



KEY QUESTIONS

- What's the coldest place where animals live?
- How deep is the sea and are there animals and plants down there?
- Where is the highest mountain on earth? Do you get plants and animals that live up there?
- Do you get living things in a desert?
- What are vertebrates and invertebrates?

- We recommend that teachers visit this website: goo.gl/zzGPk - there are many videos and powerpoint presentations, graphics and hand-outs for teachers and students to use!
- Consider labeling 5 different areas in your class with large signs for each of the different types of habitats. As you work through the section on each habitat, you can put key words and phrases up under these headings.
- **Become an Expert:** Make enough labels for all the learners in your class. Write the 5 different habitats on each label and put the labels in a "hat" for learners to pick out of the "hat". Whichever habitat they choose they will have to **Become an Expert** of that habitat and know what plants and animals live there. After you have discussed the different types of habitats from the textbook, they will be required to make a display of the animals and plants within their specific habitat. They will put up their display at the area (where you put up the heading) that you placed in the class and will have to use the words that you displayed in their work.
- If you want to / can combine this with Home Language they can present their habitat as an Oral to the class.
- After the oral presentation teachers are encouraged to hold a class quiz as a plenary activity. Divide the class into two groups with teachers asking questions about each habitat. The teacher calls on learners from each group to answer a question for 3 points. If said learner could not answer then the other group can have a chance for 2 points. If that group's learner gets it wrong a learner from the first group can answer the question - if correct they can get 1 point. It is important that the pupils keep quiet while the questions are being asked and answered, to prevent other group members from helping the learner who has to answer the question. You can deduct marks from a group if there are learners who shout out answers or behave in an unruly manner.

You might have heard that people say our planet Earth is the Blue Planet. When astronauts in space look down on Earth, the water that covers more than two thirds of the planet makes it look as if the planet is blue. Thousands of plants and animals can live on Earth because there is water.

The many plants and animals that live on earth choose special places to live. The place where a plant or animal lives is called its **habitat**.

There is a special word we use when talkinh about all the animals and plants and their different habitat. We call it 'biodiversity' When you look at the biodiversity of a certain area you look at all the different kinds of habitats in that area including all the animals and plants in that area.

DID YOU KNOW?

Plants and animals need water to live. Scientists search for water on other planets because they hope that if they find water they might find life forms there as well!

QUESTIONS

Discuss this in class: Why is it important to study the biodiversity of our planet? Write down some of the main points from your class discussion below.

Teachers are encouraged to use this opportunity to introduce and/or raise environmental concerns and to emphasise that the more we know about the biodiversity of our planet the more we know how to protect it. It is also suggested that teachers discuss the importance of people who value the diversity of plants and animals on earth. If we value diversity we are able to see that each plant and animal that gets driven to extinction is a tremendous loss for the whole earth. Perhaps point out that a plant or animal that has gone extinct might have held the key to curing terrible diseases or teaching us how to combat problems such as soil erosion.

1.1 Many different plants and animals

The Earth is home to the most amazing diversity of animals and plants. Each animal and plant naturally chooses where it wants to live: its habitat.

We can identify different types of habitats on earth, such as:

- Aquatic (water)

New Words

- adapted
- extinct
- classify
- indigenous
- biome

- Desert
- Grassland
- Forest

Within each habitat there are animals and plants that have adapted to live specifically in that environment. Let's take a look at some of the most common plants and animals that live in each of these different kinds of habitats.

Teachers can use the following activity to gauge each individual learner's geographical understanding of places in our country. Many would not have been exposed to maps and might not know where they live. Use this opportunity as a teaching activity to give learners a brief overview of South Africa's map. Also emphasise where North is!

Let's now take a closer look at the different habitats in South Africa and some of the plants and animals that we find there.

Aquatic habitats

Thousands of different animals and plants live in or near water in aquatic habitats. There are two main kinds of aquatic habitats - marine (saltwater) habitats and freshwater habitats. The plants and animals that live in these habitats are adapted to either live in salt water or in fresh water.

In South Africa there are examples of both types of aquatic habitats.

Our country has a very long coastline with many different types of habitats. For example, many animals live in and around the rock pools. They have to withstand the harsh sun and the constant pounding of the waves.

DID YOU KNOW?

"Aqua" means "water" in Latin. A word with "aqua" in it normally has something to do with water - like aquatic or aquarium.

DID YOU KNOW?

South Africa is the only place on earth where the great white sharks have learnt to jump out of the water when they catch seals (off Seal Island in False Bay).



Starfish are found in rock pools along the coast



Seagulls resting on a shore



A rocky coastline with rock pools

Our seas are also filled with animals of all shapes and sizes. Large mammals like whales and dolphins swim in our seas.



Dolphins playing in the waves ¹



A Southern Right whale with her calf off the coast of Hermanus, a popular breeding ground for whales in September. ²

The sea is also home to many species of fish. A group of fish is called a school of fish. The coral reefs off the South African coast, especially on the East coast such as Sodwana Bay, are very rich in fish and animal species.

Where a river runs into the sea, a special area called an estuary develops. The fresh water from the river mixes with the salty sea water. You can often find mudskippers here (fish that can hop onto land and into trees!)

DID YOU KNOW?

Female dolphins are called cows, males are called bulls and young dolphins are called calves.

DID YOU KNOW?

The waters off South Africa's coast is home to a rare fish - the coelacanth! Scientists thought this prehistoric fish was extinct until they found living coelacanths in South Africa's waters!



Mudskippers live in estuaries, but they can hop onto land and into low branches! ³

ACTIVITY: Identifying marine animals and plants

INSTRUCTIONS:

1. Carefully study the pictures of different marine animals and plants off South Africa's coast.
2. Answer the questions about these pictures.



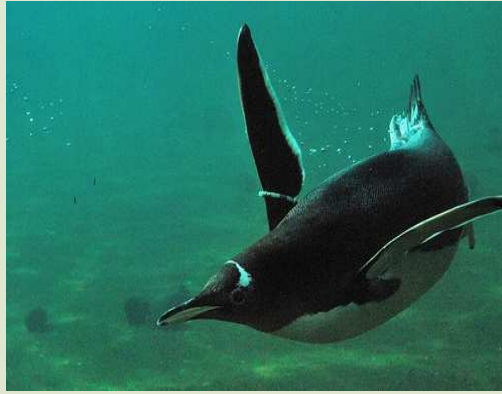
A crab ⁴



A school of fish ⁵



A crayfish in the shallow water ⁶



A penguin diving down under the water ⁷



Green seaweed flowing in the water ⁸



Mussels growing on the rocks ⁹



Sharks ¹⁰



Jellyfish ¹¹



Kelp seaweed ¹²



Turtles ¹³

QUESTIONS:

1. Can you imagine how difficult it must be to live on rocks being pounded by waves all day and all night long? Which animals in this picture live on or near the rocks?
Crabs, crayfish, seaweed, mussels
2. Carefully study all the animals in the pictures and find things that some animals have in common. Classify the animals into groups based on these similarities.
This revises Gr. 4 work where learners had to classify and compare animals based on visual differences. Encourage learners to be as creative in their thinking and classifying as possible. Also encourage them to use visual clues.
3. Many eco-tourists like to visit our country and see the natural sights and attractions. Some tourists like to go on tours where they enter into a cage which is lowered into the water. The tour operators often chuck small pieces of meat into the water to attract sharks which then swim around the cage. This is called shark cage diving. Do you think shark cage diving is appropriate? Explain why you think so.
Give learners scope (and permission) to differ from each other. Invite learners before they answer this question to discuss differing points of view on this topic. Some might be in favour of shark cage diving as it gives opportunities for research and study and makes people appreciate the sharks more. Others might agree with the minister and say that tourists might scare sharks out of their natural habitat and teach them not to fear humans and then they are easier to catch by other humans.

Now let's look at the plants and animals that live in freshwater, such as dams, ponds, stream and rivers.

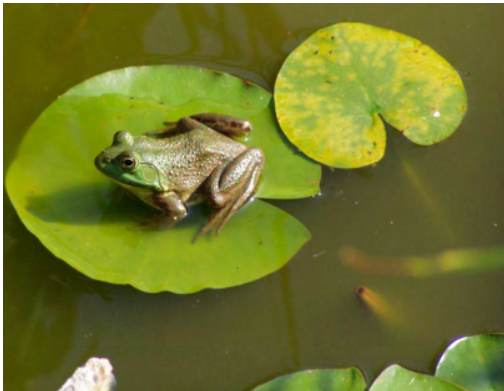
Many animals live in or near freshwater ponds, dams and lakes, rivers and streams. These include small insects, snails, clams, crabs, frogs and fish. Larger animals like turtles, snakes, ducks and large fish, as well as hippos and crocodiles also live in or near water.



Ducks raise their ducklings near plants where there is enough food for their young in between the reeds and water plants.



Hippopotamuses live in and around freshwater.



Can you see how this frog is resting on the lily pad?



A crocodile lies by the side of a river.

Some water plants have roots, for example water lilies and reeds. Water plants make oxygen for the animals to breathe and provide food for many of the animals to eat.

DID YOU KNOW?

Sharks have amazing hearing. They can hear a fish moving in the water from as far as 500 metres away!

DID YOU KNOW?

Waterblommetjie bredie (stew) is made from a type of water lily! Have you ever eaten it?!



Water lilies floating on the water. ¹⁴

In South Africa we also have large wetlands where rivers slow down and the water stands still or flows very slowly. Wetlands provide food and shelter and a natural habitat for an incredible amount of animals: frogs, reptiles, birds (like ducks and waders) and fish, to name a few!

ACTIVITY: Studying an aquatic habitat

Work in groups of 3 or 4

MATERIALS:

- pencil
- paper
- clipboard
- sunblock and a hat

INSTRUCTIONS:

1. Visit an aquatic habitat near your school; a stream or river, pond or dam, or perhaps a rockpool if you are near the sea.
2. Find examples of 3 different animals and 3 different plants that live in that environment.
3. Carefully study where they live and how you think the animals and plants are suited to their habitat. Answer questions such as:
 - a) Are the stems of the plants rigid or flexible?
 - b) Do the plants grow inside the water or just outside?
 - c) What do the animals eat?
 - d) How do the animals breathe?

4. If possible, take some pictures of the plants and animals you observe.
5. Report this information back to your class.

Deserts and semi-desert habitat

Deserts are areas that have a very low rainfall each year - in some deserts it only rains once every 10 years!



The Namibian desert.

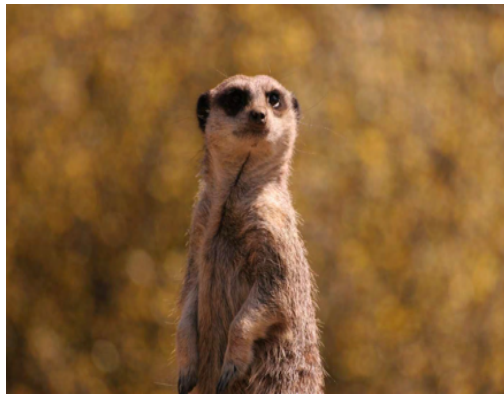
The desert may look dry, but there are many different plants and animals which are suited to living in these areas. Plants that can survive without much water in the desert include grasses, acacias, aloes, cactii and other succulents. Succulents are plants that can store their water in their leaves and stems and survive well in dry climates.



