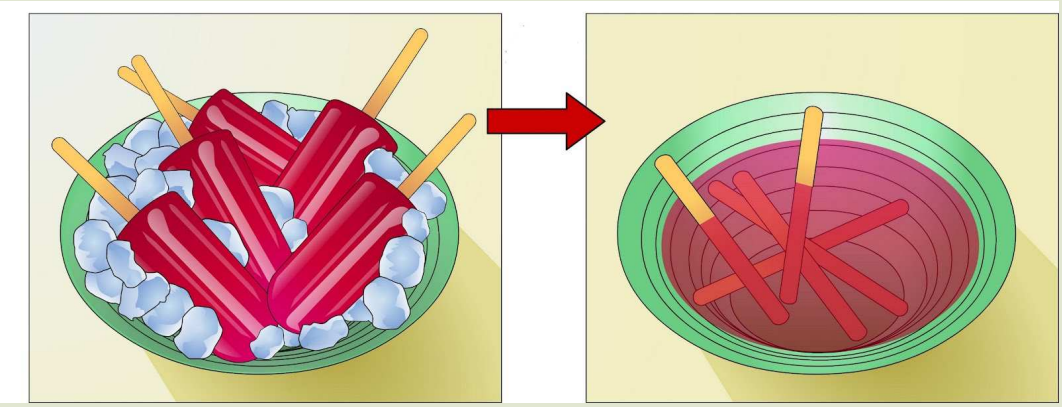
"Yes, melting is when heat causes the solid ice lollies to change into a liquid," Sophie replied, "So no one stole the ice lollies, they just melted."

"Oh ok, I see," said Mashadu, "I must be really silly not to know that!"

"No, not at all Mashadu! We only learned about it today in class and we are in Grade 4!" laughed Farrah.

"I know what we should do!" shouted Jojo, "Let's go to the tuckshop right now. I have some extra change and we can buy some more frozen ice lollies!"

They all really liked this idea, especially Mashadu who was now laughing. So off they all went, the Thunderbolt Kids and Mashadu, and bought some more ice lollies and sat under the tree to eat them.



QUESTIONS:

1. What is the name of the main character in the story?

2. What grade is he in?

3. What grade are the Thunderbolt Kids in?

4. What game are the children playing together after school?

5. When the ice lollies are frozen, are they a solid, liquid or a gas?

6. Explain in your own words what happened to the ice and the ice lollies while they were left in the sun.

7. What is the name given to this process?

8. Do you think you can reverse the process of melting? How would you do this?

9. What is your favourite type of ice cream or ice lolly?

10. If you wanted to do something nice for your friends, what would you do?

So what have we learned from Mashadu's experience with the ice lollies? The ice lollies were frozen and cold. When they were placed in the sun, they started to warm up. This heat caused a state change to take place. The ice changed to a liquid. This is called **melting.**

When Mashadu and the Thunderbolt Kids went to get new ice lollies from the Tuckshop, these ice lollies were frozen, but they were made from a liquid. The liquid was poured into the shape of an ice lolly and then they were cooled as heat was removed and they froze. When a liquid changes to a solid, this is called **solidifying.**

In the ocean, icebergs and floating ice are water that has frozen as it is so cold.
5

Now that we have read about Mashadu and his experience of changes of state, let's do some practical demonstrations in class to learn more.

ACTIVITY: Heating and cooling to cause a change of state

MATERIALS (What you will need)

- kettle
- liquid water
- glass or mirror
- gloves or towel

INSTRUCTIONS (What you have to do):

1. This activity could be quite dangerous as you might burn yourself with the hot water, so your teacher is going to demonstrate it for you.
2. Boil the water in the kettle.
3. Put a glass or mirror 30 cm above the boiling kettle (you need to wear gloves made of thick material or use a towel to avoid burning your skin)
4. Your teacher will then let you come up to see what is taking place. Make sure you have a look at the mirror.

QUESTIONS:

1. What was the change of state when the water boiled and became steam?

Evaporation takes place when heat is added to the liquid. It means the water changes from the liquid to the gas state.

We hang wet clothes out to dry in the sun. They dry as the water evaporates. [6]

The steam that comes out of the kettle is extremely hot and you cannot see it. The steam quickly cools and forms tiny droplets in the air. These tiny droplets are visible and form the "cloud" that you see. When these tiny droplets hit the mirror they cool more and form the bigger droplets which you see forming on the mirror. We say the steam condensed to form water. The change of state from the gas state to the liquid state is called **condensation**, which takes place when heat is removed.

When you leave a glass filled with cold water on the table, small droplets form on the outside. This is because there is water vapour in the air which cools down when it is near the cold glass. The water vapour in the air around the glass condenses as it changes from a gas to a liquid and forms the tiny droplets you can see.

Water droplets on the outside of a cold glass.

We now know that substances react to temperature changes around them. But where do we use what we learned in everyday life? Let us look at how milk reacts to low temperature.

Ice cream is frozen milk and cream.
7

ACTIVITY: Let's make ice cream!

MATERIALS (what you will need):

- an electric blender
- 2 litre container with lid
- 3 ripe bananas
- 2 cups fresh cream
- 2 cups of milk
- 1 teaspoon of vanilla essence
- $\frac{1}{2}$ cup of sugar

INSTRUCTIONS:

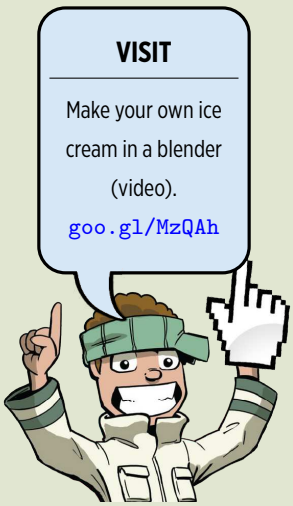
1. Watch the videos on how ice cream is made. If you do not have access to watch the videos, do not worry! We are going to make it ourselves now.
2. To make the ice cream, cut up the 3 bananas into pieces.
3. Put the bananas into the electric blender.
4. Pour the fresh cream and the milk into the blender.
5. Add the vanilla essence
6. Add the sugar.
7. You can add any other flavours you may want into the ice cream, such as chocolate pieces or strawberries.
8. Plug the blender in and turn it on. Don't forget to put the lid on!

9. Blend for about 1 minute.
10. Pour the mixture into a 2 litre container.
11. Place the lid on the container.
12. Place the container in a freezer for the night.
13. Enjoy your ice cream the next day!

QUESTIONS:

1. The ingredients were in different states (solid or liquid) before and after making the ice cream. Use the table below to record which state each ingredient was in before and after making the ice cream.

Ingredients	Before	After
Bananas		
Fresh cream		
Milk		
Vanilla essence		
Sugar		



2. What do we call the process for when a liquid changes to a solid?

_____

3. Which ingredients changed state during the process?

_____

_____

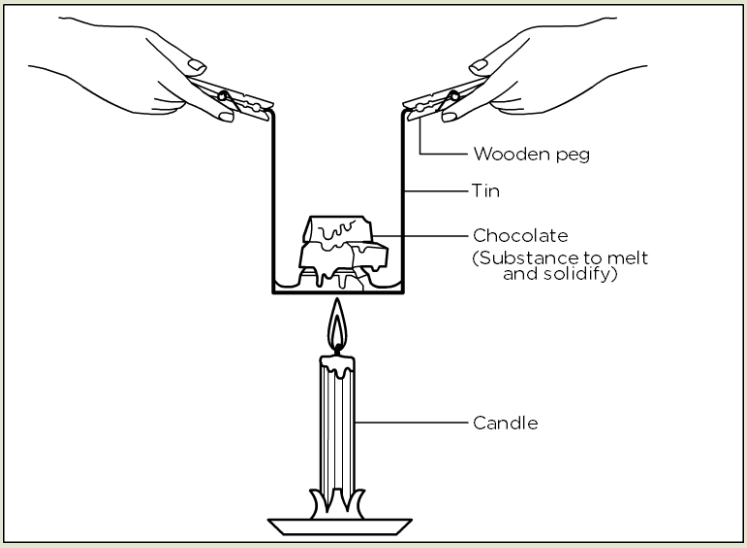
ACTIVITY: Melting and solidifying substances

MATERIALS (What each group will need):

- butter, fat or margarine
- chocolate or wax
- ice blocks or ice cream
- 3 containers which will not melt (they can be empty tins)
- 6 wooden pegs
- a candle
- matches

INSTRUCTIONS (What you have to do in your group):

1. In your groups, plan how you are going to melt and solidify the substances.
2. Look at the diagram below which shows how you can do this.
3. Be careful not to burn yourself when working with the candle! In your group, discuss the safety rules that you are going to apply.
4. Test each different substance that you have by placing it in the tin and holding it over the candle.
5. Then remove the tin from the candle and leave it on the side to cool.
6. Observe what happens to each substance and write down your observations in the table below.



Setup for the investigation.

OBSERVATIONS:

Substance	Observation before heating	What happened after heating	What happened after cooling
Butter/margarine			
Chocolate/wax			
Ice blocks/ice cream			

QUESTIONS:

1. What happened when the solids were heated by the candle?

---

2. What happened to the substances when they cooled down again?

---

3. Did the ice cream solidify again or did it remain a liquid?

Chocolate melting on a hot surface. [8]

We have seen that solids that have melted can be solidified again. So the process can be reversed or turned around again by adding or removing heat.

Let's revise what we have learned from the story of Mashadu and the activities. We have learned some new big words which may be quite confusing!

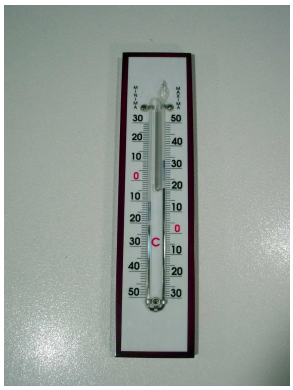
Here is a summary of the different state changes:

Change of state	**Heating or cooling?**	**We call the process**
Solid to a liquid	Heating	Melting
Liquid to a gas	Heating	Evaporating
Gas to a liquid	Cooling	Condensing
Liquid to a solid	Cooling	Freezing or solidifying

Temperature

In the previous activity, you saw that you were able to melt and solidify different substances. But, some of these substances may have taken longer to melt than others. The ice cream probably melted very quickly, but the chocolate took longer.

We have discovered that some substances melt very easy, while others need to be heated a while. Each substance starts melting at a certain temperature. This is called its melting point of a substance. Temperature is measured in degrees celsius (^{o}C) with an instrument called a thermometer.



A thermometer to measure the temperature of the air.

ACTIVITY: Drawing a bar graph

INSTRUCTIONS:

1. The table below shows the melting temperature of different substances.
2. You must draw a graph to show this information using the space below. Your teacher will help you and guide you through the steps

Substance	**Melting point in degrees celsius (°C)**
ice	0
chocolate	32
wax	62

QUESTIONS:

1. Look at your graph and decide which substance melts at the lowest temperature.

---

2. Which substance melts at the highest temperature?

---

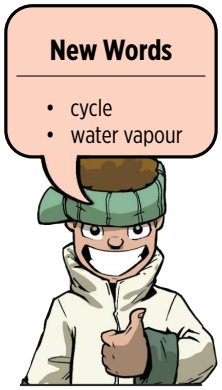
3. What is the name of the process when solid wax turns into a liquid?

---

4. What do you need to do to change liquid gas into a solid again?

---

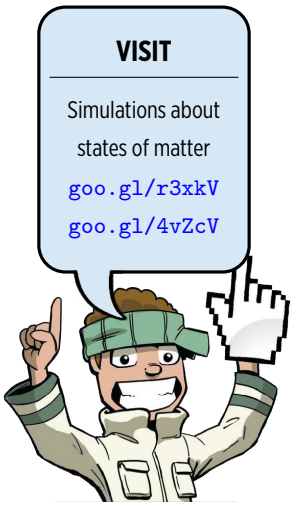
5. What process is the reverse of melting?



1.3 The water cycle

People say the Earth is the blue planet, because much of its surface is covered in water and the land forms a small part.

The Earth as seen from space[9] [10]



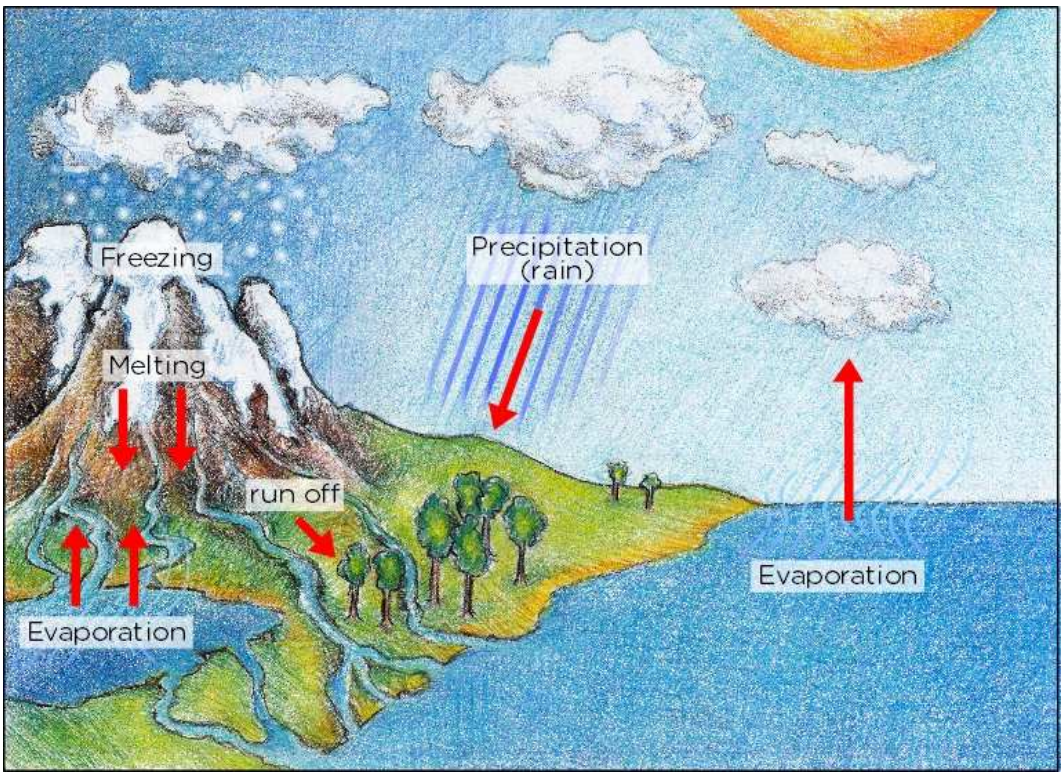
Did you know that the amount of water on Earth now is about the same as when the dinosaurs lived on our planet. How is that possible?

The answer is that invisible water vapour in the air cools and condenses to form drops of water. The reverse process takes place when water evaporates. When the water evaporates, it can not be seen anymore as it has become a gas called water vapour. This process of water always changing from a liquid to a gas and back again is an ongoing process. It is called the water cycle and this is why the amount of water on Earth stays the same.

In a cycle, a set of events (things that happen) keep on repeating in the same order.

What is the water cycle?

The water cycle refers to how water changes from one state to another in a cycle. It takes place in our whole world.



The water cycle

Let's look at the stages in the water cycle:

- The Sun's heat causes water to evaporate from the seas, streams, rivers and lakes.
- The water vapour rises into the air.
- Higher up, where the air is cooler, water vapour condenses into millions of water droplets which form clouds.
- When the water droplets in the clouds get bigger, some of the water falls as rain. The scientific term for this process is precipitation.
- In other clouds, which become really cold, the water vapour freezes and forms snow. The snow falls down to the ground and melts.
- Some runoff water that falls to the ground flows down the rivers to the seas.
- And this water will evaporate again, restarting the water cycle again.

DID YOU KNOW?

Clouds are not actually soft and fluffy! Clouds are made of water vapour which has condensed.

Look at the image again which shows the water cycle. Use the picture to explain the water cycle to your partner and see if you understand all the processes.

Let's make a model to help explain the water cycle. Models are very important in science as they help to show an important process or concept in real life. A model is something we build to represent or explain what happens in real life.

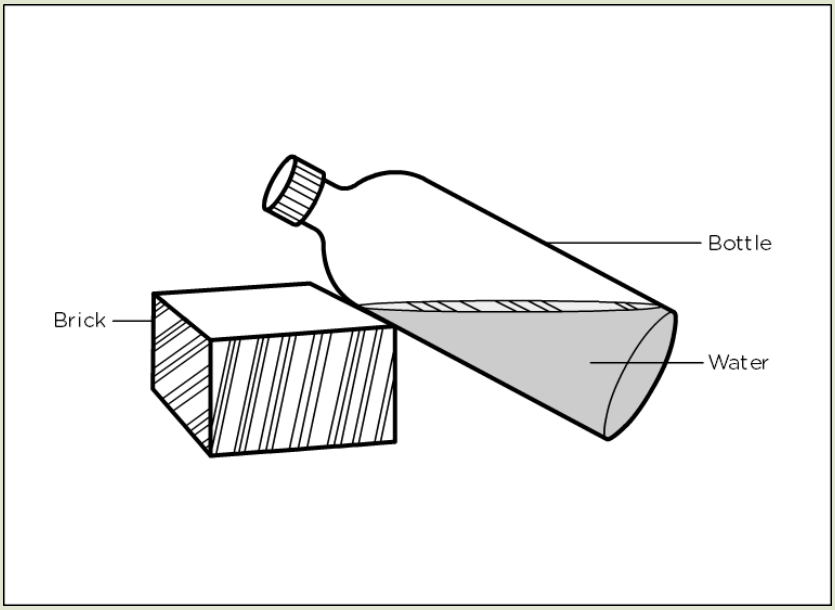
ACTIVITY: Making a model of a water cycle

MATERIALS (What you will need):

- a big plastic bottle (for example a 2 litre coke bottle)
- water
- a brick

INSTRUCTIONS (What you have to do):

1. Put about a cup of water in a big plastic bottle and put the lid back on.
2. Rest the upper part of the bottle on a brick as shown in the diagram.
3. Leave the bottle in the sun for about 20 minutes.
4. Observe what happens and write down your observations.



Setup for the model of the water cycle

QUESTIONS:

1. Which part of the model is like the sea?

2. Which part is like rain falling?

3. Which part is like the river flowing back to the sea?

4. What do we call the process where water turns into water vapour (a gas)?

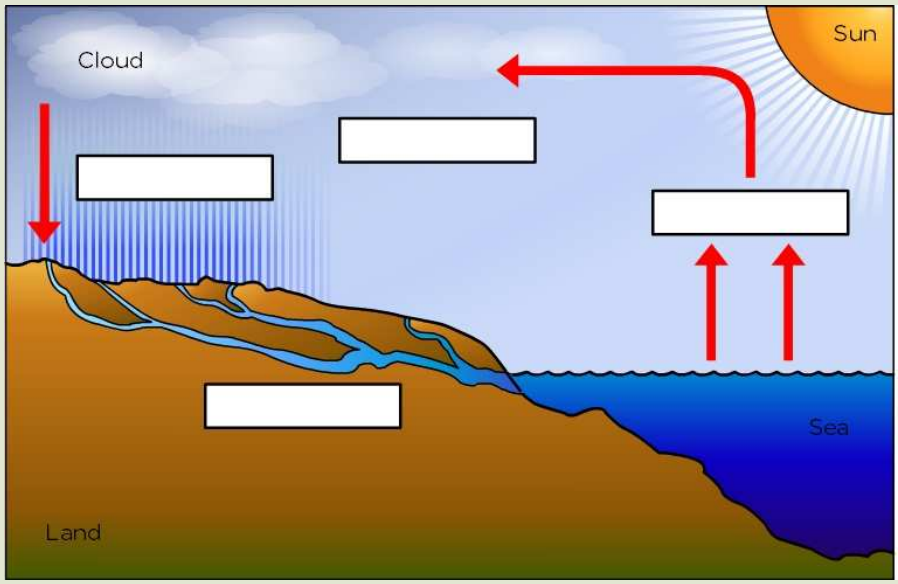
5. Can you see how the water in the bottle is going through a cycle? Write down the cycle below.

Now that we have seen a model of the water cycle, let's try drawing it.

ACTIVITY: Drawing the water cycle

INSTRUCTIONS:

1. Complete the water cycle by filling in the missing words in the spaces given.



2. Use the water cycle to explain in your own words how rain is formed. Write your answer below.

KEY CONCEPTS

- Matter is everything around us.
- Materials are matter used to make something.
- Solids are matter that has a fixed shape.
- Liquids are matter that runs or flows, can be poured, takes the shape of the container.
- Gases are mostly invisible and takes the shape of the container and spreads out / flows in space.
- A change of state is brought about by heating and cooling matter.
- Adding heat to matter causes solids to change to liquids and liquids to change to gases.
- Removing heat from matter causes gases to change to liquids and liquids to change to solids.
- Water evaporates, condenses, freezes and melts in the water cycle.

REVISION:

1. List the three states of matter.

2. Describe what happens to solid ice when it is heated.

3. Below are the definitions of each of the three states of matter. They are placed in the wrong order. Match the right letter to the number and draw a line from one to the next.

1. Has a definite shape and takes up a definite space on the surface	A. Liquid
2. Has no definite shape and spreads in the space	B. Solid
3. Has no definite shape and takes the shape of a container	C. Gas

4. What will happen to the water in a saucer if we leave it in the sun for four hours on a very hot day?

5. Explain why water droplets form on the outside of a cold cool drink can?

6. A block of ice, a brick, and a marshmallow are left in the sun next to each other on a hot day. Discuss what changes you would observe in the objects after three hours.

7. What is the reverse of freezing?

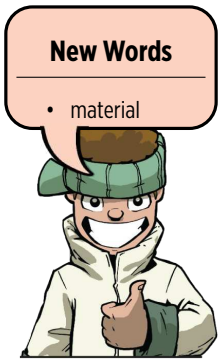
8. Do you think ice or chocolate will melt quicker if they are both left outside in the sun on a hot day?

2 Solid materials

KEY QUESTIONS

- What kinds of materials are solid objects made from?
- What is the difference between raw and manufactured materials?
- Where do raw materials come from?
- Is sand really made from glass?

In the previous chapter, we looked at materials all around us and how they can be either a solid, a liquid or a gas. Now we are going to look more closely at solid materials.



2.1 Solid materials all around us

Almost everything around us is made of materials. The shoes you wear, the pen you write with, the glass you drink out of, cellphones, a soccer ball, all your toys, the chair you sit on are all made of materials.

ACTIVITY: Investigating materials that objects are made from

INSTRUCTIONS:

1. Study the object below and answer the questions that follow.

QUESTIONS:

1. What is this object called and what is it used for?

2. What material is the object made of?

3. Do you think this is a good material for this object? Give a reason for your answer.

4. Can you suggest another type of material that can be used to make this object? Do you think this material will work better? Give a reason for your answer.

5. The object has a zip. What is the function of the zip?

6. What material is the zip made from? Do you think this is a good choice of material? Give a reason for your answer.

In the previous activity, you should have learnt that:

- We use materials to make useful objects.
- We choose materials for a specific purpose when we make the object.

In the next section we are going to see how some materials are used to make new objects. We are also going to look at why some materials are better to use for making certain objects.

2.2 Raw and manufactured materials

New Words

- raw
- natural
- manufactured
- man-made
- ceramics
- suitability
- plastic
- plantation
- wood fibre
- pulp
- recycle

Every day we use different products made from different materials. The chair you are sitting on is made of a material called wood or plastic. Wood is from a tree. Wood comes from a natural resource. It can be used as a raw material by humans to make furniture.

What does raw and manufactured mean?

Where have you heard the word "raw" before? Perhaps it was when someone was talking about your food and they said the meat or vegetables were still raw as they had not been cooked yet. When we talk about raw food, it means the food has not been processed by cooking. When we process something we do something to it to turn it into something else with different properties.

We can also talk about raw materials. This is when the material is in its natural state. It has not been processed yet. We find raw materials in the environment around us, such as the trees in a forest, or coal and oil underground. But, when this raw material has been processed, meaning humans have changed it, then we call it a manufactured material.

Examples of a raw materials are wood and plant fibre. Once wood and fibre have been processed, humans make it into paper. Paper is a manufactured material.

Wood is a raw material. [1]

Paper is a manufactured material made from wood and plant fibre.

QUESTIONS

Sheep are farmed for their wool. Wool is a raw material, but it is processed to make a manufactured material. What things are made from wool?

Raw materials in our environment are used to make other materials which are very useful. Let's look at some.

Examples of raw materials used to make other materials

- Animal skin is a raw material and is processed into leather to make shoes, handbags and belts.
- Animal wool is used to make clothes, such as jerseys and scarves
- Sand is a natural, raw material. Sand is heated to extremely high temperatures and melted to make glass.
- Clay is moulded and burned to make ceramics, such as teacups, teapots and vases.
- Coal and oil are used to make plastics, paints and fabrics.
- Wood and plant fibres are used to make paper.

Look at the pictures in the following activity which show the raw material and the manufactured material that is made from each. Raw and manufactured materials have different properties.

ACTIVITY: Describing the properties of raw and manufactured materials

INSTRUCTIONS:

1. Below are some of pictures of the raw material and the manufactured product that is made from the raw material.
2. Study these pictures and compare the properties of the raw material and then the manufactured material after it has been processed.

	
Animal skin (hide) is used to make leather.	Boots made from leather.
Describe the properties of the cow hide:	**Describe the properties of the leather:**

 Wool from sheep is used to make to make clothes.	 Wool is spun to make strings and dyed to make it colourful and will be made into clothes by knitting.
Describe the properties of the sheep wool:	**Describe the properties of the processed wool:**

 Clay being moulded into a pot.[2]	 A pot made from clay which has been painted
Describe the properties of the clay:	**Describe the properties of the ceramic pot:**

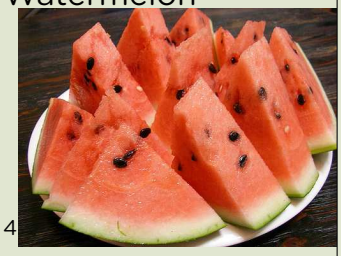
 Sand is used to make glass.[3]	 Glass is made from 70% sand which has been heated to very high temperatures.
Describe the properties of the sand:	**Describe the properties of the glass:**

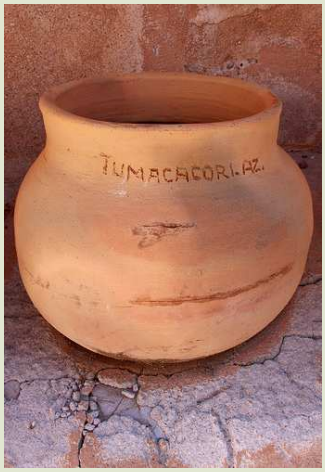
We know that materials are used to make different objects. You have now learned that some materials are called raw or natural materials and some are called manufactured or man-made materials. We can group matter according to how it is used. This grouping of matter is called classifying.