Can you see how thick the leaves of this succulent plant are? The leaves are where the plant stores water.

Many animals live in the desert (for example, the Kalahari), including:

- Predators (eg. lions, cheetahs and leopards, hyenas, jackals)
- Large and small mammals (eg. meerkats, giraffes, warthogs, porcupines)
- Antelope (eg. eland, gemsbok, springbok and hartebeest, steenbok, kudu, duiker)
- Many species of birds (eg. falcons, ravens, eagles, buzzards, hawks, turtle doves). The social weavers are small weaver birds that build family nests where hundreds of weaver families can live!
- Many different reptiles (eg. puffadders, cobras, lizards, geckos, iguanas)
- A great many insects also live in the desert, such as bees and butterflies, grasshoppers and many more!



An alert meerkat



A huge nest made by social weaver birds¹⁵



An eland



A jackal



A puff adder



Warthogs

DID YOU KNOW?

Elephants can change a forest area into a grassland in a matter of months! They break off tree branches, smash tree trunks and eat the bark, leaves and twigs.

Grassland habitat

Grasslands are covered in grasses with very few trees. As soon as the first rains fall the grasses grow incredibly fast and new plants sprout all over the bare earth. This is also the time when many animal babies are born as the new grass can feed the mothers to provide plenty of milk for the young.

QUESTIONS

List some of the animals which you think live in grasslands.

Answer: Kudu, nyala, impala, zebra, buffalo, lions, leopards, other small mammals, many birds, etc.

Forest habitat

A forest is a large area that is mostly covered in trees. Forests are extremely important to life on earth. The many trees clean the air and provide oxygen for the animals on earth to breathe. They also provide people with fuel, food and shelter, medicine and employment (through all the industries that are built around forestry). Many animals live in forests, from large elephants and bears to smaller monkeys, squirrels, owls and woodpeckers.

We need to conserve (look after) our forests and stop people who want to chop down naturally growing trees. It is very important to also conserve the many animals that help pollinate trees and spread their seeds over large areas. Without these animals the trees would not be able to reproduce and would become extinct.



Inside the Knysna forest, one of South Africa's few indigenous forests.



An elephant in the Knysna Forest elephant park.

- Identify (in advance) an area where you can take your class to study animals and plants within a certain area. Ideally this can be within a Nature Reserve, park or school garden, where different types of habitats can be studied.
- If you are going to walk the class there, walk from the school to this area to ensure that there are no dangers along the way that you need to make the learners aware of before leaving the school.
- Study the area before the day of this activity. Make sure that you avoid areas with lots of litter and dangerous sharp or rusty items that might cause injury to learners. Carefully take note of the main plants and animals in that area. If possible take samples of these plants to class. Display the plant with its name next to it in your class. Show these plants to the class, one by one, before you go on the walk.
- Teachers are encouraged to invite one or two people / parents with local plant and animal knowledge to come along on this nature walk to walk between pairs and help them with identifying different plants and animals. They can also help with escorting learners safely to the spot.
- Prepare learners for this activity before leaving class. Explain that they are going to count the plants and animals inside their marked-out area. Tell learners that they may only count the plants and animals that are actually INSIDE the marked-out area or flying directly above it. They may not coax or carry animals into their marked-out area or take others that they don't like out of it.
- They need to distinguish between plants based on the size and shape of their leaves, flowers or fruit. If you were able to arrange for parents to escort you the learners may ask them for help to identify which plants are in their hoola hoop.

ACTIVITY: Counting plants and animals

After learners have identified the plants and animals in their areas, ask them to collect some flowers and seeds if there are any. Learners can then press the flowers by placing them between sheets of paper and then stacking a pile of books on top of the paper. They have to leave them to press for several days. Once they are pressed, learners can stick the flowers onto pieces of paper along with the seeds they collected and provide the names of the flowers. These can be put up in the class.

MATERIALS:

- Something to mark out an area such as stones or sticks to make the corners and strong to tie in between
- scrap paper
- pencil
- clipboard
- sunblock and hat
- measuring tape/ruler

INSTRUCTIONS:

1. Work in pairs
2. Take a walk with your class to a park or nature area outside your school.
3. Choose an area where the two of you would like to work.
4. Carefully place the string around a section of your area.
5. Study the animals and plants in that area.
6. Make a drawing of the habitat inside your marked out area showing all the plants and animals that you see there. Use scrap paper for this.
7. Do you know the names of these plants and animals? Perhaps an adult can help you name the animals or plants you don't know? Write the names of each of these animals and plants next to each drawing.
8. Make sure that you have examples of at least 5 different plants and 5 different animals in your picture.
9. Measure the height of each plant and record them all in the table below.
10. Collect leaves from two of the plants and make leaf rubbings on pieces of paper by placing the leaves underneath the paper and rubbing over with a pencil or crayon.

New Words

- herbivores
- carnivores
- omnivores
- scavengers
- decomposers
- depend
- ecosystem
- pollinator
- water vapour
- atmosphere

11. If there are any flowers or seeds, gently collect some and take them back to class. Your teacher will show you how to press them
12. When you return to class copy your drawing from the scrap paper into your book. Make a neat drawing in your book and remember to add in the labels for all the different animals and plants.

1.2 Interdependence in an ecosystem

Introducing this topic:

- Make the class form a circle with each learner facing the back of the learner in front of them. They must hold each other's waists. Make sure they are standing as close to each other as possible. Explain that they are all going to be interdependent on the other. They need to sit on each other's laps in this circle. If one fails or does not do their job properly the whole circle will collapse. If they all do their jobs properly the circle will work and remain intact.
- This BBC website is an excellent resource to read before starting this lesson: ¹⁶
- This website provides two powerpoint slide shows - although they are far too advanced for learners at this level, they provide an excellent introduction to ecosystems and interdependence [goo.gl/Tuk8X](https://www.youtube.com/watch?v=Tuk8X).

Plants and animals, humans, rivers, mountains - everything is connected in one way or another. All living and non-living things depend on each other.

We can group interdependence into two main groups:

1. The interdependence in an ecosystem between living things (how animals and plants are interdependent).
2. The interdependence in an ecosystem between living and non-living things.

Interdependence between living things

Many plants and animals depend on each other for different things. Let's have a look at some of these:

1) Interdependence and feeding

Animals depend on plants and other animals for food. Animals can be divided into the following groups, according to what they eat:

- Herbivores eat plants.
- Carnivores eat the animals that eat the plants.
- Omnivores eat plants and animals.
- Scavengers feed off plants and dead animals.
- Decomposers are animals that assist the natural process of decomposition. They eat and break down the remains of dead animals. The elements that are released during this process (carbon, phosphorus and nitrogen) are put back in the soil and become food for plants.

DID YOU KNOW?

An ecosystem is a community of living things that depend on, and interact with, each other and the non-living things (water, air and soil) in their different habitats.

2) Interdependence and pollination

Plants depend on animals for pollination.

Animals that pollinate flowers are called **pollinators**. Plants use different methods to attract pollinators. This includes producing nectar, special smells or having brightly coloured flowers. Some plants even make their flowers look like female wasps to attract male wasps!



Bees about to collect nectar and, at the same time, pollinate the flowers.

17

DID YOU KNOW?

Pollinate means the pollen from one flower needs to get to the pollen from another flower to pollinate it.

Plants and animals depend on each other. Many flowering plants depend on bees to pollinate them. Bees depend on flowers to provide them with nectar. Without nectar, bees cannot make

DID YOU KNOW?

Sometimes farmers don't have enough bees on their farms to pollinate their crops. They "rent a hive" from travelling bee hive managers who bring their hives to pollinate the farmer's crops.

honey. Without bees, most flowers cannot be fertilised. If flowers are not fertilised, they cannot produce seeds and will not be able to reproduce.



Bird feeding off the nectar and pollinating the flower¹⁸



A wasp feeding off the nectar and pollinating the flowers¹⁹

QUESTIONS

Bees are not the only animals that can pollinate flowering plants. What animals do you think can pollinate a tree's flowers? Look at the pictures below.

Birds, beetles, wasps, ants, honey eaters, etc.

VISIT

Video on pollinators
goo.gl/y7kAh



A beetle feeding off a flower. As it moves around the flower, it also pollinates the flower.²⁰

Teachers are encouraged to let children discuss the type of animal that can pollinate a tree's flowers based on their physical characteristics. Perhaps ask if they think a tortoise or an bat is more likely to pollinate a tree's flowers. Then discuss why they say

so. Also include a question that makes them think about the tree's adaptations to let, for example, the fruit bats pollinate it - the flowers need to be open during the night for example to attract bats and therefore they won't need to have bright petals, but the petals will need to be bigger to allow the bat to find it using eco-location!

Teachers should try and watch this video with their classes - it is very well done and explains everything at a Gr. 4 / 5 level with illustrations, young actors the learners' age, etc. The quality of the video isn't great so it wouldn't work to stream it on a large screen but perhaps a novel idea would be to ask everyone to bring in their cell phones and watch it together or to let them watch it on the computers in the computer lab?

DID YOU KNOW?

1/3 of everything we eat is there thanks to pollinators! We really depend on pollinators for our food!

A world without pollinators would not be very sweet. Look at the following things we eat and drink that all depend on pollinators.



Without pollinators, we would not have blackberries and raspberries to eat. ²¹



Strawberries are delicious! The fruits are produced once the flowers on the strawberry plants have been pollinated. ²²



²³Different types of nuts form after pollination.



Red and green apples are the fruits produced on apple trees after pollinators have pollinated the flowers. ²⁴

3) Interdependence and seed dispersal

Plants need to have their seeds spread over a wide area. If all the seeds fall in one spot, the plants that grow will not have enough water, soil or sunlight to grow properly! That is why plants make their fruit sweet and tasty. In this way they attract animals who will eat the fruit, walk a long way off and excrete the seeds. Where the seeds fall they will then have a rich, fertile soil (from the animal excretion) to grow in! Other seeds stick to an animal's fur - they might not even know it's there! When they brush against a tree for example, the seed will just fall off. Plants depend on animals for seed dispersal.

ACTIVITY: The honey badger and the honey guide

This is an example of interdependence between three different animals.

INSTRUCTIONS:

1. Read the story about the honey badger and the honey guide below
2. Answer the questions which follow.

The honey badger loves to eat honey! The honeyguide bird loves to eat the bee larvae, but cannot get into the beehive without being stung to death. The bird also cannot break the hive open. So when the honeyguide finds a beehive, it goes in search of a honey badger. The honey badger has a thick skin that is resistant to bee stings.

VISIT

The honey badger and
honey guide (video)

goo.gl/G10qG

The honey guide convinces the honey badger to follow it to the bee hive. The honey badger is able to use its strong legs and claws and teeth to break open the hive while its thick coat protects it from being stung. After the badger has finished eating the delicious golden honey, the honeyguide can enjoy all the bee larvae!



The honey badger follows the honey guide bird.

QUESTIONS:

1. Why can't the honey guide bird just eat some of the larvae without waiting for the honey badger?

The bird cannot break open the hive by itself. It will also be stung to death by the bees.

2. How does the honey badger break open the hive?

It uses its legs, claws and teeth.

3. Why does the honey badger not get stung by the bees?

It has a very thick coat which the bee stings cannot get through.