ACTIVITY: Classifying materials into raw or manufactured

INSTRUCTIONS:

1. Look at the pictures in the table below. How can we tell whether something is a raw or manufactured material?
2. Classify the objects into one of the groups, raw or manufactured material, by placing a tick in the right column

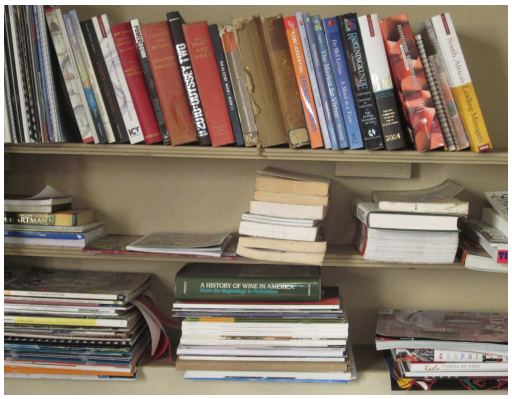
Object	Raw material	Manufactured material
Watermelon  4		
Glass 		
Feathers 		
Coins 		

Diamond 		
Pot made of clay [5] 		
Plastic bag 		

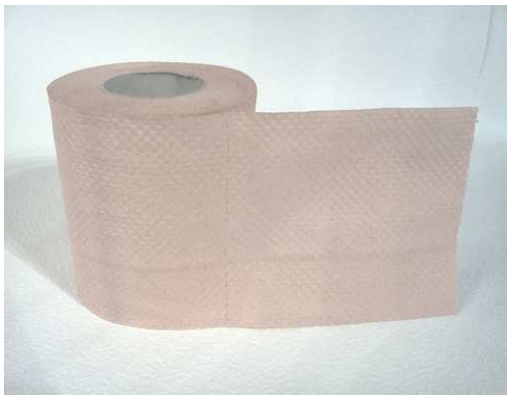
Wood  6		
Sand 		

The paper story

Can you imagine a world without paper? There would be no books, newspapers, magazines or even a sheet of music when you want to play piano. No paper means no more paper food labels or paper packaging. Not even toilet paper or kitchen wipes.



Books are made from paper.



Toilet paper is made from paper. [7]

DID YOU KNOW?

In 2011, Sappi (one of South Africa's leading papermaking companies) planted 37 million trees in southern Africa!

Paper is a very important material in our lives today. Let's find out how paper is made.

Paper is made from the wood and plant fibre from trees growing in plantations all over the world.

A tree being planted. [8]

A plantation of trees for making paper. [9]

QUESTIONS

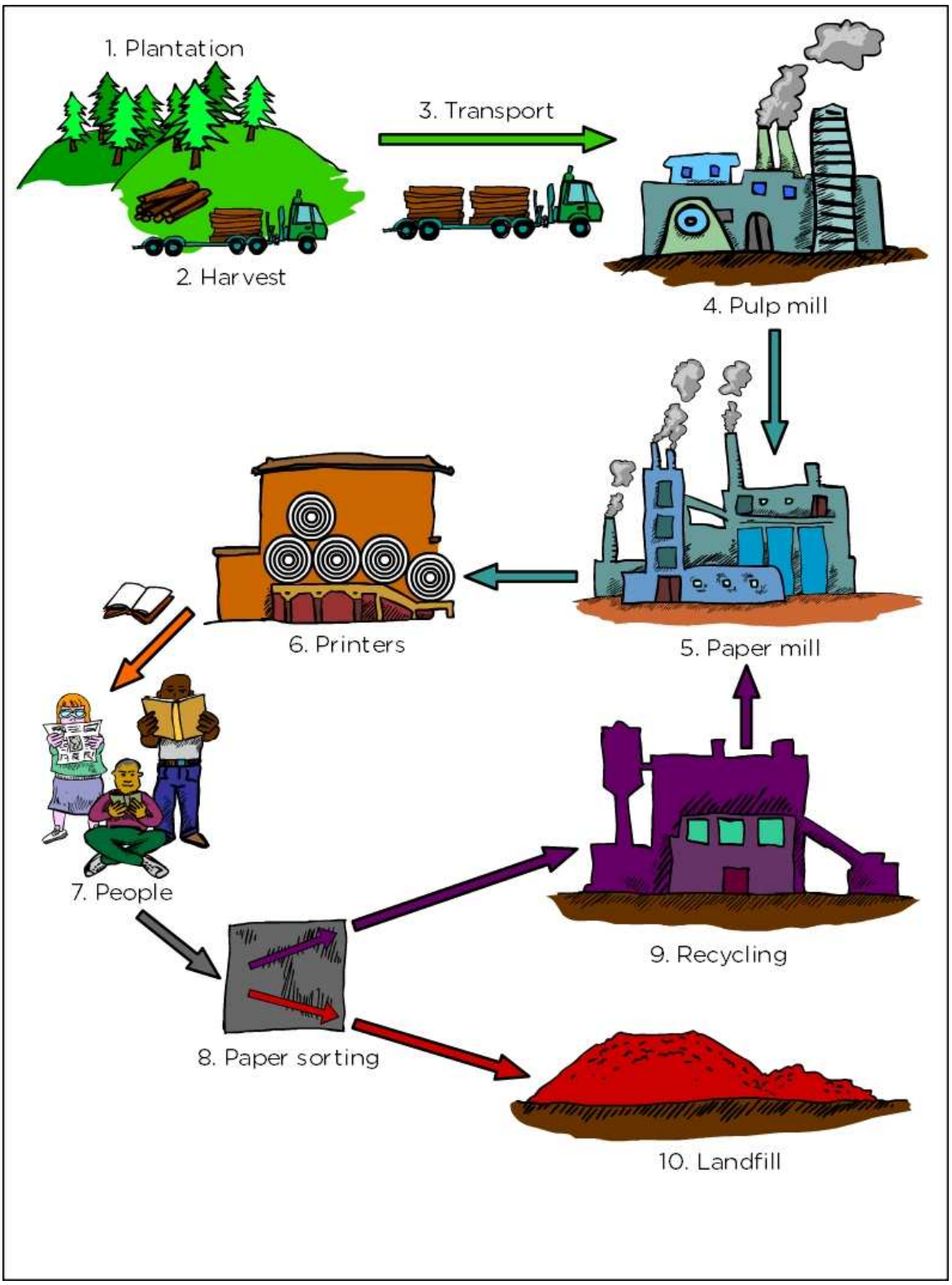
What raw material is used to make paper?

_____

A field trip with the Thunderbolt Kids!

The Thunderbolt Kids had just been learning about paper in their class. Tom wanted to know more about how plant fibres from trees are actually made into paper. So, the Thunderbolt Kids decided to visit a paper mill to learn more about the life cycle of making paper.

They were each given a diagram to help explain the papermaking process. You have also been given a copy of the diagram. The processes that take place at each stage were explained to the Thunderbolt Kids at the mill and Tom wrote down his notes. You will see his notes below for each stage - make sure you read these too!


1. Plantation
2. Harvest
3. Transport
4. Pulp mill
5. Paper mill
6. Printers
7. People
8. Paper sorting
9. Recycling
10. Landfill

Tom's Notes:

1. **Plantation**
   - Trees are planted in well-managed forests. These are called plantations.
   - The trees are allowed to grow for several years before being cut down.
   - The main types of trees used to make paper are the Eucalyptus (gum trees) and Pine trees.
2. **Harvest**
   - Once the trees reach a certain height they are cut down. This is called harvest.
   - The logs are cut into smaller pieces so that they can be transported
3. **Transport**
   - The logs are all loaded onto big trucks and transported to the mills
4. **Pulp mill**
   - The logs are first debarked, meaning all the bark is taken off, and then chopped up into smaller pieces, called chips
   - The chips are mixed with water and other chemicals to make a soft pulp
   - Pulp consists of wood fibres and water
5. **Paper mill**
   - The pulp then flows to the paper mill
   - At this mill the pulp is washed, bleached and cleaned before the paper is made.
   - The pulp is pressed and dried and then rolled or cut into sheets of paper.
6. **Printers**
   - The paper is transported to other buyers and printers in big rolls
   - These printers make the paper into other products such as books, magazines and newspapers
7. **People**
   - The finished products are transported to shops where people buy the products
   - When people are finished using the paper products, such as reading a newspaper, they throw it away in the dustbin or recycle it.
8. **Paper sorting**
   - All the rubbish paper is collected after it has been thrown away and it is sorted

- Some paper can be recycled, but some cannot, so the paper is sorted into two different groups

9. **Recycling**
    - Used paper can be collected and used again. This is called recycling.
    - The paper that can be recycled is converted into other products
    - Or it is made into recycled fibre which can then be used at the paper mill again
10. **Landfill**
    - Paper which cannot be recycled is taken to the landfill sites where it is dumped
    - Landfill sites have a negative impact on the environment, so it is best to try hard to reduce the amount of waste which ends up at landfill sites by recycling

After the field trip, Sophie was really interested in how she could set up recycling at their school to help reduce their impact on the environment. Farrah showed her arty side when she made some earrings and a cover for her notebook from recycled paper. Jojo was just happy that he had his favourite sports magazine to read, which is made from paper. And Tom was really happy that he got to learn more about the papermaking process.

ACTIVITY: The Papermaking Process

INSTRUCTIONS:

1. Read through the diagram again that the Thunderbolt Kids were given at the paper mill and the notes that Tom wrote down
2. Answer the questions below.

QUESTIONS:

1. What are some of the final products that paper can be made into?

_____

_____

2. Which type (species) of tree is mostly used to make paper?

3. What is pulp made of?

4. What does "debarked" mean?

5. What is a landfill site?

6. Arrange the processes in the process of papermaking in the correct way.
   A. Chips go into the pulp mill.
   B. Wood logs are transported by trucks.
   C. Pulp flows to the paper mill.
   D. Paper is transported to buyers who make other paper products.
   E. The pressed and dried pulp is rolled or cut into sheets as paper.
   F. Wood is harvested from trees growing in a plantation.
   G. Pulp is washed, bleached and cleaned and dried.

7. Talk to a partner about the section of the papermaking process that interested you most. Explain why you find it interesting.

8. Do you think many people work in the papermaking industry? Explain your answer.

9. Do you think the papermaking process is a long or a short process. Give a reason for your answer.

10. Name 2 of the major papermaking companies in South Africa that you know of.

We mentioned recycling as a part of the papermaking process. Recycling is a very important process as it allows us to reduce our waste and use things over again. Not only paper can be recycled. You can also recycle glass, tin and plastic.

Bins for recycling. Watch out for these types of bins in your area! [10]

DID YOU KNOW?

It takes 40% less energy to make paper using recycled paper than to use new wood fibres.

QUESTIONS

1. Is there a paper recycling project in your school or environment?

2. Why do you think we need to recycle paper?

2.3 Properties of materials

New Words

- Hardness
- Toughness
- Strength in tension
- Flexible
- Stiff
- Waterproof
- absorbent
- Scientific method
- Deform
- Indent
- Scrape

Raw and manufactured materials have specific properties. We already looked at some of the properties of raw and manufactured materials by describing them. The properties of a material help determine how it is used. For example, plastic is waterproof so some rain jackets are made of plastic to keep the rain off and keep you dry. A rain jacket made from wool or fibre would not be waterproof and you would be soaked! This is because the wool is an absorbent material (it absorbs water).

Hard or soft?

A material is described as hard when you cannot scratch it, you cannot cut it and you cannot dent it. Hardness measures how difficult or easy it is to change the shape of the material, either by denting, cutting or scratching it. A diamond is an example of a hard material as diamond cannot be scratched by other objects. In fact, diamond is so hard it is used in drill bits to drill through rocks and many other materials.

The opposite of hard is soft! Think of the wet, raw clay from the previous chapter. This clay is soft and can therefore be moulded into a new shape.

A diamond is a very hard material. [11]

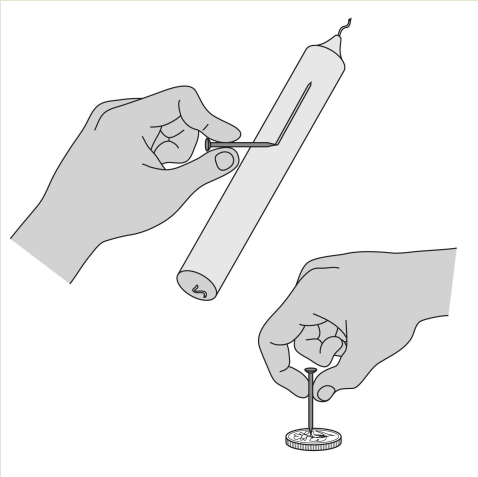
ACTIVITY: Exploring the hardness of materials

MATERIALS:

- a sharp steel nail
- a wax candle
- a metal coin
- a plastic spoon or wooden pencil

INSTRUCTIONS:

1. First make a prediction about whether you think you can scratch or dent the object. Fill your predictions in the table.
2. Scrape the point of the steel nail across the surface of the wax, the metal and the plastic



3. Fill in your observations in the table below
4. Try to indent (make a dent in) each of the objects by pushing the point of the steel nail into each of the objects
5. Fill in your observations in the table.

Material	**Prediction - can you scratch or dent the material?**	**Scraping observations**	**Denting observations**
Wax candle			
Metal coin			
Plastic rod			

QUESTIONS:

1. Which of the three materials is the hardest?

_____

2. Which of the three materials is the softest?

_____

Tough or fragile?

A material is **tough** if it is hard to break. Kevlar is used to make bullet resistant vests. This material makes it very difficult for bullets to go through.

Kevlar is an example of a tough material.

If you hit a metal coin with a hammer, there will be no or little damage. If you hit a piece of chalk with a hammer it will break into pieces. The metal coin is tough compared to the chalk. The chalk is very fragile.

Toughness measures how much energy is needed to break a material. We will test some everyday materials to decide which material is the toughest.

INVESTIGATION: How tough are some materials?

AIM: To investigate how tough different materials are.

APPARATUS (Each group will need:)

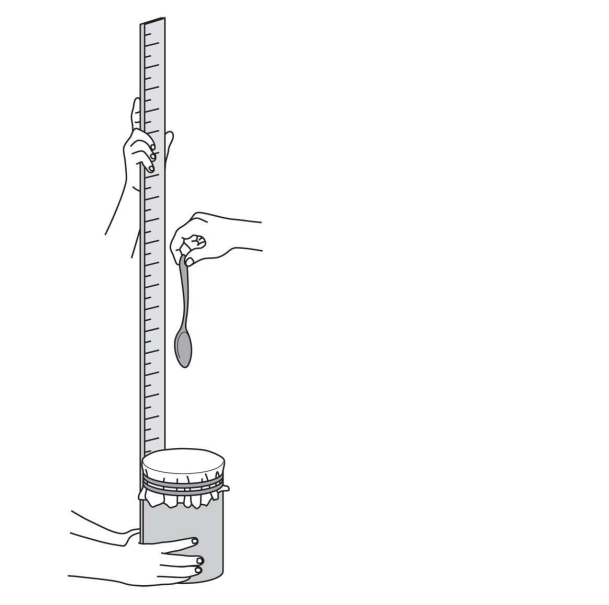
- 1 container with a wide round opening (eg. large jam tin, yoghurt container)
- 1 square sheet (20 cm by 20 cm) of each of the following materials:
  - newspaper
  - photocopy paper
  - tin foil
  - wax paper
  - plastic wrap
- 2 thick elastic bands to fit around the container

- a meter stick or tape measure
- a metal teaspoon

METHOD (Each group will have to):

1. Choose a material to test
2. Place the material over the top of the container and hold the material in place using the elastic band. Make sure that the material is flat and secure.
3. Hold the covered container next to the meter stick.
4. Hold the teaspoon by the handle 10 cm above the top of the container.
5. Drop the teaspoon straight down onto the material
6. Record your observations in the table below (Did the material dent, tear?)
7. If the material did not break repeat the experiment by dropping the teaspoon from 20 cm above the material. Record your observations.
8. Keep increasing the height from which you drop the teaspoon by 10 cm until the material breaks.
9. Remove the broken material and replace with a different material.
10. Repeat the experiment.

Setup:



RESULTS AND OBSERVATIONS:

Record your measurements and observation in the table. :

Material	Final drop height (cm)	Observations
newspaper		
photocopy paper		
tinfoil		
wax paper		
plastic wrap		

CONCLUSION (What you learnt):

The energy of the teaspoon when it hits the material depends on the height from which you dropped the teaspoon. The greater the height the greater the energy. The toughest material only broke with the teaspoon with the greatest energy.

1. Which material broke first and which material broke last?

---

2. Which material needed the least amount of energy to break?

---

3. Which material took in (absorbed) the most energy before breaking?

---

4. Which material was the toughest?

Stiff or flexible?

Stiffness and flexibility are ways of describing how an object behaves when a force is applied to it. A stiff material will not bend when you apply a force (push on it). But a flexible material will bend. When builders choose materials for building structures, sometimes they need flexible materials and other times they need stiff materials.

QUESTIONS

Fill in the table with your ideas of stiff or flexible materials and where they could be used. Look around your classroom or home and find 3 more materials which you must add in the empty lines and also classify.

Material	**Stiff or flexible**	**Where would material be useful?**
rubber		
glass		
wood		
plastic material		

Case study: The flexibility of rulers

The Thunderbolt kids use rulers a lot in class. Their teacher likes them to use rulers to draw straight lines so that their work is neat. Tom needed a ruler as his was broken. Tom noticed that his was broken and so was Farrah's, but Sophie's and Jojo's rulers were not broken. Tom also observed that each of them had rulers made of different materials, either wood, plastic or metal. Tom thought that maybe the type of material that the ruler was made of might influence whether it would break or not. Tom asked his teacher if the material of the ruler made a difference to whether the ruler would break or not. Their teacher suggested that the whole class do an experiment to test the flexibility of the different rulers by doing a science investigation. Science investigations are used to answer questions!

QUESTIONS

1. What did Tom **observe**?

---

2. What was the **question** he wanted to answer?

---

3. Why did the class do the experiment? This is the **aim** of the experiment.

---

4. What do you think the answer is to the question in number 2?

Let us now try answer the question by doing a science investigation.

INVESTIGATION:

Which material is the most flexible for a ruler?

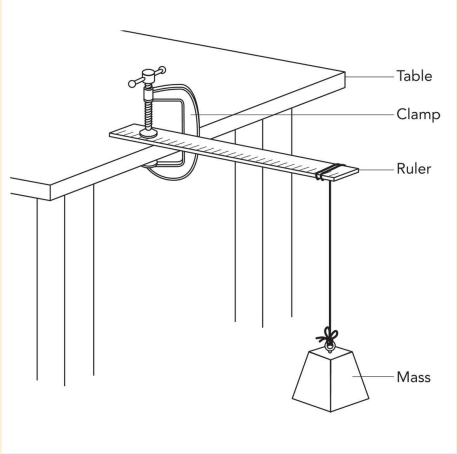
Teacher note: It is probably best to test the experiment yourself first to see if the 500g mass is sufficient to cause the rulers to bend. If not, you might need a bigger or smaller mass. Also, if you do not have a clamp, an alternative could be to rest a very heavy object on the end of the rulers such as some books or a pot plant.

APPARATUS (What you will need):

- 30 cm plastic ruler
- 30 cm wooden ruler
- 30 cm metal ruler
- 500 g mass
- string
- clamp

METHOD (What you have to do):

1. Set up the apparatus as shown. The ruler must be clamped on to the end of a table.
2. Measure how far the mass pulls the end of the ruler down and record the distance in the given table.
3. Clamp the next ruler in exactly the same position and measure how far the mass pulls the end of the ruler down.
4. Repeat with the last ruler



RESULTS (recording what you observed and found out):

Type of Ruler	Distance moved down by the end (cm)
a.	
b.	
c.	

1. Which type of ruler allowed the mass to move the furthest?

2. Which type of ruler allowed the mass to move the least distance?

3. If the mass is able to move down, then it means the ruler has to bend. We have said that the measure of how much something can bend is its flexibility. Which ruler do you think is the most flexible and why?

CONCLUSION (what you learned from the results):

What did you learn from this investigation? Provide an answer to your original question.

From your own conclusion, explain to Tom how you decided which ruler is most flexible.

The class was so excited after doing the experiment to advise Tom which ruler to buy, that they suggested doing another experiment to test how the most flexible ruler behaves when different masses are hung on to one end of it.

INVESTIGATION: Investigating the flexibility of a ruler

APPARATUS (What you will need):

- 30 cm flexible ruler
- clamp
- string
- any ruler
- six (6) 100 g mass pieces
- graph paper

METHOD (What we have to do):

- Use the most flexible ruler and set up the apparatus as in the previous experiment.
- Hang a 100 g mass piece on the end of the ruler. Use any other ruler to measure how far the end drops down. Record the distance dropped from the start in the table.
- Add another 100 g mass piece and record the total distance the end drops down.
- Repeat step 3 until 600 g are hanging from the end of the ruler.

RESULTS (what you observed):

Mass (g)	Distance dropped from start (cm)
100	
200	
300	
400	
500	
600	

Use the results from your table to plot points on graph paper. We decided to change the mass hanging to the end of the ruler. With each mass the distance dropped changed. When plotting a graph the quantity we chose to change (in this experiment, we changed the the mass) is plotted on the x-axis.

- Draw the x-axis, label it and choose the scale.
- Draw the y- axis, label it and choose the scale.
- Give your graph a heading.
- Draw a line graph using your plotted points to guide you.

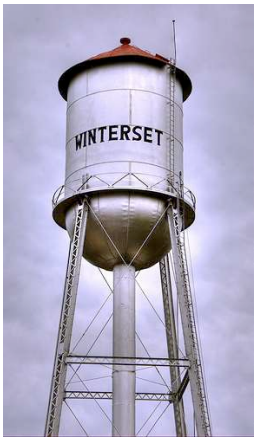
CONCLUSION (what you learned):

1. Which mass piece made the ruler bend the most?

2. Which mass piece made the ruler bend the least?

3. What can you conclude about the distance the ruler moves (bends) and the mass that is hung from the end?

Extension: Strength in tension



An example of being strong in compression [12]

Some situations require that materials be strong in compression (be able to withstand pushing forces) and other situations where materials need to be strong in tension (be able to withstand pulling forces).
The vertical (upright) steel poles of the water tower that are supporting a great weight have to be strong in compression in order to hold up the weight of the water tank.

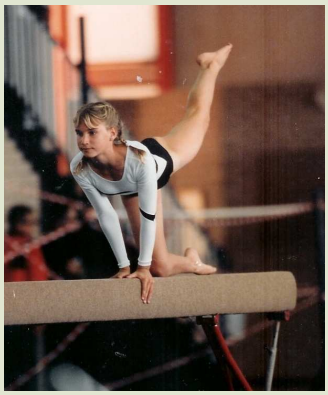
The rope supporting the bungee jumper needs to be strong in tension to ensure that the rope does not break and that the jumper survives his experience.

An example of being strong in tension [13]

ACTIVITY: Identifying different materials that are strong in tension

INSTRUCTIONS:

1. In each of the following scenes, identify the material that is strong in tension (pulling forces).

Scene	Material that is strong in tension
1. A person carrying a plastic shopping bag full of groceries  14	
2. A gymnast on a beam 	

3. A child on a swing [15] 	
4. The cable car on its way to the top of Table Mountain 	
5. A parachutist falling under a parachute 	

When deciding which material to use, it is important to consider the type of material, the size of the material, the shape of the material and the forces the material will experience.

2.4 Different materials for the same object

The *use* of the object determines the type of material it should be made of. Imagine a bicycle with wooden wheels. Do you think the wheels will turn and work as well as steel and rubber? Materials are chosen and used for the *properties* they have.

ACTIVITY: Identifying different materials

INSTRUCTIONS:

1. Look at the pictures of different chairs below . Even chairs can be made from many different materials (plastic, wood, metal, canvas, etc) or a mixture of more than one material.
2. Identify the types of materials that each chair is made from.
3. Write down where that material comes from.

Chair	Main materials used	Where the material comes from
 16		
 17		
 18		

 19		
 20		

Similar objects, such as balls used in sport, can be made from very different materials, depending on what the object is used for. Let's have a look in the next activity.

ACTIVITY: Activity: Linking different materials with the purpose of the object

INSTRUCTIONS:

1. Work with a partner to complete the activity below.
2. Study the pictures of the balls and then answer the questions.
3. If you have some of these balls, study each one by rubbing it, pressing it and feeling the texture.

Ball A	Ball B
	

QUESTIONS:

1. What sports are these balls used for?

2. Each ball is made from a different material. What are these materials?

3. Observe and then describe the properties of the material which is used in each ball.

4. Why do you think the material was chosen for each ball?

KEY CONCEPTS

- Raw materials are those which have not been processed and they come directly from natural products.
- Manufactured materials have been made from raw materials
- Raw and manufactured materials have specific properties
- If a material is hard, it is strong and tough to scratch or break
- If a material is stiff, it is firm and does not bend easily. Stiff is the opposite to flexible.
- Other properties to describe materials are: strong, weak, light, heavy, waterproof and absorbent.