4. Explain in your own words how this is an example of interdependence between three animals.

Assess learners ability to rephrase and explain this scenario in terms of interdependence. Both animals benefit as they are unable to get the honey without one another. Without the bird, the badger would not find the honey and without the badger the bird would not be able to get to the larvae. Without the bees, the honey badger would not have larvae to eat and the honey bird would not have honey to eat.

Interdependence between living and non-living things

Living things are also depend on non-living things in an ecosystem. Living things depend on their environment for:

- Air (oxygen and carbon dioxide)
- Water
- Soil
- Food
- Shelter and a place to safely have their young.
- Places to hide from danger.

Water and oxygen are extremely important for all living things.

QUESTIONS

Have you ever wondered how the water "gets" into the clouds if it runs in rivers and streams? Remember when you learnt about the Water Cycle in Grade 4?

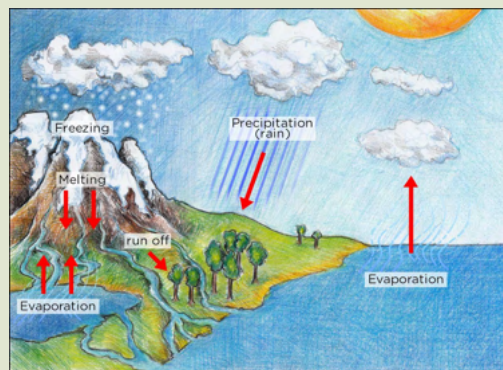
Teachers can use this as an opportunity to discuss learners' preconceptions of the water cycle and to ascertain what they know or misunderstand in order to address this in the following section.

Water that we drink from a tap or from a river, is all part of a very big system called the Water Cycle. The Water Cycle is a very good example of how all living things are interdependent.

ACTIVITY: The water cycle

INSTRUCTIONS:

1. This image of the Water Cycle shows all the processes which take place.
2. Revise these with your partner next to you.
3. Write a paragraph below where you explain the cycle



The Water cycle.

QUESTION:

1. You can change the water vapour you breathe out into water drops again! Find a mirror or window. Breathe on it. What do you see on the window?

See condensation on the window. Teachers can reinforce the concept that as soon as the mirror or glass warms up slightly the water drops on it will evaporate again.

Trees and other plants depend on the water in the soil. Other animals and plants depend on the water that runs down from the mountains in rivers and streams and collects in lakes. Plants and animals in the sea depend on this water as it forms the environment that they live in.



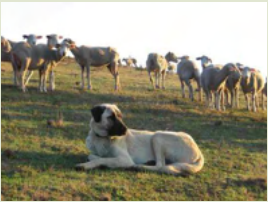
ACTIVITY: Describing Interdependence



Introducing this activity

After studying the interdependence of living and non-living things in their environment, this activity requires learners to identify interdependence between living organisms and their environment. If possible, collect books and information about the sets of animals in the photos in this activity. There should be enough for each group to have at least 4 / 5 books, printouts and/or other material. This can be used as a possible group project.

INSTRUCTIONS:

1. Work in groups of 3.
2. Carefully study these animals and see if you can identify the interdependence between the animals and/or plants and the non-living things in their environment.
3. Discuss the interdependence with your group and make some notes on scrap paper.
4. Descriptions of each picture have been provided. You need to match the picture with the description by writing the correct letter next to each picture.

Picture	Answer	Description of interdependence
		<p>A: Clownfish and anemones. Clownfish are not hurt by the poison from the anemone. The clownfish feed on small creatures living in the anemone. These creatures can harm the anemone. Not only does the clownfish remove these creatures, but the anemone uses its waste for nourishment. The anemone's poisonous stings protect the clown fish from predators.</p>
		<p>B: Earthworms in soil. Earthworms are dependent on the soil for a place to live. If the earthworm is exposed to air for too long, its skin will dry out. That is why they need rich, moist soil to live in. As earthworms dig through the soil they also excrete droppings back into the soil which makes it more fertile for other plants and animals. Their digging helps to aerate the soil by creating tunnels.</p>
		<p>C: Weaver bird building its nest. Many birds need trees and plants to build their nests in so they can raise their young. The weaver uses young, green reeds to build its nest. These reeds are flexible and bend easily. When they dry out, they become harder and make a stable, stronger nest.</p>

	<p>D: Rhino and oxpecker. The oxpecker eats the ticks that are on the rhino's skin. The oxpecked feeds on these ticks and the rhino is freed from the pests. Oxpeckers have the same relationship with zebra, giraffe, buffalo, etc.</p>
	<p>E: Anatolian Shepherds and the herd of sheep they are protecting from predators. Anatolian puppies are placed with a flock of sheep at an early age. They become attached to the flock. When a predator (like a cheetah) comes near the flock, the Anatolian Shepherd dogs will chase the predator off. When a flock is protected by an Anatolian Shepherd, the predators (for example, cheetahs) are also indirectly protected, because the farmers will not need to kill them in order to protect their sheep.</p>

QUESTIONS:

1. In the pictures above, which interdependent relationship is between an animal and a plant?
The weaver and the reeds it makes its nest from.
2. In the pictures above, which interdependent relationship described is between an animal and the non-living things in its environment.
The earthworm and the soil.
3. Which example in the pictures involves the interdependence between three animals, and what are they?
The Anatolian Shepherds, the sheep and the cheetahs.

VISIT

Website about the
Cheetah conservation
project
goo.gl/Roayb

1.3 Animal types

Now we know more about the different habitats on Earth and in South Africa. We also know that animals and plants depend on each other and on their habitat. Let's look at the different types of animals that live on planet Earth.

New Words

- vertebrates
- invertebrates
- exoskeleton
- endoskeleton
- hydroskeleton
- observation
- terrarium
- molluscs
- classify

Introducing this topic

This unit explores the different kinds of animals grouped into two main groups: vertebrates and invertebrates. CAPS refer to animals with bones and those without bones. The vertebrate groups are: mammals, birds, reptiles, frogs (amphibians) and fish. The invertebrate group are those without bones such as worms, millipedes, insects, spiders, scorpions and crabs.

Presentation hints

1. Introduce this unit with a class discussion comparing the different animals from the previous activity.
2. Ask learners to group the animals listed in only TWO groups. What do they look for? Let them come up with ways to classify. Some might group according to size (small or large) or on physical features such as limbs and body covering.
3. Explain the concepts vertebrate and invertebrate using the words bones and without bones. Make a table on the board showing animals that have bones inside their body and animals that don't have bones inside their bodies. The ask learners to write the names of the animals from their posters in the correct column.
4. Discuss how accurately they were able to classify the animals.
5. If possible make a poster for the wall displaying the animals that have bones inside their bodies and those without.
6. Make it personal: Ask them to feel their own bones, specifically their backbone (the line of bones down the middle of the back, made up of vertebrae). Ask them in which group they would be classified.

Grouping animals

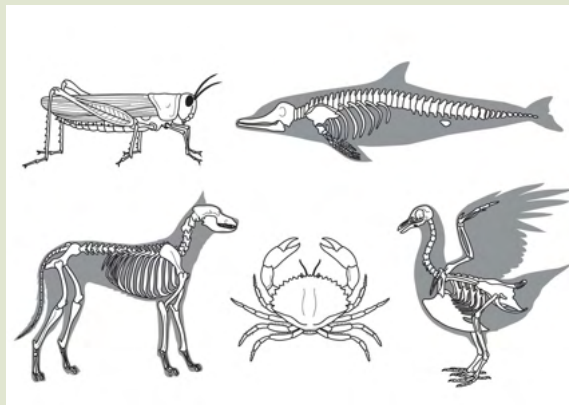
When we group similar things together, it is called classifying. When classifying animals, there are generally two main groups of animals - those who have bones **inside** their bodies with a backbone, and those who do not have bones inside their bodies.

- Animals with a backbone are classified as **vertebrates**.
- Animals without a backbone are classified as **invertebrate**.

ACTIVITY: Classifying animals

INSTRUCTIONS:

1. A radiographer takes X-rays of people and animals to see the bones inside their bodies. Tracey, a radiographer, took some interesting X-rays of 5 animals. Carefully look at these X-rays and decide which animals are vertebrates.



Examples of vertebrates and invertebrates

Animals that are vertebrates:

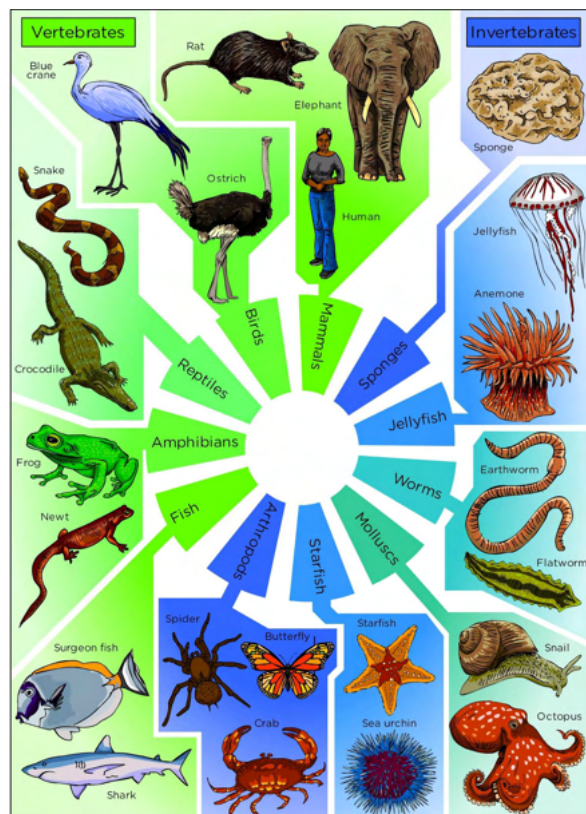
dolphin, dog, seagull

2. Look at the X-rays of the crab and the grasshopper. Can you see a backbone in their bodies? Why do you think this is?
They do not have bones inside their bodies. Instead, they have a hard, bony outer skeleton.
3. What do we call animals like the grasshopper and the crab?
Invertebrates.
4. Study the animals from the previous activity on interdependence. Decide if they are vertebrates with bones INSIDE their bodies, or invertebrates without bones INSIDE their bodies.

5. Write the name of each animal in the correct column below.

Vertebrates with bones	Invertebrates without bones
rhino, ox pecker, weaver, Anatolian sheepdog, sheep,	earthworm, sea anemone

When people realised that they could group the animals into two main groups, they went even further and started grouping them into smaller groups within the two main groups. Look at this next illustration which shows some of these groups.



Classification of animals

QUESTIONS

1. Have a look at the illustration of all these different groups. Why do you think the animals were put into a left group and a right groups?

This question is meant to reinforce the learner's understanding and recognition of vertebrates and invertebrates.

2. Vertebrates are divided into 5 groups, what are these groups?

Mammals, reptiles, birds, amphibians and fish.

3. One of the birds in the illustration is our National Bird, which one is it?

The Blue Crane

DID YOU KNOW?

If "hydro" is in a word, that word generally has something to do with water!

Let's take a closer look at invertebrates and vertebrates.

Invertebrates

Invertebrates are animals that do not develop a backbone (spinal column). They also do not have an endoskeleton (a bony skeleton inside their bodies). They do develop a different types of skeletons, like hydroskeletons and exoskeletons.