REVISION:

1. Match the columns below with the raw material and the manufactured material that it is made into:

Raw material	Manufactured material
1. Sand	A. Ceramics
2. Clay	B. Leather
3. Coal and oil	C. Glass
4. Animal wool	D. Paper
5. Wood and plant fibre	E. Plastic
6. Animal hide	F. Fabric

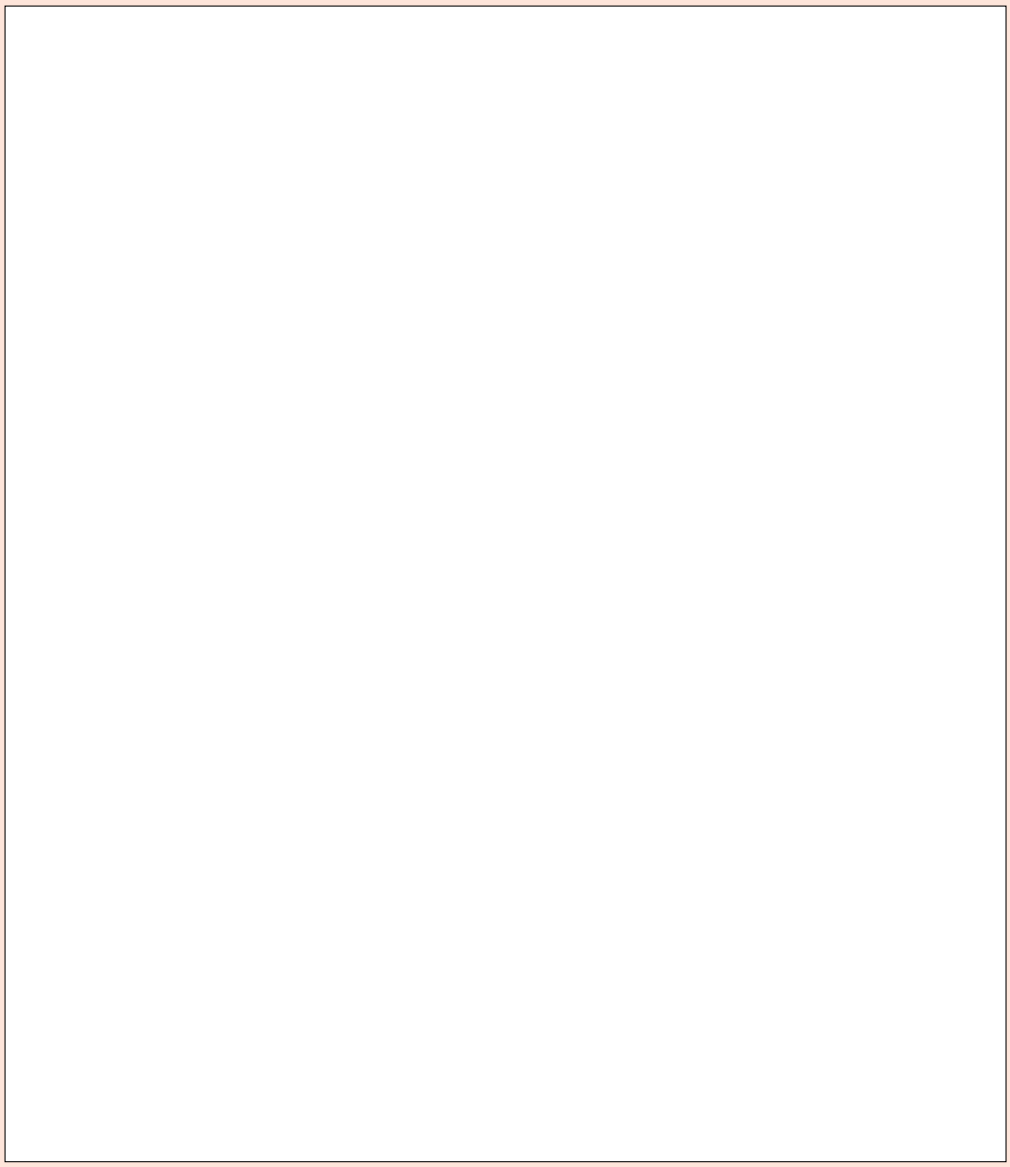
2. What is the term used for a material which is not flexible?

---

3. What is the term used for a material which is not waterproof?

---

4. Choose three materials that you would use to build a chicken run (an enclosed yard for keeping chickens). State at least two properties of each material and how those properties would help in making your chicken run to be safe from animals and weather elements. Use the space below to draw a table for your answers.

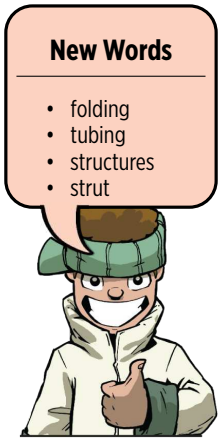


Now that we've learned about materials, we can learn how to make them stronger!

3 Strengthening materials

KEY QUESTIONS

- Which shape of pillar is the strongest?
- Which ways are used to strengthen materials used in buildings?
- What is the purpose of folding, tubing etc. in the building structures?
- How can triangles strengthen structures?
- Where in everyday life do we find examples of folding, tubing and braces?
- What is a strut and where is it used?



3.1 Ways to strengthen materials

There are different ways to strengthen materials to make a stronger structure. We can do this by changing the shape of the material. You may think that the shape may not make that much of a difference, but let's have a look.

Which shape is stronger?

ACTIVITY: Explore different ways to strengthen paper

MATERIALS:

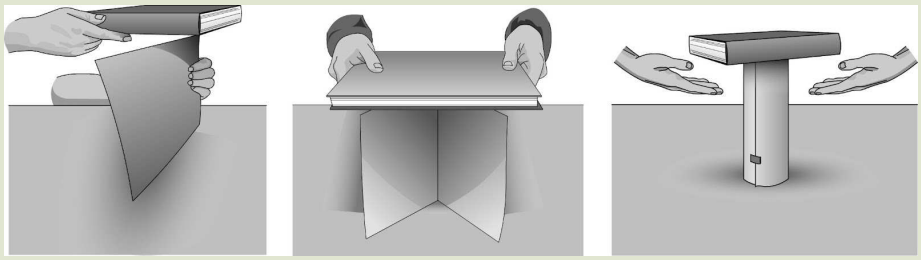
- Up to 5 sheets of A4 paper for each group
- Pieces of sticky tape
- A number of identical or similar size books for each group

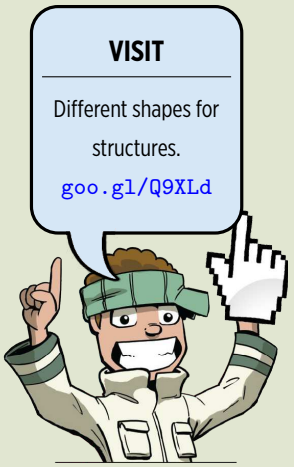
INSTRUCTIONS:

1. In groups of 4, investigate different ways of using your paper sheets to balance a book.
2. Look at the pictures below for some ideas.
3. Use a piece of sticky tape if you need it.
4. How many different ways can you find of balancing a book

more than 10 cm above the desk or floor, using only 1 sheet of A4 paper? You can try this on your own or in a small group.

5. Once you think that you have found all the ways you can do it, choose a member of your group to report back to the rest of the class on the ways that you have found.
6. With your teacher's help, show each different method side-by-side on a table or on the floor at the front of the class.





QUESTIONS:

1. Could you balance a book on just a single flat piece of paper?

2. Which shape is the strongest? Why do you think so?

What did we learn from doing this activity? Materials can be made stronger by changing their shape. An example is rolling the paper into pillars. Pillars can be circular, triangular or square. Which one do you think is the strongest?

Tom has a pile of books next to his bed at home. He wants to make a stand for these books so that his room looks a bit neater. He thought about making a stand using materials he can easily get hold of, such as paper. His idea is to make 4 pillars and then place a cardboard sheet on top on which to place his books. But, Tom does not know which type of pillar would be the strongest - triangular, circular, or square.

Let's help Tom and do an investigation to find out which shape of pillar is the strongest for him to make a book stand.

INVESTIGATION: Which pillar is the strongest?

AIM:

1. Write down what you think the aim is for the experiment.

_____

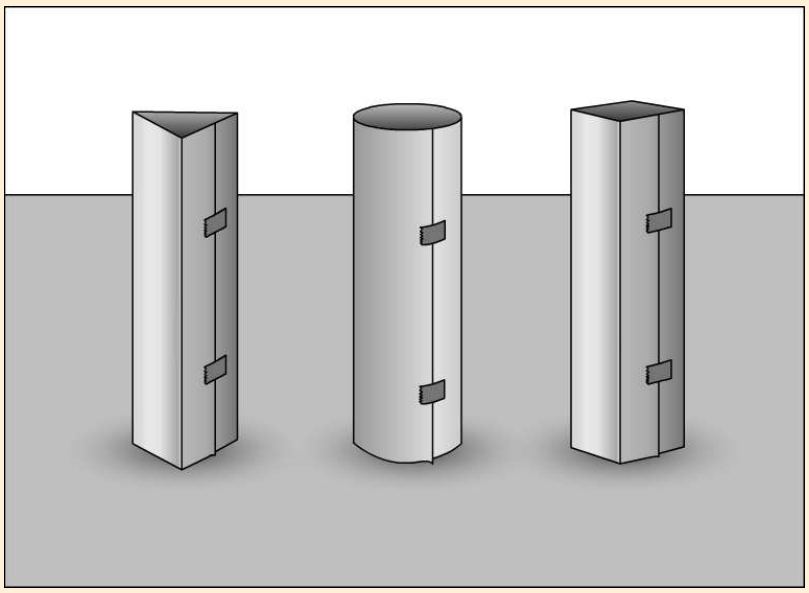
_____

APPARATUS

- four sheets of A4 paper
- scissors
- sticky tape
- a piece of cardboard to form a platform as the lid of a box
- a number of the same type and size of books

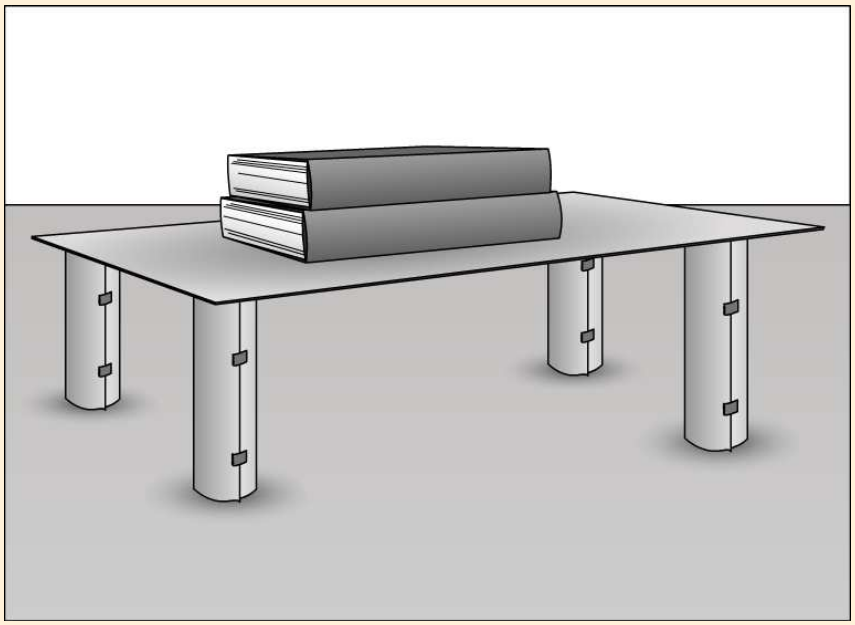
METHOD:

1. Each group will make and test a different pillar, either circular, triangular or square. Look at the image below to see how to make the different shaped pillars.



Triangular, round and square paper pillars.

2. In your group, make 4 of the same pillars out of the 4 sheets of paper (one sheet per pillar).
3. You can use sticky tape if needed. Check the amount with other groups so that you all use the same amount, otherwise it would not be a fair test.
4. Put a platform of cardboard on the folded pillars as in the picture below.



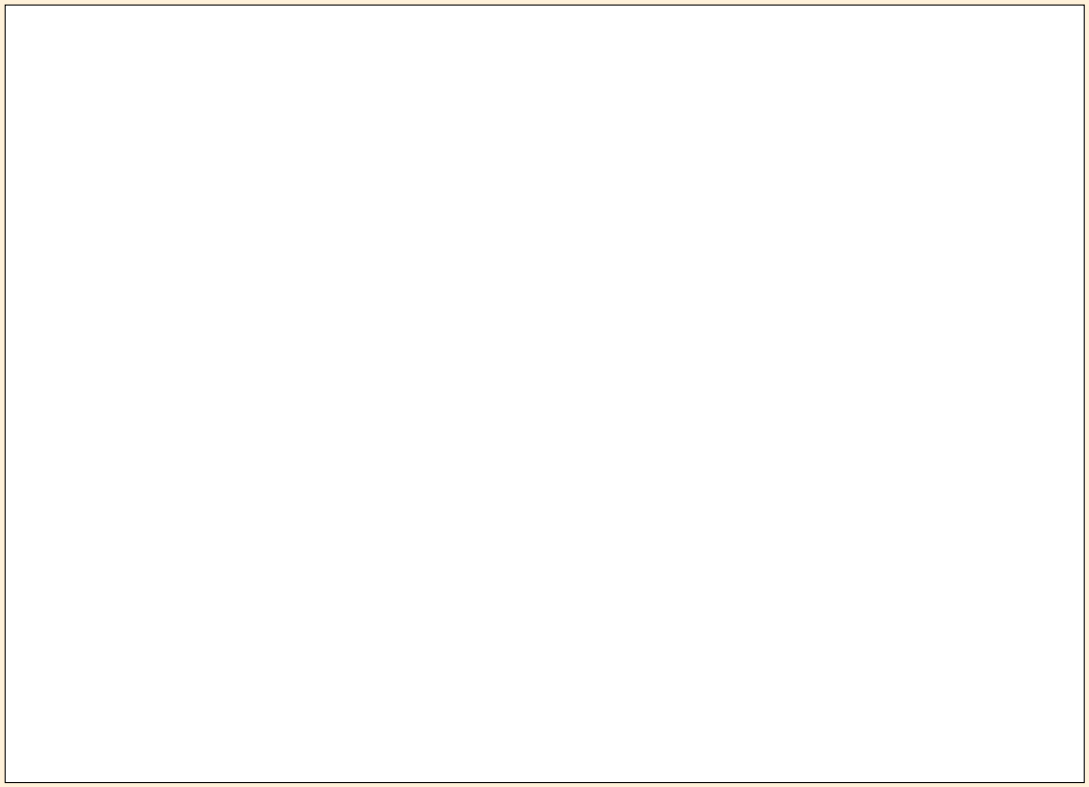
A platform for the books using 4 circular paper pillars

5. Now go round to each group as a class and test the structures.
6. Add books (one-by-one) onto the platform. Use the same books for each group and place the books on in the same order each time.
7. Record the number of books that each structure can hold before collapsing on the table below.

RESULTS:

Groups	**Number of books**
Circular pillars	
Triangular pillars	
Square pillars	

Now draw a bar graph of your results. A bar graph is used to represent your results in a different way. Your teacher will guide you through the process.



CONCLUSION:

What is your conclusion from this experiment? Which shape of pillar is the strongest?

_____

_____

QUESTIONS:

1. Which shape pillar would you tell Tom to use for his book stand?

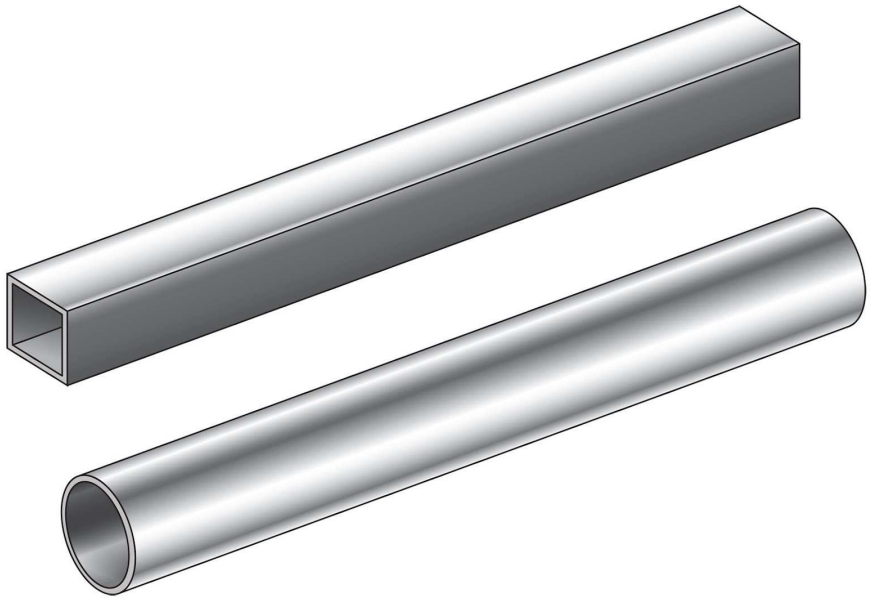
_____

2. How did all the groups make sure that the experiment is a fair test? In other words what did you, the learners in your class, make sure was the same in all the groups?

Tubing and Folding

Materials are strengthened by shaping them into a tube (tubing).

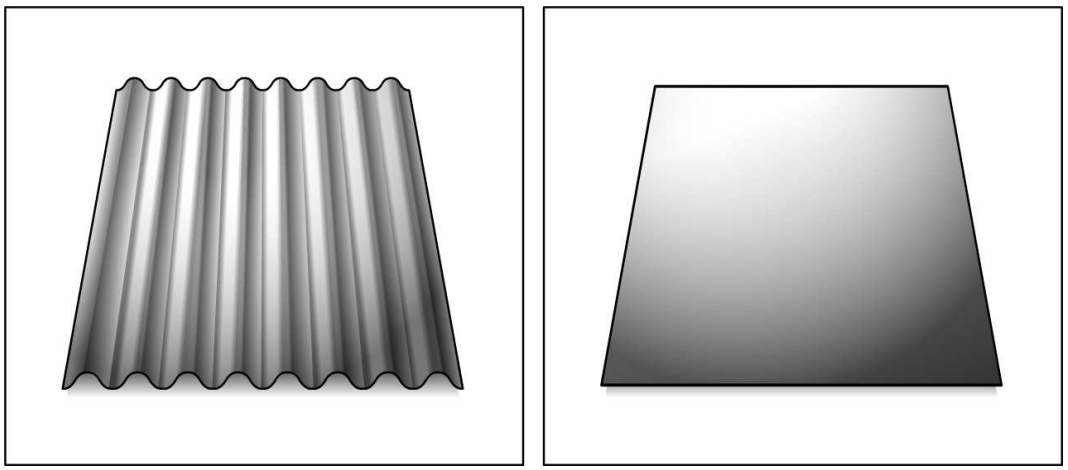
Tubing is often used to make frames and for supporting weight. The tube can be in a number of shapes, as we saw in the investigation. It can be circular, square, triangular or even in a U-shape.



Square and round tubing.

When exploring different ways to strengthen paper you discovered folding the paper also helped to strengthen it. Corrugated cardboard and bubble wrap plastic are examples of strengthened folded materials .

Corrugated iron is another example of how folding makes a material stronger. Look at the picture below of a sheet of corrugated iron and a flat sheet. Corrugated iron is much stronger which is why it is used for the roofs of some houses.



Corrugated iron and a flat sheet of iron

ACTIVITY: What is my school made of?

The Thunderbolt Kids need to investigate the uses of different materials in different schools. They have asked your help with your school.

INSTRUCTIONS:

1. In groups of 4 you need to investigate the different materials used in the buildings and structures in and around your school.
2. Look particularly for materials which have been tubed or folded, and for the use of struts and braces.
3. Record your observations in the table below.
4. An example has been provided:

Structure	Material	Ways to strengthen (Folding, Tubing, Triangulation)
Roof	Corrugated iron	Folding

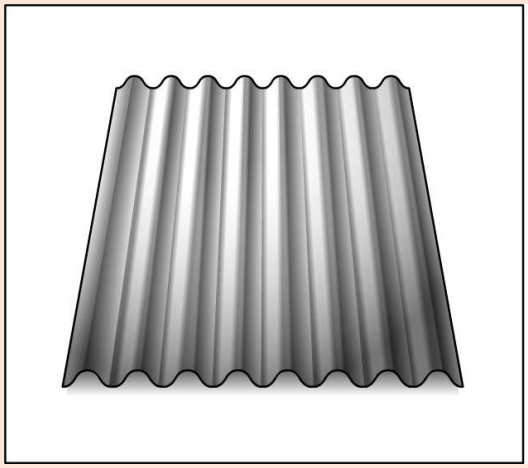
KEY CONCEPTS

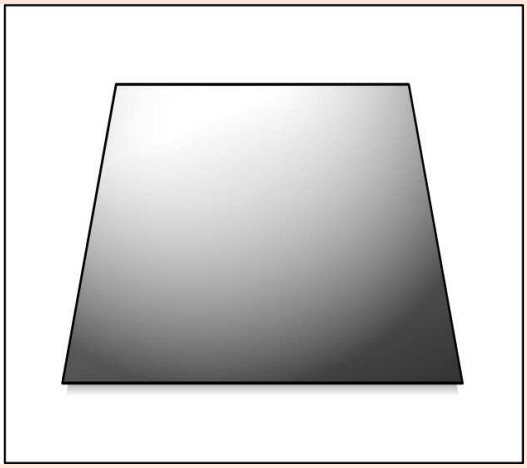
- The strength of structures can be increased by changing their shape, using methods such as tubing and folding.
- Shapes of structures can be circular, triangular or square.
- Braces across corner joints in structures increase their rigidity and strength.
- Struts are used to strengthen or support structures.

REVISION:

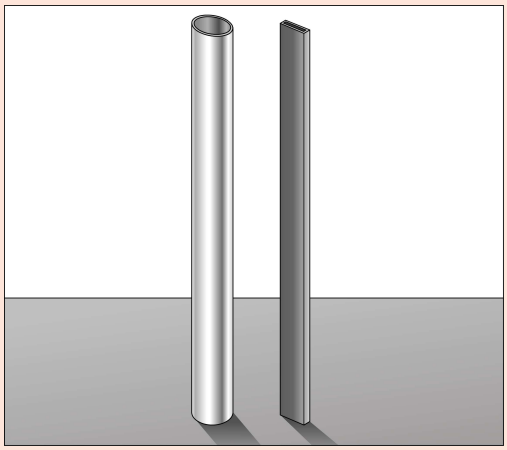
1. Name some ways to strengthen paper to make a stronger structure.

2. Choose which piece of metal below would be better to use for a roof, and explain why.

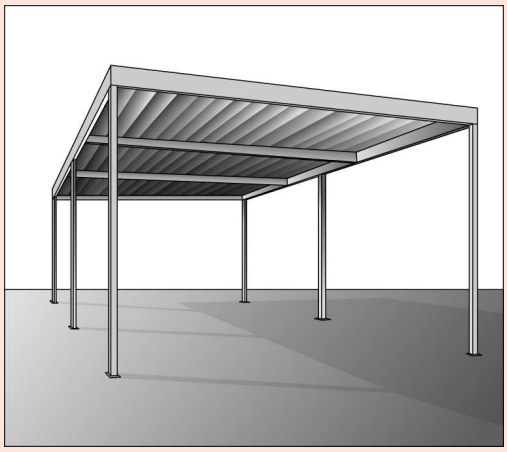




3. Which piece of steel shown in the picture would you use as the stand for a basketball hoop? The flat piece of steel or the circular tube? Why?



4. The upright poles of the carport shown in the picture are made of square tubing. Give two good reasons why they are not just made of solid steel the same size?



4 Strong frame structures

KEY QUESTIONS

- What are structures and what are their purposes?
- What is a strut? Where are struts used?
- How are struts used in building traditional homes?
- Which materials are used to construct traditional homes?
- Which materials are used to construct modern homes or buildings?
- Where do we find struts in the human body?

New Words

- strut
- stable
- member
- columns
- roof truss
- skeletons
- pylon
- crane

4.1 Struts and frame structures

In the previous chapter we saw how to strengthen a material to build a strong structure, such as folding and creating tubes. Now we want to look at how we can strengthen a structure. A structure is something that is arranged in a specific way and consists of different parts. A jungle gym is an example of a structure. It has many different parts such as beams, ropes, and bars.

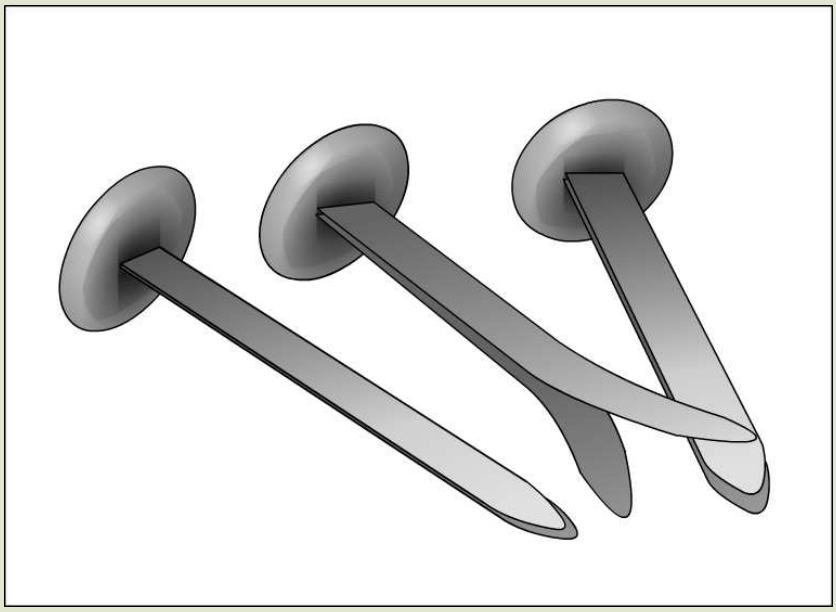
A jungle gym is a type of structure. [1]

A structure is made of different parts. The way we put these parts together can make a structure strong or weak. Let's have a look at ways to join parts together.

ACTIVITY: Exploring ways to make a strong structure

MATERIALS:

- 7 cardboard strips, all the same length
- 10 - 12 paper fasteners - e.g. split pins
- A hole punch

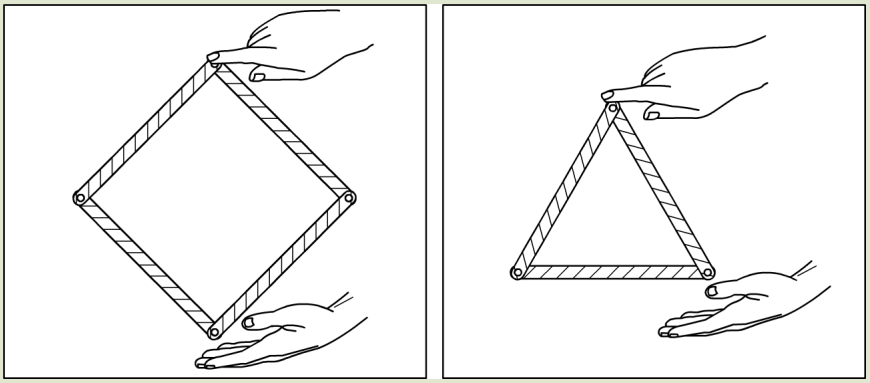


Split pins

INSTRUCTIONS:

1. You are going to make different structures using the pieces of cardboard
2. Make holes at both ends of each strip.
3. Join the strips into a square and a triangle. Use the paper fasteners (split pins) to join the strips together at the corners.
4. Now test each of the shapes by pressing two corners together as in the picture below (don't force them). Watch what happens. Which shape is easy to "squash"?

5. Cut a longer strip of cardboard which will reach from one corner of the square to the opposite corner, punch holes in it in the correct places, and add it onto the square.
6. Now press two corners together and see what happens.