QUESTIONS

Look at the illustration of all the classes of animals again. Can you find other examples of animals with no bones inside their bodies (endoskeleton) and with no hard outer skeleton (exoskeleton)?

sea sponge, sea anemone, jellyfish, flatworms, octopuses and earthworms.

These soft-bodied animals mostly have what we call a hydroskeleton. Examples of animals with a hydroskeleton are:

- sea anemones
- earthworms
- jellyfish

- some starfish and sea urchins

Animals with such a body often need to live in or near water or damp soil. Their skins are often thin and moist because they breathe through their skin.

DID YOU KNOW?

Hermit crabs have very soft bodies, not like their other crab and crayfish family. The hermit crab finds an empty shell and settles down inside it. When the crab grows too big for the shell, it moves out and finds a bigger shell!



An earthworm needs to live in damp soil.²⁵



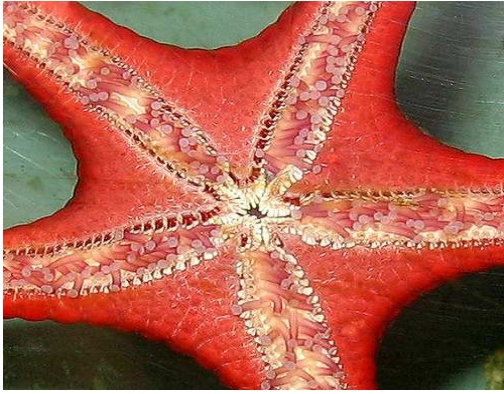
A jellyfish has a hydroskeleton.²⁶

Many invertebrates have a shell or hard covering protecting their bodies. This external skeleton is called an exoskeleton.

QUESTIONS

Can you think of any invertebrates that have exoskeletons? Have a look at the previous illustration again if you need some ideas.

starfish, butterfly, millipede, crab, spider



Underneath a starfish. Can you see the little "legs" sticking out of the exoskeleton?²⁷



Sea shells protect the soft bodies of invertebrates.²⁸

DID YOU KNOW?

97% of animals alive today are invertebrates! (That means almost all animals are invertebrates!)



A hermit crab hiding safely in a hard shell.²⁹



The hermit crab now decides it is safe to walk around.³⁰

Insects are in an interesting group of invertebrates.

- All insects have exoskeletons.
- They all have segmented bodies and legs. That means their bodies and legs are made up of different sections.
- Insects have six legs and three main body parts - a head, a chest (thorax) and a tail (abdomen).


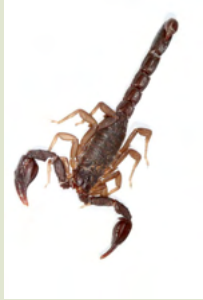

ACTIVITY: 1, 2, 3, 4, 5 ...once I caught a bug alive!

INSTRUCTIONS:

1. Study the invertebrates in these photos.
2. Can you see if they have a head, chest and tail?
3. Carefully count their pairs of legs (if you can't see all their

legs!)

4. Do they have any wings?
5. Write the number of legs and/or wings each invertebrate has in the space below it.
6. Describe how each animal's body is covered.

			
	31	32	33
Legs			
Wings			
Coverings			

EXTENSION

Build a terrarium in your class for invertebrates. A terrarium is an enclosure, container, or structure adapted or prepared for keeping smaller land animals, esp. reptiles, amphibians, or terrestrial invertebrates under semi-natural conditions for observation, for study or as pets. Terrariums are typically glass-fronted cases.

1. Find an old glass container that is no longer being used. This container MUST have a lid.
2. Put 10 - 15 cm of soil in the bottom.
3. Plant some ferns and other easy-to-grow plants in there.
4. Collect insects and other invertebrates and keep them in your terrarium. The plants growing inside the terrarium will produce oxygen for your little critters. Water the plants once a week or so.
5. Each learner can choose one specific invertebrate and keep a diary of that animal's "life" over the next 3 - 4 weeks.
6. The learners can then present their findings to the class.

SAFETY WARNING Some learners might be allergic to some of the animals you find. Avoid bringing any potentially harmful animals such as stinging insects.

Vertebrates

Vertebrates are animals that have a skeleton inside their bodies (an endoskeleton). Part of their skeleton is a backbone. The word 'vertebrate' is closely related to the word 'vertebrae' which is what we call the individual bones that form the backbone (so vertebrates have a backbone made up of vertebrae). Vertebrates are broken down into 5 smaller groups:

- Fish
- Amphibians (including frogs)
- Reptiles
- Birds
- Mammals

VISIT

A video about
endoskeletons video:
goo.gl/I51sz

Vertebrates grow much larger than invertebrates because their bones grow with them and can support their muscles.

ACTIVITY: Identifying common characteristics

Introducing this activity

The following section in the CAPS / textbook covers the animal skeletons in more detail. This activity practises learners' abilities to identify common features or characteristics, but more so helps them appreciate that learning can happen within an interdependent community of learners working together. Teachers are encouraged not to "teach" this activity but to facilitate discussion by asking probing questions and walking between groups to make sure everyone remains on task.

INSTRUCTIONS:

1. Work in pairs and study these pictures of animals that all have an endoskeleton.
2. Identify characteristics that are similar in all these animals.
3. Write down your observations on scrap paper.

4. Report back to the class and compare your ideas with those of your friends. Add or change your observations on the scrap paper.



*A dog*³⁴



*An elephant*³⁵



*A frog*³⁶



*A human*³⁷



*A seagull*³⁸



*A shark*³⁹



A crocodile ⁴⁰

QUESTIONS:

1. Complete the sentence below by writing down all the characteristics which are common to animals with endoskeletons.
Animals with endoskeletons all...
2. Write down two examples of mammals from the above pictures.
Elephant and dog
3. What type of bird is shown in the picture?
A seagull
4. Give an example of a reptile.
Crocodile.

Let's take a look at the differences and similarities between exoskeletons and endoskeletons.

This extension activity is not required by the CAPS but is a good introduction to the following section on Animal Skeletons where the function of the skeleton is covered in great depth.

ACTIVITY: Extension: Comparing endoskeletons and exoskeletons

INSTRUCTIONS:

1. Divide into groups of 5 - 7.
2. Carefully study the above section on Animal types and especially focus on the differences between exoskeletons and

endoskeletons.

3. Brainstorm as many differences between exoskeletons and endoskeletons in your group as you can think of.
4. Once you have brainstormed in your group, share your ideas with the class and discuss these.
5. Record this comparison in the table below.

	Exoskeleton	Endoskeleton
Examples of animals		
Position of the skeleton		
Functions of the skeleton		
Muscle attachment		
Joints		
Mode of movement		

	Exoskeleton	Endoskeleton
Type of animal	crab, bee	lion, human, bird, frog
Position	outside the body	inside the body, fluid-filled
Functions	protects, prevents drying out, supports	protects soft organs, support, movement, stores minerals in bones
Muscle attachment	attaches to inside of the exoskeleton parts	attaches by tendon onto the bones of the skeleton

Joints	only hinge joints	various joints between the bones
Mode of movement	walking, jumping, swinging, flying	walking, running, jumping, swinging, swimming, flying



KEY CONCEPTS

- There are many different plants and animals.
- They live in different habitats on Earth.
- All the plants and animals and their habitats make up the total biodiversity of the Earth.
- South Africa has a rich variety of indigenous plants and animals and their habitats.



REVISION:

1. Match the type of habitat in the left column to the appropriate description in the right column by drawing a line between the correct pairs.

Next to each habitat write an example of an animal and plant that live specifically in that kind of environment. Choose animals that live specifically in that habitat.

Example of a plant and animal that lives in this habitat	Habitat	Description
	Forest	Even though the animals in this habitat can be the biggest on the planet, some of these giants only eat tiny plants!
	Desert	Many large mammals and other animals and a range of plants and big trees live here.
	Aquatic	Very few trees grow here even though the soil is fertile.
	Grassland	Very few plants grow here because water is not readily available.

Learners need to list appropriate animals - preferably from those we studied in this chapter

- Even though the animals in this habitat can be the biggest on the planet, some of these giants only eat tiny plants!

Aquatic

- Many large mammals and other animals and a range of plants and big trees live here. **Forest**
- Very few trees grow here even though the soil is fertile.

Grassland

- Very few plants grow here because water is not common. **Desert**



2. Write a short description of the interdependence of the honey badger, the honey guide bird and the bees. Which animals benefit from this relationship and which do not?

The badger doesn't know where the bee hive is so it cannot get honey. The honey bird knows where it is but it cannot get to the larvae inside the hive because the bees' stings will kill it. The badger has a thick skin that the bee stings cannot penetrate. The honey guide shows the badger where the honey is and the badger breaks open the hive, eats the honey and leaves the larvae to the honey guide. The bees make honey which the birds feed off and the badger eats the bees' larvae. The bees do not benefit from this relationship.

3. Name the different types of skeletons.

Exoskeleton, hydroskeleton and endoskeleton

4. In the table below write which kind of skeleton the animal has then in the next column write whether the animal is an invertebrate or a vertebrate.

Animal	Type of skeleton	Vertebrate or Invertebrate?
 <p>A grasshopper ⁴¹</p>		
 <p>A bluebottle ⁴²</p>		

 <p>Cape sparrow</p>		
 <p>Tortoise 43</p>		
 <p>Frog 44</p>		
 <p>Crab 45</p>		

Grasshopper: Exoskeleton, invertebrate
Bluebottle: hydroskeleton, invertebrate
Cape Sparrow: Endoskeleton, vertebrate
Tortoise: Endoskeleton, vertebrate
Sea horse: Endoskeleton, vertebrate
Frog: Endoskeleton, vertebrate
Crab: Exoskeleton, invertebrate



I loved learning about some of the plants and animals that live on our planet Earth.

Let's now take a closer look at animal skeletons, including our own!



KEY QUESTIONS

- What does my skeleton look like?
- Why do I have bones in my body?
- Do all skeletons look like mine?
- Can you tell if a skeleton belongs to an animal or a human?

New Words

- backbone
- skull
- spinal column
- ribs
- shoulder blades

2.1 Skeletons of vertebrates

Introducing this topic:

If possible, stick old x-rays on the windows before the class commences - when they walk in it would make quite an impact as to the nature of the lesson. Perhaps visit a local veterinary hospital and ask if they don't have old x-rays that you could use. If you have enough x-rays covering the windows the light in the class should be dimmed which will lend an element of eerie fascination to the lesson.

- Start by asking learners about skeletons and if they have ever seen a skeleton. Many at this age are quite "into" skeletons and things that go bump in the night.
- Explain that you are going to learn about the skeletons of vertebrates. Because humans are vertebrates, you will start by learning about their own skeletons and what the different bones are for in the body (their function). Then you will learn about the skeletons of other vertebrates and because you will know about the human skeleton, you will be able to compare its function to that of the human skeleton.
- Collect cereal boxes for their skeleton puzzles.

You now know that all vertebrates have bones inside their bodies, while invertebrates do not.

Every time a vertebrate animal moves, it uses its bones, joints and muscles. In this section we are going to study the bones, joints and muscles that help vertebrates to move.

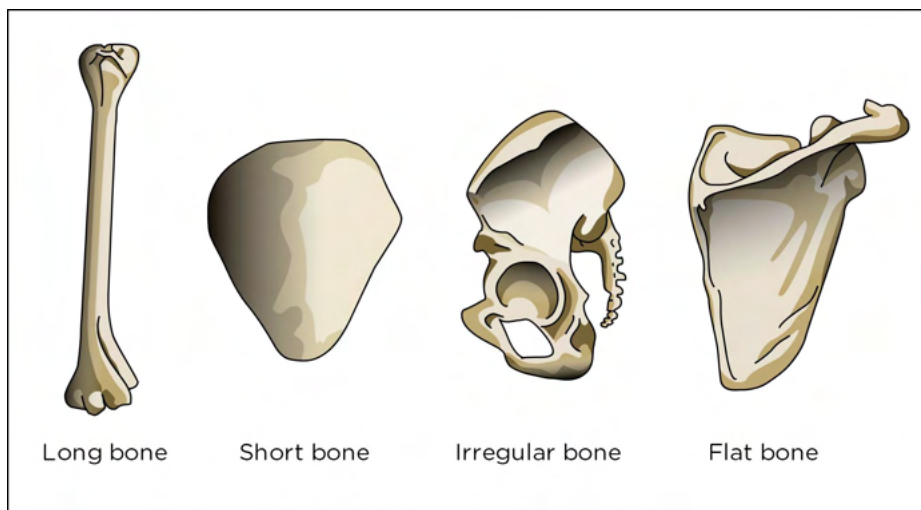
Bones

Bones are hard and form a very strong frame structure to support and protect a vertebrate animal's body.

Vertebrates all have similar kinds of bones - some are much bigger than others, but the basic structure of the bones are very similar.

VISIT

The skeleton song
goo.gl/SPfw1



Different kinds of bones.

ACTIVITY: Identifying bones in your body

MATERIALS

- Photocopied bones puzzle picture of the human skeleton
- Photocopied labels that go with the picture of the human skeleton
- Scissors
- Glue
- Recycled thin cardboard such as a cereal box
- Pencils and ruler
- Colouring pencils if you want to decorate your skeleton

INSTRUCTIONS:

1. How many functions of the bones in the skeleton can you remember?
 - *It gives the body shape*
 - *Protects internal organs*
 - *Supports organs and flesh*
 - *Allows for movement by attaching to muscles*
2. Your teacher will hand out a jumbled puzzle of the human skeleton. Carefully cut out each piece along the dotted line.

Teachers must emphasise that learners cut only on the dotted lines. This is a good activity to assess learner's fine motor, spatial and hand-eye coordination skills as this impacts many other areas where learners might battle in their schoolwork and might give teachers some idea as to the types of problems they experience and how they can address these. We suggest that teachers walk through the class and carefully observe learners during this activity and assist those who need their help.

DID YOU KNOW?

An adult human has an average of 206 bones in their body!

3. Build your human skeleton on the back of your recycled cardboard - do not stick it on yet as you might need to move it slightly if it does not fit properly onto the cardboard.
4. When you have it in place correctly, use glue to stick it to the cardboard.
5. Cut out the labels from the table.
6. Carefully pack the labels in the correct places - do not stick these down until you have done all of them as you might need to reposition them to fit it all in.

Here are the words of a song that teaches you about bones. The chorus lines has been left out each time.

1. Work in groups of 5 - 7.
2. Compose a rap rhythm and beat, compose your own tune or use an existing song to accompany these lyrics. Feel free to make or use instruments to accompany your singing.
3. Present your song to the class.

The Bone Song

Your head bone's connected from your neck bone,
Your neck bone's connected from your shoulder bone,
Your shoulder bone's connected from your back bone,

So...

Your back bone's connected from your hip bone,
Your hip bone's connected from your thigh bone,
Your thigh bone's connected from your knee bone,

So...

Your knee bone's connected from your leg bone,
Your leg bone's connected from your ankle bone,
Your ankle bone's connected from your foot bone,
Your foot bone's connected from your toe bone!

So...

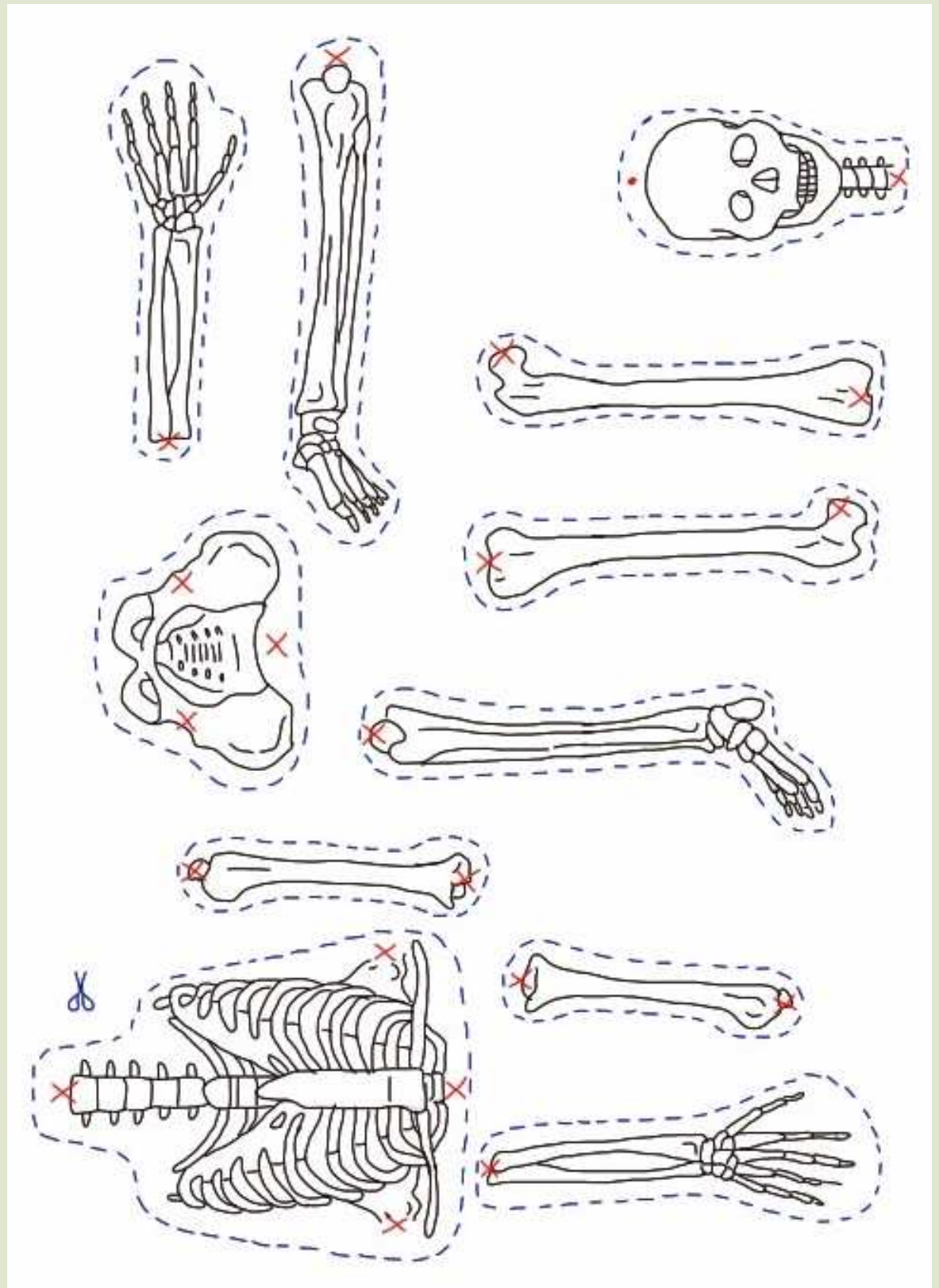


Photocopy the bones puzzle sheet (make enough copies for each learner).

The labels below are for the bone puzzle and also need to be photocopied for the learners to cut out and add to their completed bones puzzles.

skull	foot bones	lower jaw bone
thigh bone	ankle bones	inner forearm
calf bone	toe bones	shin bone
ribs	backbone	wrist bones
kneecaps	hip bone	finger bones
tail bone	collar bone	hand bones
breast bone	arm bone	outer forearm

Teachers who feel industrious can enlarge this puzzle and make a "life-size" version to hang or stick on the classroom door. Add labels and stick a small box to the door for suggestions for a name for the skeleton.

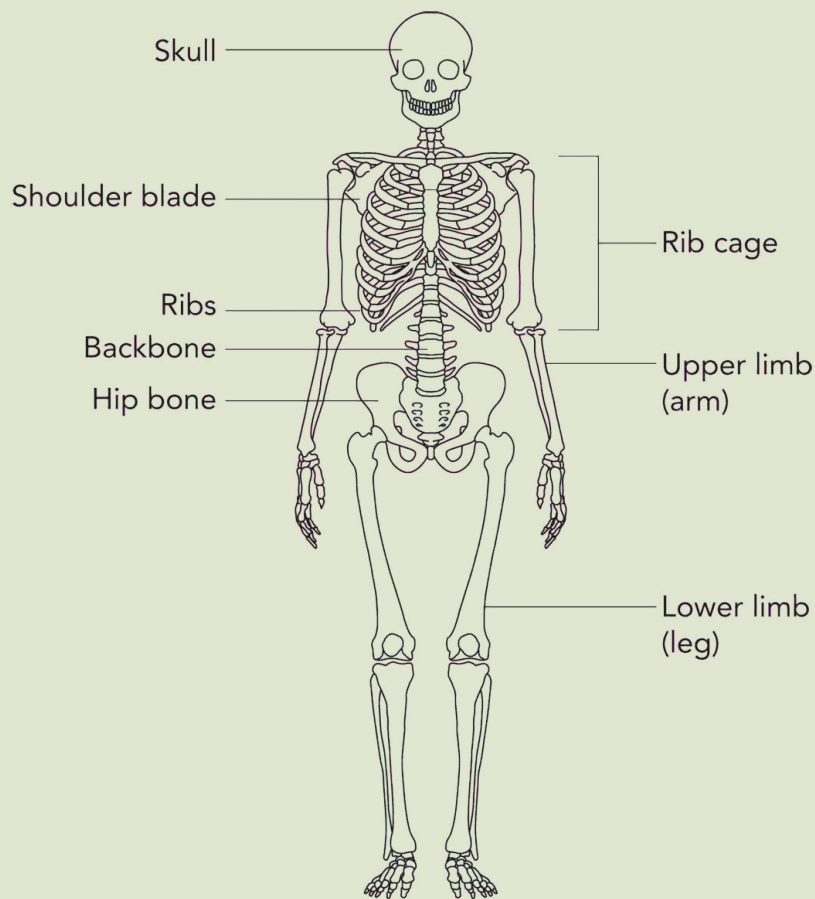


Now that you know where all the bones in the body are, you are probably wondering what exactly each bone's job is. Let's find out.

ACTIVITY: The bones in the human skeleton

INSTRUCTIONS:

1. Examine your skeleton puzzle. This illustration of the human skeleton might also help. Pay special attention to the shapes of different kinds of bones.
2. Can you identify examples of the four different kinds of bones? Write the examples of each kind of bone that you can find in this table.