Press on the square and triangle shapes as shown here.

QUESTIONS:

1. Which shape lost its shape (collapsed) when you pressed on the corner?

---

2. How can we strengthen the shape that collapsed?

---

3. How many shapes are formed when the shape is strengthened with the extra piece of card?

---

4. What is the name of this shape?

---

5. Which shape do you think is the strongest?

We saw in the last activity that you can make a shape stronger by putting an extra piece in place. For example, the square was much stronger after you placed an extra piece of card diagonally from one corner to the opposite. This extra diagonal piece is called a strut. The other pieces are also called struts and together they all make up a strong, stable frame.

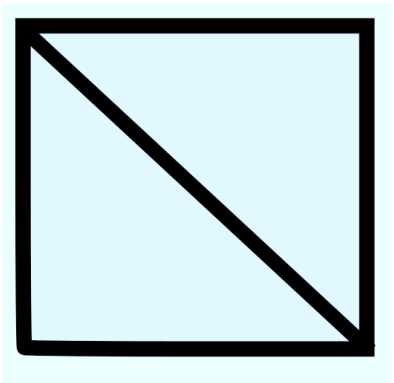
A roof in an airport where the structure is made stronger by using triangle shapes which are very strong.

The frame is the structure which supports the other parts. The struts strengthen the frame structure when joined in particular, stable shapes.

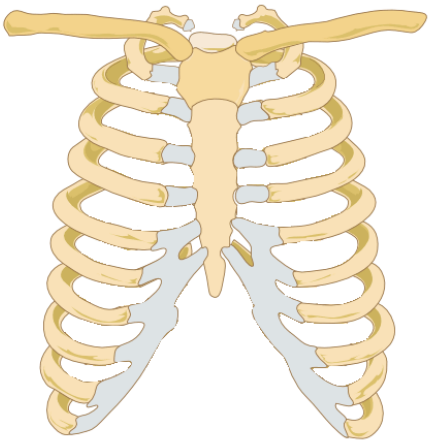
A frame is a rigid support structure that gives shape and forms support for its parts. The word rigid means stiff, not bending or changing shape. Every building, vehicle, and piece of furniture has a frame structure.

QUESTIONS

There are five struts making up this frame. Label all 5.



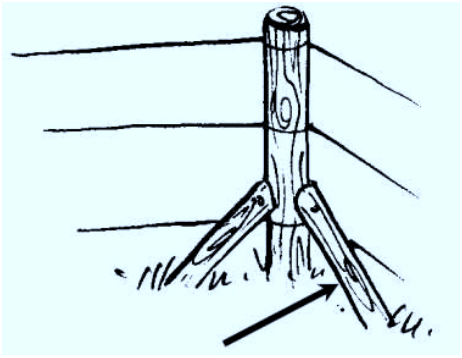
Did you know humans also have a frame structure? Can you guess?! It is our skeleton! Our skeleton consists of bones which make up the frame to support all our muscles and organs. Look at the picture below of the rib cage. It is a perfect example of a frame structure. The frame structure of the rib cage protects all the organs inside, such as the heart and lungs.



The rib cage is a frame structure.

A strut is a part of structure that will support or hold another strut in place. It can be a rod or a bar. A strut is designed to withstand compression. The picture below shows how wooden struts are used to prevent the fence from collapsing.

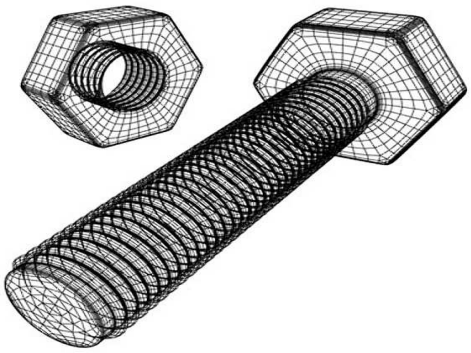
QUESTIONS



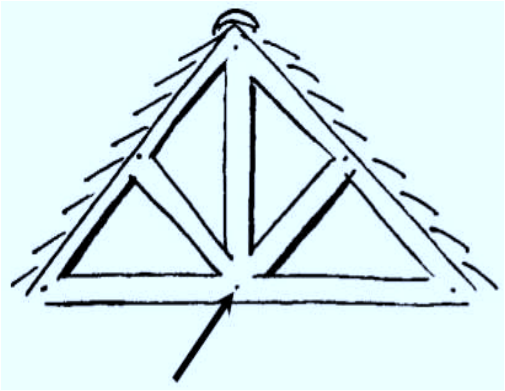
The strut in this fence must be strong and solid to give the fence stability.

Study the picture of the struts in the fence. What properties do you think the struts need to have to do its job? For, example can the strut be made of something soft? Can the struts be flexible?

A tie is a connector that is designed to withstand tension, for example, a nut and bolt.



Nuts and bolts are ties that connect two parts together.



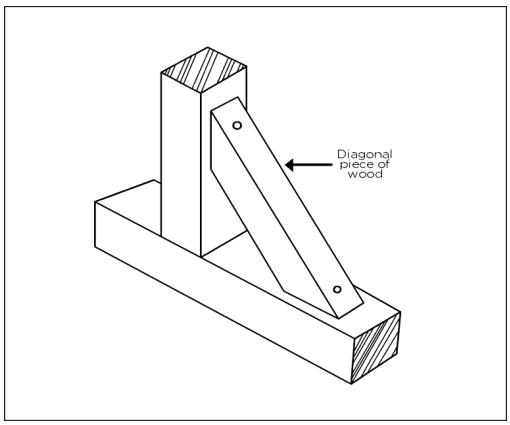
The arrow shows the bolt connecting the struts together.

A guy is designed to withstand tension. A guy can be a rope, chain or a single wire. For example, when you put up a tent you use guy ropes to hold down the tent.

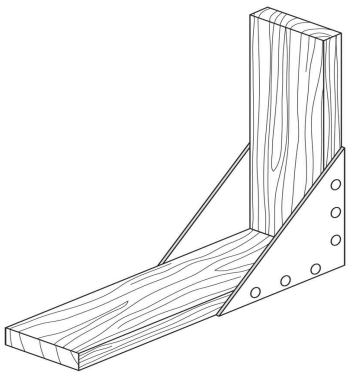
A chain is an example of a guy [2]

Twisting many wires together to make a guy even stronger.[3,4]

Corners of rectangles are often weak points in structures, where the structure can bend and collapse like the square in the investigation you did in the previous unit. Triangles are strong shapes, which do not collapse easily. By putting another support (called a brace) across a rectangle's corner to make a triangle, the corner is made much stronger.



A diagonal brace on a corner where two pieces of wood meet

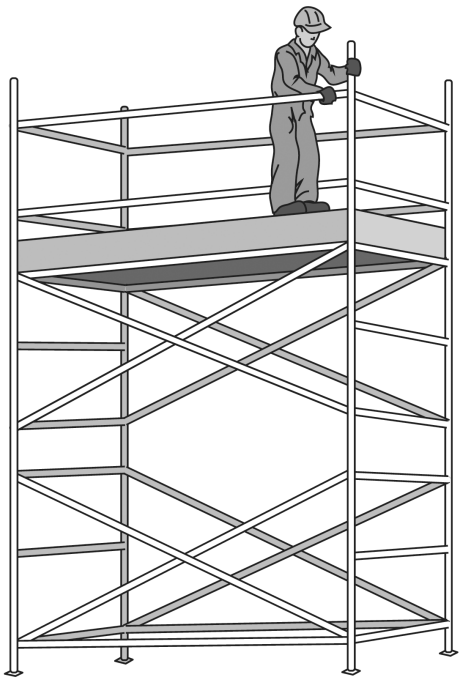


Another way of strengthening a corner so it can't collapse, called a ***gusset****.*

Examples of frame structures strengthened with struts

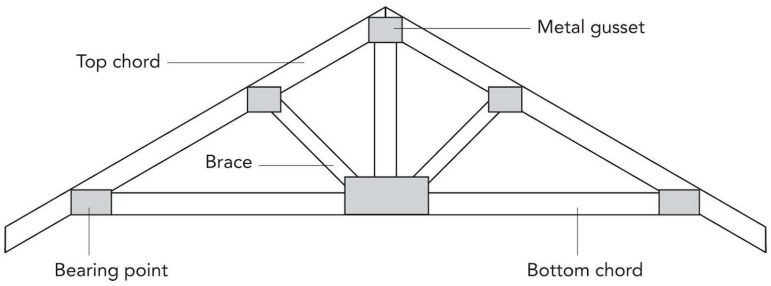
We are mostly going to look at the parts of frame structures used in building something.

When builders need to work high above the ground, they often use a frame called scaffolding. If this didn't have any braces across it which make triangles, it could easily collapse.



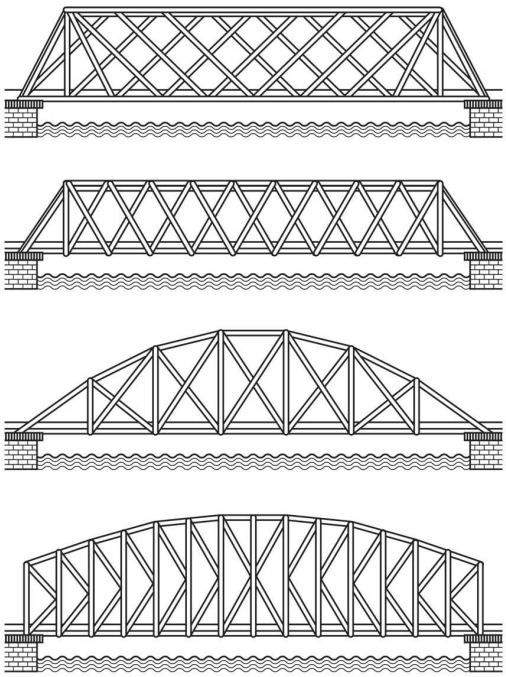
Construction workers use scaffolding.

The picture below shows a roof truss. A roof truss is used to help carry the weight of the roof of a house. All of the triangles in it help make it strong.



A roof truss. You don't need to know all these names!

Bridges also make use of struts to make the frame stronger. The diagrams below show the use of triangles to make bridges stronger:



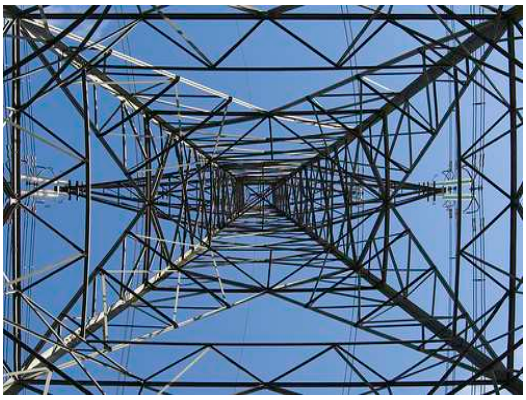
All of the triangles in these bridges make them strong.

QUESTIONS

Why do you think bridges need to be so strong?

Some structures are really big and carry a lot of weight. These structures include cranes and pylons. These structures need to have a very strong frame and they therefore use struts to make them stronger. Can you see all the diagonal struts which strengthen the frames of the pylons?

A pylon is the structure which supports electricity lines. [5]



This is what it would look like if you stood under a pylon and looked up! [6]

Cranes need to lift very heavy objects, but they also need to be able to move around. So, they must be as light as possible, but still very strong. A frame structure with struts is the best way to do this.

A crane. [7]

QUESTIONS

How many cranes are there in the front cover for Matter and Materials which are helping to build the soccer stadium?

Designing a strong structure

The Thunderbolt Kids went for a walk in the forest around their school after class. Farrah wanted to find some interesting objects from nature to draw, so she had asked the others to come with her for a walk. While they were running through the forest, picking flowers and climbing trees, they came to a river. The river was quite wide and they could not cross. Sophie suggested they turn around and go back. But Tom hated having to give up when something was put in his way. He felt he could solve this problem. Jojo was running from one tree to the next to see how fast he could do it, Sophie was inspecting a small pond where some tadpoles were swimming around, and Farrah had sat down with her sketch book to draw a caterpillar crawling along a branch. Tom sat down next to the river to see if he could solve this problem of getting to the other side of the river.

Tom remembered that in class that week, they had been looking at ways to strengthen materials; making them stronger to hold a heavier load. He remembered that folding and rolling paper into a tube made it stronger. He also thought about the struts used in frame structures to make them stronger, more rigid and stable.

DID YOU KNOW?

A bibliography is the term given to the list of information resources that you used when researching. Remember to write a bibliography for your research.

The next day in class Tom asked his teacher if they could design a model of a bridge to cross the river outside the school. The teacher thought this was an excellent idea and decided to set it up as a class competition: To design and make a model of a bridge to span 1 m between two desks and then test whose bridge could hold the most weight!

Let's also take part in the competition in your class and help Tom come up with the best design for a bridge to cross the river.

We are going to follow these steps when designing the bridge:

1. Investigate
2. Design
3. Make
4. Evaluate
5. Communicate

This is called the Design Process. Do you remember last term when you designed a shelter for birds? In that project, we only designed the shelter, made drawings, and then evaluated the design. Now, we are going to take this process further and actually make the bridge and then evaluate the products that we made!

If you do not want to do this design project of making a bridge, there are other options which also make use of struts to create a strong structure, such as designing a model of a tower, pylon or chair. This activity, however, will use a bridge as an example.