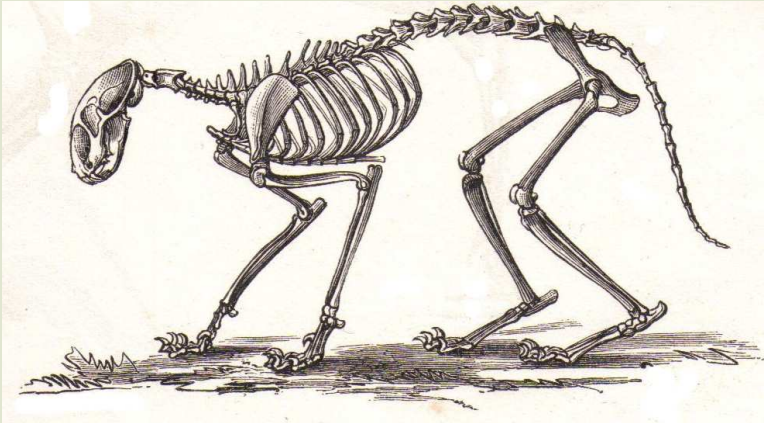
The human skeleton.

Type of Bone	Where in the vertebrate body can you find it?
Long bones	arms, legs, finger bones and feet bones
Short bones	wrist and feet
Flat bones	hip bones, skull, sternum (chest bone) and shoulder blade; ribs are also considered flat bones
Irregular bones	vertebrae / backbone; jawbone

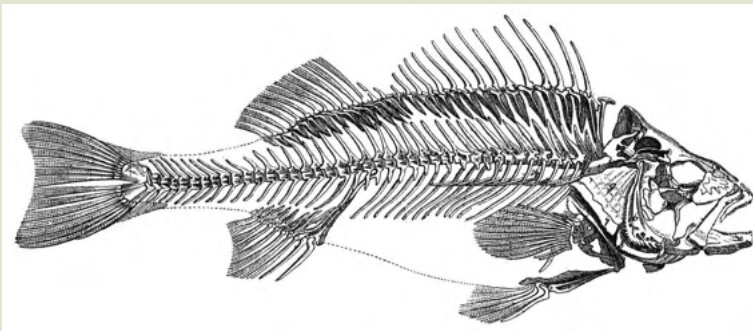
3. Now see if you can identify these bones in some other vertebrate skeletons! Use this key to show on the picture of the skeleton where the different bones are :

- L = Long bone
- S = Short bone
- F = Flat bone
- I = Irregular bone

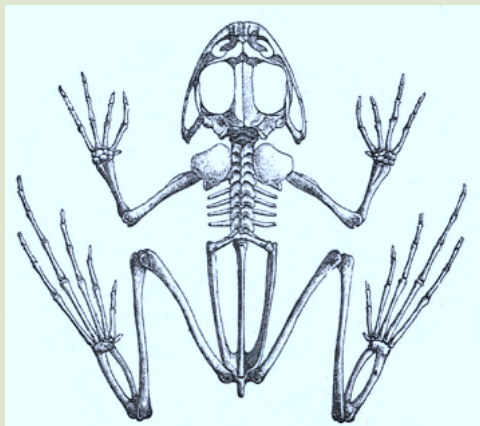
Cat skeleton



Fish skeleton



Frog skeleton



QUESTIONS:

1. Which of the animals is a mammal?
cat
2. Which is an amphibian?
frog

Now that you know how to identify the different kinds of bones in vertebrates, let's take a closer look at the functions of some of these bones.

Remind learners that we study the human skeleton as an example of a vertebrate but that most vertebrates share the same structure of the bones and that these bones' functions are similar.

Functions of the bones in a vertebrate skeleton:

1. The skull

The vertebrate skull is made up of different bones that grow together to form a protective "box" or "shell" structure.

- The skull protects the eyes and ears, nose and mouth.
- It protects the brain.
- The teeth and the lower jaw is also attached to the skull.

2. The backbone

- The backbone is made up of vertebrae.
- A hole runs through the middle of each vertebrae. When the vertebrae are connected, the holes all line up to form a tube. This is where you find the spinal cord. The spinal cord is a bundle of nerves that is connected to the brain. It is surrounded by blood vessels.
- The backbone has two functions (jobs):
 - It protects the spinal cord that runs inside it.
 - It supports the upper body.

QUESTIONS

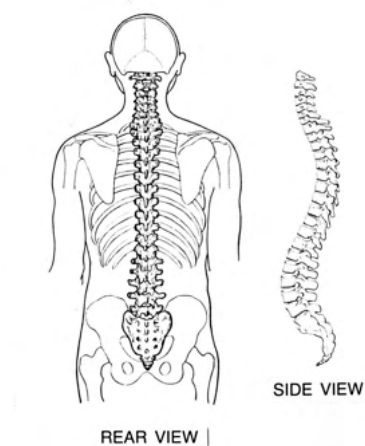
Can you identify the animals that each of these skulls belong to? Write the name in the space below each skull.



Answer: Crocodile skull, horse skull, rhinoceros skull, human skull.

DID YOU KNOW?

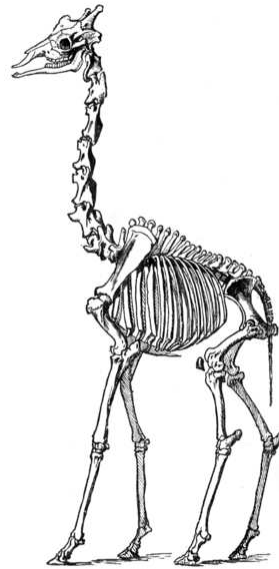
A baby and an adult do not have the same amount of bones. When a baby is born, their skull bones are not joined. The bones can move over each other to allow the baby to go through the birth canal! After birth the skull bones start to grow together!



The human backbone and vertebrae.

QUESTIONS

Compare the bones in the backbone of the giraffe below with that of the human above. What do you notice about the shape of the vertebrae in the neck and in the back of the giraffe and those of the human's neck and bones?



Giraffe skeleton.

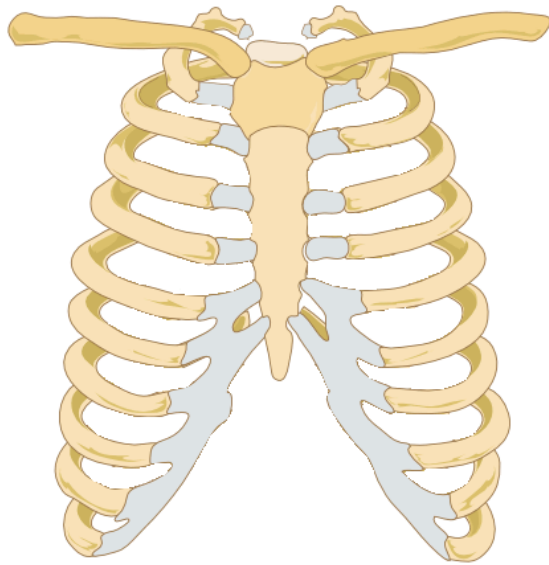
DID YOU KNOW?

Giraffe only have 7 vertebrae in their necks - go ahead and count them. That is exactly the same as in a human neck - and almost all other mammals.

3. The ribs

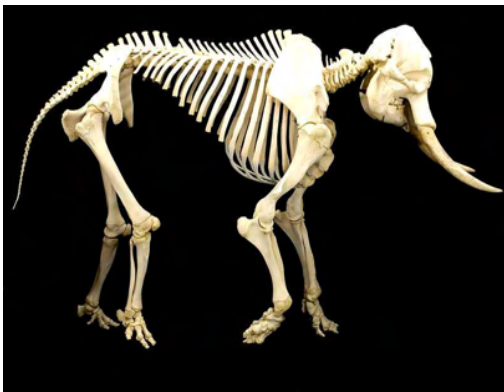
Vertebrates have long curved bones around their chest. We call these bones ribs. These ribs are joined to the backbone and often to the front to form the rib cage.

- In most vertebrates, the ribcage is around the chest area of the animal to protect the lungs, heart and other important organs.
- In animals like snakes, the ribcage can protect and support the whole body.
- The breast bone in birds is much longer. The flight muscles attach to this.

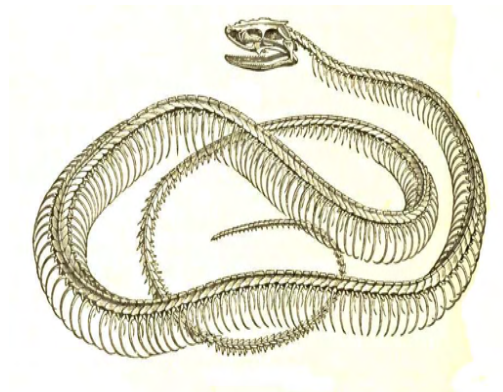


This is a human rib cage.

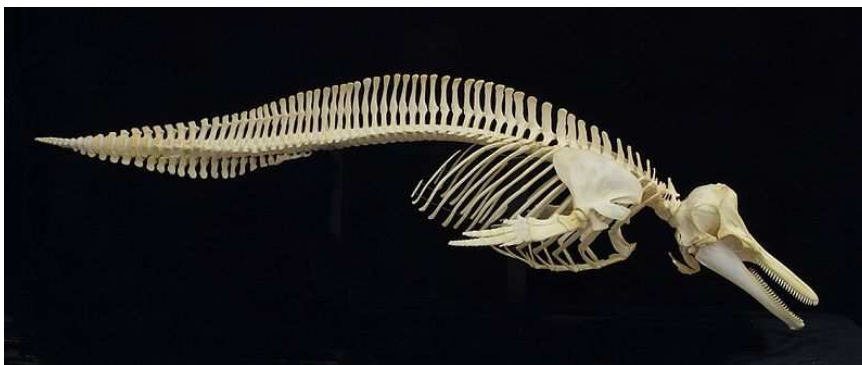
Many mammals have a similar shape rib cage. Compare the rib cages of these animals to your own.



An elephant skeleton - do you see the rib cage and backbone?



A snake's rib cage protects and supports almost the whole body.



A dolphin - do you see the front limbs look just like the other mammals' limbs?

4. Shoulder blades, arms, legs and hip bones

Vertebrates use their fore and hind limbs for movement.

VISIT

Videos about the
skeletal system

goo.gl/D5wuL

goo.gl/TMRRy

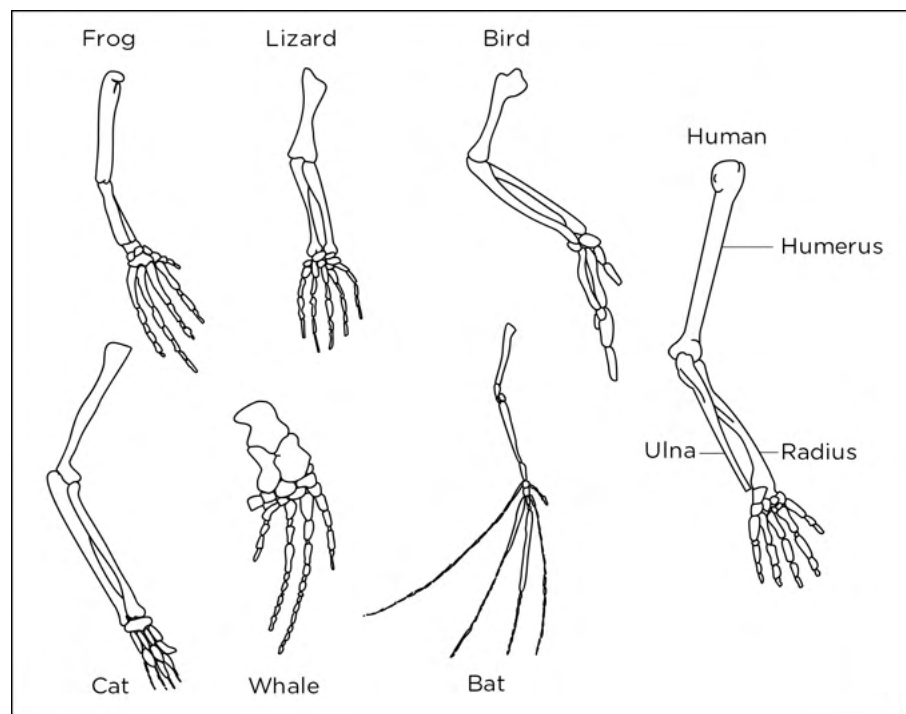


Many animals' limbs are attached to their bodies at the shoulder or hip joints. However not all animals have hip or shoulder girdles - like fish and snakes.

- Muscles attach to the shoulder blades and they control the movement of the forelimb or arm.
- The lower or back limbs (legs) attach to the body at the hips.

The human arm. Can you see the flat shoulder bone, and the long bones making up the arm?

The bones in different vertebrate limbs look very similar. Look at the picture which, shows the limbs of different animals.



Different forelimbs of vertebrate animals.

2.2 Movement in Vertebrates

New Words

- ligament
- tendon
- joint

Now that you know a little more about a bones, let's see how animals use their bones, joints and muscles to help them move.

QUESTIONS

Do you remember what a skeleton's function is? List as many of the functions of the skeleton as you can think of below.

- The skeleton gives support and shape to their bodies.
- It protects soft organs and tissues.
- Muscles are attached to the bones.
- Muscles allow vertebrates to move around.

Vertebrate animals can move because of two really important things:

1. They have **joints** between their bones that can let their bones move.
2. Their **muscles** are attached to their skeletons.

If you want to know how an animal moves you need to know how their joints and their muscles work.

Introducing this topic

There are many ways to introduce this topic and depending on the class' discipline and behaviour one might be inclined to choose one rather than the other.

- Prepare a large variety of music genres: hip hop, classical, nursery rhyme, rock, gospel, orchestral, opera, metal, etc... If at all possible try to "copy" them into one playlist so each song plays at the most typical part for about 30 - 45 seconds. It's difficult to get into the sway of things when you have to wait for the intro of each song to finish and then for the teacher to take out and load another CD!
- Distribute scrap paper to half the class and ask them to take a pencil and hard book to press on and sit in a circle around an open space in the class or hall. The other half of the class will dance or move to the music. They will need to write down or quickly sketch as many different types of movements that the "dancing group" does to the different kinds of music.

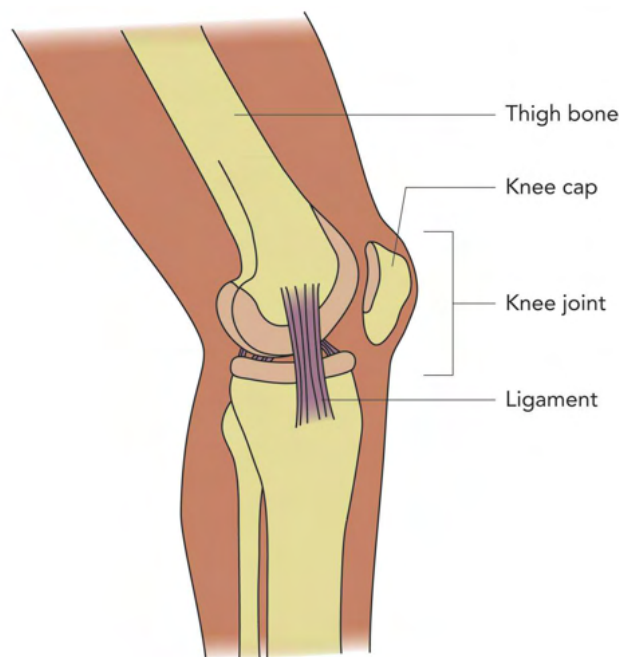
- Swap over and let the "dancing group" observe this time.
- Discuss the different kinds of movement that they identified and try to make a chart or class mind-map - use words like: sway hips and arms; jump up and down with legs and feet; swing arms around wildly; jiggle whole body; nod head up and down; shake head; slide arms and legs across the floor; etc. Write this mind-map on a large sheet of paper to display in class. You will refer to this later.
- If possible combine this lesson with a lesson on the different kinds of verbs in Home Language teaching.
- Discuss what they think made them move : the muscles, bones and joints.

VISIT

Video: Types of joints
goo.gl/5BhaI

Joints

Joints are the places where bones come together. They come together in a special way to allow the animal or human to move - like at your elbow or wrist. There are different kinds of joints.



This is a knee joint. Can you see that it is where the bones of the leg come together?

QUESTIONS

List four other joints in your skeleton.

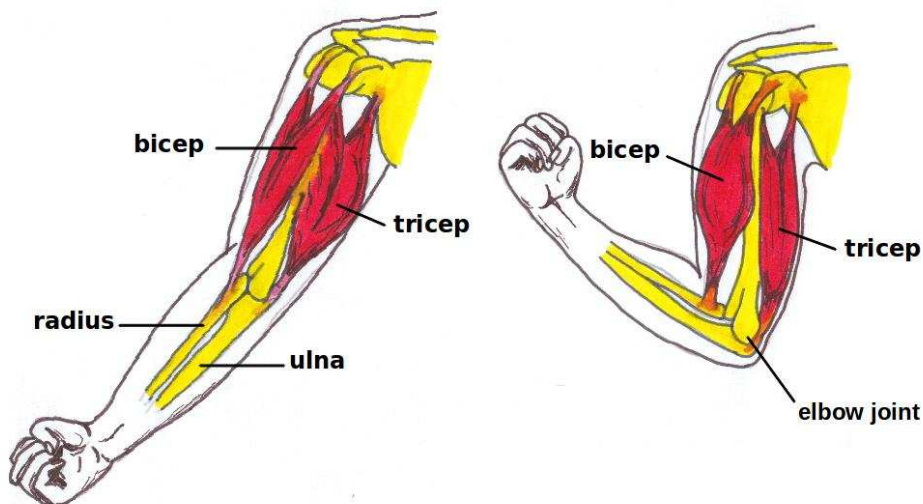
Elbow joint, shoulder joint, hip joint, joints between fingers, joints between toes, ankle joint, etc

How do the bones and the joints move?

Look at the example of the moving arm. Look at the picture. There are two muscles which enable your arm to move - your tricep and bicep. They work as a pair. When the one muscle contracts, the opposite muscle relaxes.

To bend your arm, the bicep muscle "contracts" and pulls on the radius bone. The tricep muscle relaxes, allowing your arm to bend at the elbow joint.

To straighten your arm, the tricep muscle contracts and pulls on the ulna bone while your bicep muscle relaxes and your arm straightens.



The arm moves using muscles, joints and bones.

ACTIVITY: Describing movement in vertebrates

INSTRUCTIONS:

Now that you know that bones and joints are controlled by muscles, let's look at the ways that muscles and bones make you (and other vertebrates) move!

1. Divide your class into two or four teams and play CHARADES.
 - Your teachers will put the names of different animals in a hat.
 - A person from one team pulls an animal's name from the hat.
 - They may not make ANY NOISE or make any signals that will give the animal away!
 - They need to mime the movement of this animal to their group.
 - Three people in their group may have a turn to guess which animal they are miming. If all three get it wrong then the other team can guess what the animal is. If they cannot get it right then the "mime-artist" must reveal their animal.
 - Points will be awarded as follows:
 - 5 points for the first guess that is correct... If this guess was wrong...
 - 4 points for the next guess that gets it correct If this guess is wrong
 - 3 points for the next guess that gets it correct If this guess is wrong ask the other team but the mime is not allowed to demonstrate their action again

This is a time-saving clause as this game can drag on and on if they are given multiple opportunities to mime. Everyone should be watching the first time.

- 2 points for the other team if someone gets it correct the first try. If they get it wrong then...
- 1 point for the least try - if they get it wrong then no points are awarded.

Suggestion: depending on the class atmosphere and discipline teachers can choose to let the mime choose who should answer but it might be easier if teachers called the names of those who should venture a guess.

2. Choose three (3) of the animal movements that your friends mimed and which you really liked. Write down for each of these:
- The bones that were used to create that movement in the animal.
 - The joints that were part of the movement.
 - The muscles that controlled the movement.

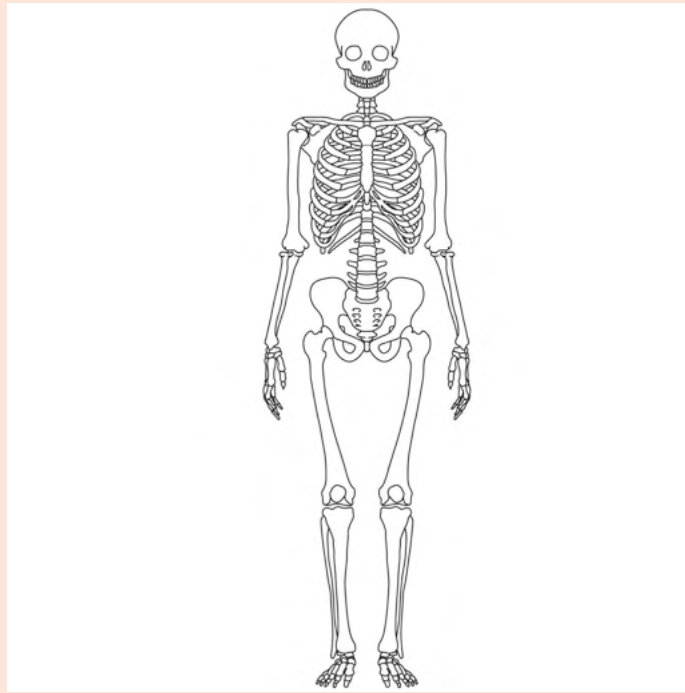


KEY CONCEPTS

- A vertebrate skeleton (inside the body) has bones and joints.
- Bones are strong and form a strong frame structure.
- A skeleton protects part of the body.
- A skeleton supports the body.
- Vertebrate animals can move because they have muscles attached to the skeleton.

REVISION:

1. What type of skeleton do you have?
Endoskeleton
2. What do all vertebrate animals have that makes them vertebrates?
Vertebrates have a backbone and skeleton inside their bodies.
3. What is a major difference between the skeletons of a mouse, a crab and an earthworm?
 - *A mouse has a skeleton and backbone inside their bodies. This is called an endoskeleton.*
 - *A crab has no bones inside its body but a hard shell outside its body to protect it. This is called an endoskeleton.*
 - *An earthworm has no bones inside its body nor does it have a casing on the outside like the crab. It has a hydroskeleton which is fluid support.*
4. Below is a diagram of the human skeleton. Label the following on the diagram of the skeleton:
 - skull
 - backbone
 - ribs
 - rib cage
 - shoulder blade
 - hip bone
 - upper limb
 - lower limb
 - Think of at least two other bones in the skeleton that we did not include in this list. Label them on the skeleton.