ACTIVITY: Designing and making a bridge

INVESTIGATE:

The first step is to investigate and do some research around how to build a bridge. In the chapters leading up to this, we have already looked at ways to strengthen materials and create strong structures using struts. Remember this when you are investigating and designing your bridge!

You also now need to investigate ways of building bridges. You can use books and the internet. Use the space below to write down some of your findings from your research.

DESIGN:

Now you need to use the information you have found out to come up with a design for your bridge.

Your bridge has the following specifications and constraints:

- It must span a minimum length of 1 m.
- It must be able to support a load (bags of coins and books).
- It must be built in class.

DID YOU KNOW?

When making your bridge, you may come up with a better design! So, leave some space for a second drawing at the bottom.

Answer these questions to formulate your Design Brief:

1. What do you need to design?

2. What will the size and shape of your bridge be? Remember that your bridge must span a gap of 1 m between two desks.

3. What materials are you going to use to build your bridge? Make a list of all the materials you will need.

4. What tools are you going to need to make your bridge?

5. Are there any other specifications and constraints that you can think of for your bridge?

Now you need to draw some designs for your bridge. Use scrap pieces of paper to do your first designs. Once you are happy with your design, use the space below to draw your final design. Label your drawing showing materials you are going to use for the different parts.

MAKE:

Now comes the fun part! You have to make your bridge according to your sketch and using the materials you identified. Do this in class.

Once you have all finished making your bridges, set them up between 2 desks that are 1 m apart. Now, let's have some fun to test whose bridge can hold the most weight! We will only test one bridge at a time and use the same objects (bags of coins or books) to place on each bridge, adding one object at a time. This will ensure it is a fair test.

EVALUATE:

Answer the following question on the bridge that you have built after testing it.

1. Did your bridge work? How many objects did you place on it?

2. Did your bridge fulfill all the requirements in the specifications given to you?

3. If you ever had to build this bridge again, what would you do differently?

COMMUNICATE:

An important part of the Design Process is to communicate what you found to others so they can learn from what you did.

Write a paragraph below where you tell Tom about the bridge that you built, what worked and what didn't work, so that he can also learn from what you did.

4.2 Indigenous structures

New Words

- indigenous
- exotic
- traditional
- rural
- hut
- rondawel
- "matjieshuis"

When we say something is "indigenous" we mean that it occurs naturally in a place. Something that is not indigenous is exotic. We can say certain plants and animals are indigenous to South Africa, such as the lion and elephant and the baobab tree.

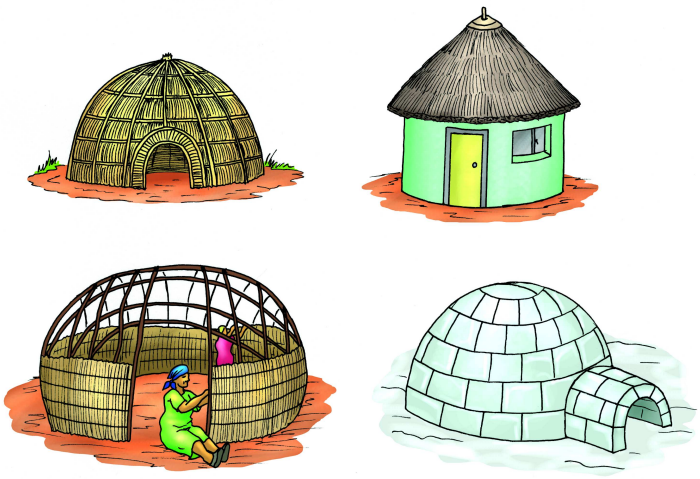
We can also talk about indigenous people and indigenous knowledge. This is when we are talking about ideas or knowledge or beliefs that a community of local people has developed over time, and that is specific to the area that they live in.

Now, we are going to talk about indigenous structures. This means structures for houses which are built in South Africa by the people that live here.

Types of traditional homes

In South Africa, we have a rich tradition of building homes from the materials available in our environment. Traditional homes have been built the same way for a long time. Today these homes are mainly seen in rural areas. The building materials used are indigenous (grown locally) and the people collect the materials in their environment. Many other cultures also build their own traditional homes from indigenous materials. The Eskimos sometimes even use blocks of ice to build temporary homes they use when they go hunting in the snow and ice!

In South Africa, we have the traditional homes of the Zulu uguqa, the Xhosa rontabile and ungqu-phantsi and the Nama matjiehuis.



Types of traditional houses. The Igloo, a traditional house to Eskimos

ACTIVITY: Identifying materials used in traditionalf homes

INSTRUCTIONS:

1. In the above pictures of traditional homes, each home has been constructed out of specific materials.
2. Complete the table below for the materials used in each home. Then state whether it is a strut, beam or column

Traditional homes	Materials used	Strut/beam/column
Zulu hut		
Xhosa rontabile		
Nama matjieshuis		
Igloo		

3. Identify the shape of each of these traditional homes

Traditional homes	Shape
Zulu hut	
Xhosa rontabile	
Nama matjieshuis	
Igloo	

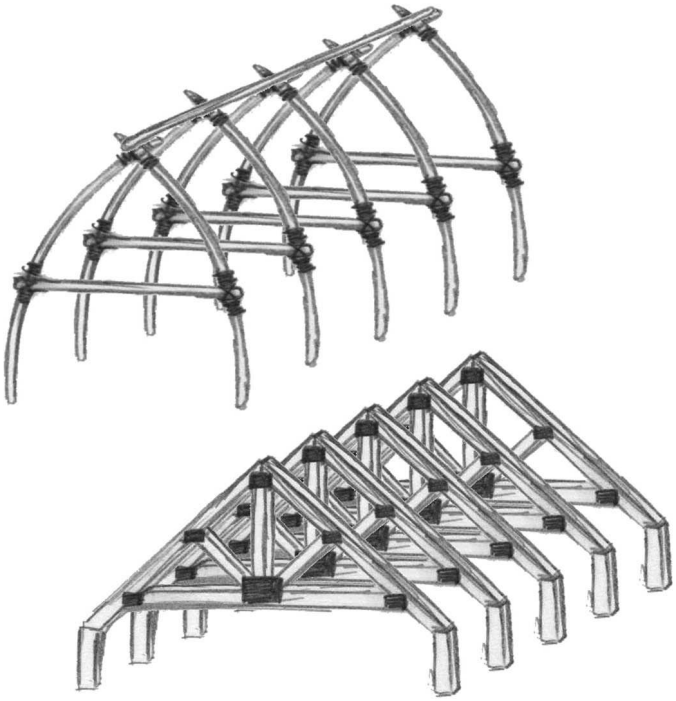
The materials used in each hut has specific properties to make it suitable for its use.

4. List the materials for the huts again and then select the appropriate property of the material in the given boxes (by ticking).

	Materials	Hard	Tough	Stiff	Flexible	Strength
Zulu hut						
Xhosa rontabile						
Nama matjieshuis						
Igloo						

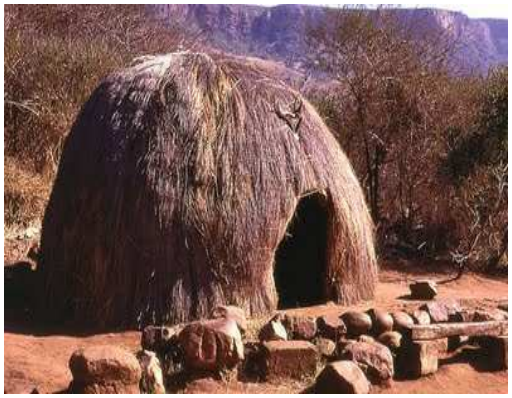
Traditional and modern structures

Today we also have very modern homes. Sometimes the structures of modern homes are based on what was used to build traditional homes. Look at the two structures below. The first ones uses reeds and branches which are bent to make the framework for the house. This is a traditional structure.



Traditional and modern structures

In the second picture, you can see the roof trusses for a modern home. Can you see the similarities between the two? For example, the shape and how the structures are made stronger with struts. There are also some differences. For example, in the traditional house, the reeds and branches are tied together with rope. But in the modern house, the roof trusses are strengthened with gussets.



A traditional hut [8]

A modern home [9]

ACTIVITY: Comparing modern and traditional structures and materials

1. Work in pairs. Study the above frameworks and the two pictures of the houses
2. Discuss and compare the roofs of the traditional and modern house. Where are the differences? Are there similarities?
3. Discuss and compare the similarities and differences between traditional and modern structures and materials with your partner.
4. Discuss the advantages and disadvantages of the modern structure.
5. Discuss the advantages and disadvantages of a traditional structure.
6. Use the space below to draw tables to show some points from your discussions about:
   a) The similarities and differences in roofs
   b) The advantages and disadvantages of the modern structure
   c) The advantages and disadvantages of a traditional structure

KEY CONCEPTS

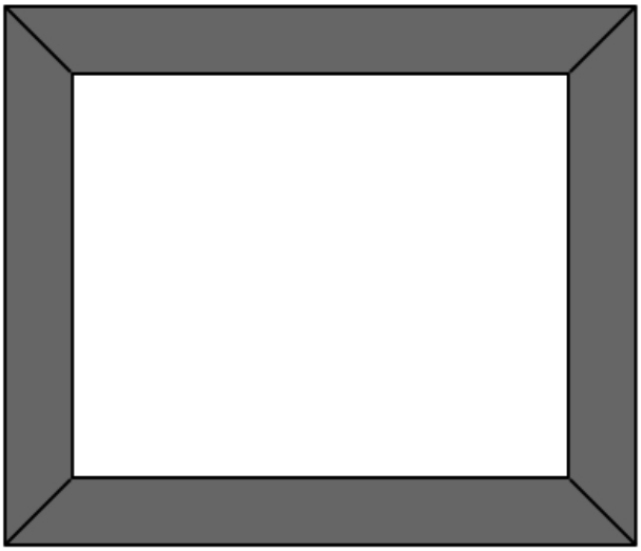
- Frame structures can be made stronger by using struts.
- A strut is a solid bar joined into a structure to make it more stable.
- Struts are used in roof trusses, bridges, cranes and pylons.
- Skeletons are frame structures made of a system of struts. The bones are the struts.
- Indigenous, traditional homes such as a Zulu hut (uguqa), Xhosa rontabile and Nama matjieshuis make use of a framework of struts.
- Indigenous materials come from living plants in the environment.
- Traditional homes of the Xhosa, Nama and Zulu make use of a framework of struts.

REVISION:

1. Give four examples of structures which make use of struts to strengthen the framework.

2. Why do you think the human rib cage can be considered a frame structure?

3. Draw a brace or braces onto the wooden frame below to make it it a much stronger structure.



4. Give 3 examples of traditional homes in South Africa.

5. What are some of the indigenous materials that traditional homes are made out of?

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I enjoyed that!

Chapter 1 Living and non-living things

1. http://www.flickr.com/photos/peterkaminski/325590008/
2. http://www.flickr.com/photos/8720628@N04/2217496745/
3. http://www.flickr.com/photos/brittgow/4781540407/
4. http://www.flickr.com/photos/benwatts/4087289013/
5. http://www.flickr.com/photos/37873897@N06/7225883680/
6. http://www.flickr.com/photos/lizjones/310415897/
7. http://www.flickr.com/photos/usaghumphreys/3952303284/
8. http://www.flickr.com/photos/72906133@N00/6590383249/
9. http://www.flickr.com/photos/8374568@N07/3451503721/
10. http://www.flickr.com/photos/ajturner/2919343853/
11. http://www.flickr.com/photos/stevepj2009/3333523138/
12. http://www.flickr.com/photos/timpearcelosgatos/4366159576/
13. http://www.flickr.com/photos/fxtreme/295250582/
14. http://www.flickr.com/photos/schwuk/160754346/
15. http://www.flickr.com/photos/wasdin/2395014850/
16. http://www.flickr.com/photos/tgerus/4662650273/
17. http://www.flickr.com/photos/dominicspics/5343849351/
18. http://commons.wikimedia.org/wiki/File:Polluelo_rompiendo_el_cascar%C3%B3n_01.jpg
19. http://commons.wikimedia.org/wiki/File:Frog_eggs.jpg
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21. http://www.flickr.com/photos/erikpaterson/4848567659/
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Chapter 2 Structure of plants and animals

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2. http://www.flickr.com/photos/crabchick/5809576233/

3. http://www.flickr.com/photos/jorgebrazil/4983656659/

4. http://www.flickr.com/photos/49164267@N04/4885206411/

5. http://www.flickr.com/photos/7147684@N03/1037533775/

6. http://www.flickr.com/photos/imaginextra/4609807052/

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Chapter 3 What plants need to grow

1. http://www.flickr.com/photos/skenmy/504840320/

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Chapter 4 Habitats of animals and plants

1. http://www.flickr.com/photos/framesofmind/4875066923/
2. http://www.flickr.com/photos/garyrobson/520722754/
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3. http://farm5.staticflickr.com/4006/4449854125_3bd74d012b.jpg
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7. http://www.flickr.com/photos/free-stock/4900327148/
8. http://www.flickr.com/photos/80651083@N00/1814803669/
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8. http://www.flickr.com/photos/jaynelloyd/6782664355/

9. http://www.nasaimages.org/luna/servlet/detail/NVA2%7E62%7E62%7E78737%7E135593:Whole-Earth#

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Chapter 2 Solid materials

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2. http://www.flickr.com/photos/kellinahandbasket/2183799236/

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6. http://www.flickr.com/photos/nufkin/2321665314/

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