5. Joints help us to move. Look at the diagram of the human body. Add in labels to show where you can find an example of the following:

- elbow joint
- knee joint
- shoulder joint

6. Name the three things that all vertebrates need to be able to move.

bones, joints and muscles; if they say tendons and ligaments that is technically correct too so give them a point for each one (this should earn them 2 bonus points)

7. What is the difference between the way a human moves, the way a dolphin moves and the way a dog moves? Describe the movement of each animal, the limbs that are used and the position of the body.

A human walks upright on the hind limbs whereas a dog walks on all four limbs. A dolphin uses its front limbs and its tail to move through the water. A human and a dog move on the ground whereas a dolphin moves in the water. Humans and dogs have four limbs, but a dolphin only has two limbs and a tail for movement.



KEY QUESTIONS

- How does a skeleton or shell keep things safe inside?
- Do humans have shell or frame structures?
- How do you make a structure really strong?

Introducing this topic

This is a technology unit and will follow the principles of technology teaching and specifically the design process. As such the different activities in this unit will be preparing learning to build their own shell or frame structure at the end of the unit - these are called **enabling** activities. They are designed to enable learners to tackle the problem at the end of the unit with the necessary knowledge, understanding and skill to complete it confidently.

Learners will have to make a model of a vertebrate skeleton using struts made from rolled paper or drinking straws as a project. Enabling activities in this unit will therefore be:

- What is the difference between a shell and a frame structure?
- Are there shell and frame structures in nature?
- How can a structure be reinforced or made stronger?
- What is a strut and how does it make a structure stronger?

Once learners have gained a good understanding of these four points they are required to make a model of a vertebrate skeleton using these skills.

In this chapter we will investigate two kinds of structures, frame and shell structures.

3.1 Structures

A structure is something that is arranged or put together in a specific way and is made up of different parts. A jungle gym is an example of a structure. It has many different parts like beams, ropes, and bars, that are put together in a special way.



New Words

- frame structure
- shell structure
- support
- weight
- enclose
- resist
- load

A jungle gym is a type of structure.^{1,2}

Most structures are designed to remain stable and rigid which means they should not break and crumble or topple and fall over if something heavy is placed on top of or against them.

Structures have different jobs or functions. They:

- support
- protect
- enclose - that means they keep something in or they keep things from getting in (like a tin of juice or a fence around a building).
- help with movement

We get three kinds of structures:

- frame structures
- shell structures
- solid structures

In all structures, the shape of the structure is very important. A structure will be able to resist or hold a certain weight depending on its shape.

In Gr. 4 in Matter and Materials, we looked at strong frame structures and also how to make structures stronger using struts and braces. In this chapter in Life and Living, we are going to focus on two kinds of structures: frame structures and shell structures. This is because they relate to the skeletons of animals.

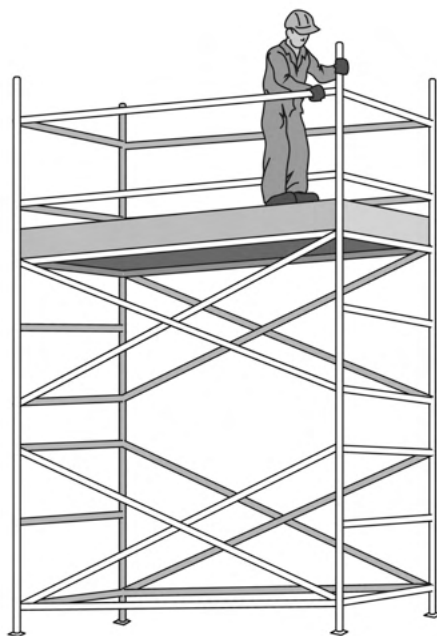
QUESTIONS

Turn to a friend and think about the words "Shell Structure" and "Frame Structure" and think what these could mean. Then think of examples of frame structures and of shell structures that you can see in buildings or perhaps on your walk or ride to school. Report back and discuss these with your class.

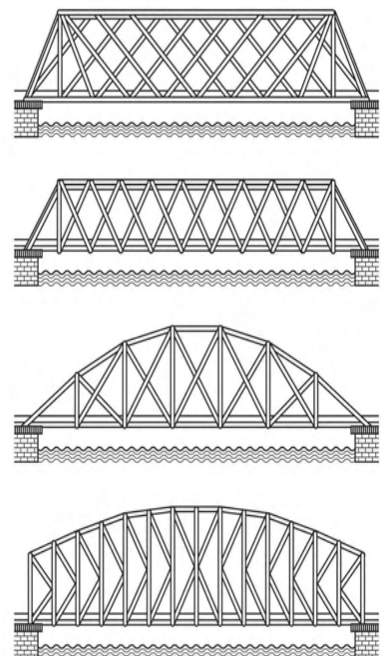
Teachers can use this question to assess pre-existing knowledge of shell and frame structures as similar work should have been covered in the previous year. Frame structures: burglar bars, palisade fences, cell phone towers, Eskom towers, sieve, jungle gym, etc. Shell structures: tortoise shell, hut, trailer, canopy on a bakkie, eggshell, snail shell, lids, pipes, etc.)

Frame structures

Frame structures are easy to identify because they have a frame or a skeleton. These structures are built or put together by attaching pieces of material together to make a frame. Look at these photos of frame structures.



Construction workers use scaffolding. The scaffolding forms a frame.



All of the triangles in these bridges make them strong frame structures.



A pylon is a frame structure that supports electricity lines.³



The veins in a leaf form a frame structure.⁴



A spider's web is a frame structure.⁵

These photos are all examples of frame structures. In some the frame is clearly visible - these are called open frame structures. In others the frame is covered by a "skin".

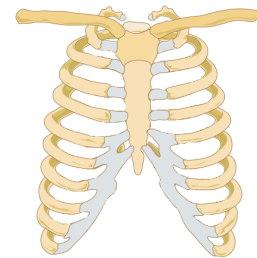
QUESTIONS

Turn to a friend and discuss what you think all these structures have in common - what is the same? Report back to your class.

There are struts and triangle shapes. The frame is sometimes bare and is the whole structure (such as the pyon or jungle gym) or the frame structure is covered by a skin, such as the leaf.

One of the most important frame structures for all vertebrate animals is their skeleton. The material used to make this frame is bone that is attached to the muscles that move the skeleton. The skeleton supports the muscles and protects the organs.

Here is a picture of a human rib cage. Can you see how it makes a frame structure?



The rib cage is a frame structure.

QUESTIONS

Which organs does the rib cage protect?

The heart, lungs and liver

In general, we can say that all vertebrates have a frame structure as a skeleton. This is because vertebrates have an endoskeleton which supports makes a frame to support the body.

Shell structures

Shell structures generally hold or protect things inside the structure. Humans make shell structures to protect and hold things, like a dish, a tin, a car or house.



A car has shell structure which protects the passengers inside. ⁶



These guavas are contained in a basket which is a shell structure. ⁷

In nature, eggshells and the exoskeletons of invertebrates, like crab and crayfish shells, are examples of shell structures. Shell structures are made to resist a very heavy load.

DID YOU KNOW?

It is almost impossible to crush an eggshell if you hold it vertically between your thumb and index finger!



An eggshell is an example of a strong shell structure. ⁸

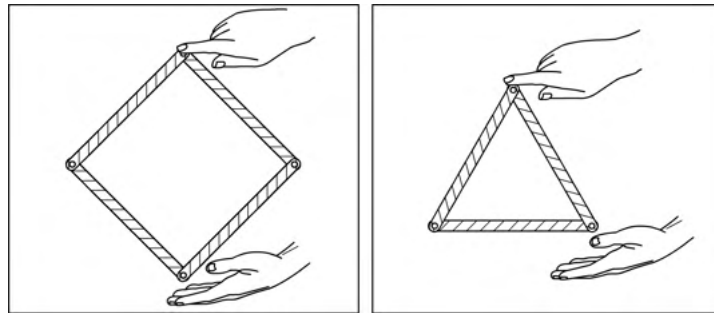


A crab has an exoskeleton which is a shell structure. ⁹

Strengthening Structures

Structures that protect something or hold a weight without breaking or falling, need to be really strong. Let's investigate the different ways we can use to strengthen a structure.

Do you remember in Gr. 4 Matter and Materials when we looked at whether a triangle or a square was stronger? Look at the picture to remind yourself.



Creating a square and a triangle shape.

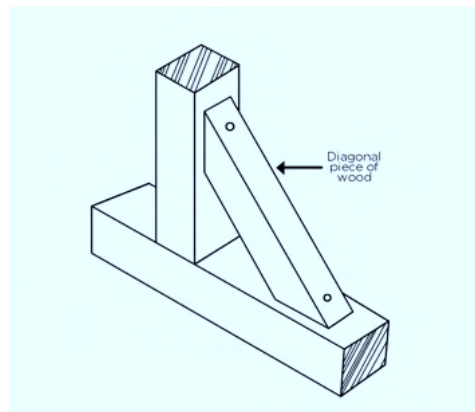
QUESTIONS

When you press on the shapes as in the picture, which shape is the most stable and rigid? Explain how you could make the other shape stronger and more stable.

The triangle is the strongest. The square can easily be squashed. You can make the square stronger by putting a diagonal strut in from one corner to the other.

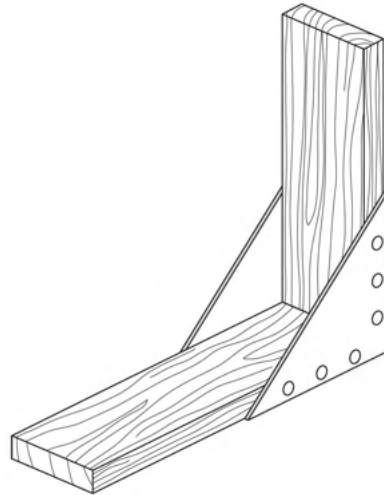
Corners in structures are very important because it is often the weakest point of a structure. To strengthen corners you can:

- Put another support (called a brace) across a rectangle's corner to make a triangle. This makes the corner much stronger.



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

- Place a triangular patch over the corner. This is called a gusset.



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

ACTIVITY: Making and designing a skeleton

This is the first time learners are doing a Technology project in Grade 5. They will have done some projects in Gr. 4, but it will be useful to emphasise the Design Process again as you are going through the project. The first step is to identify a need to do a design. In this case, a scenario has been set up that the local museum is looking for models of skeletons to put on display and Farrah has a suggestion for the Gr. 5 class to build their own models as you have just been learning about skeletons as structures. Use this to generate the need for doing the design and making the model. At the end you can make a "display" on one side of the classroom as if it is the museum and place the models on display with name tags for each skeleton.

The pattern followed for Technology projects is IDMEC:

I stands for Investigating the problem which some people have, investigating existing products, and investigating concepts and skills that you will need to solve the problem. In this case you would have already done a lot of investigating prior to the activity

when first looking at animal skeletons and then at structures and ways to strengthen structures. Learners must use this knowledge and experience when doing their designs.

D stands for Designing. That means using what you learned from investigations to think of good ways to solve the problem. Remember that learners may come up with new designs for their skeleton as they are going through the project. Encourage them that modifications are allowed and that they should not scrap the original idea but show how their idea has progressed and changed and why they might have changed their design.

M stands for Making. When you make your model, you use the materials and tools specified to make the model according to the design. Notice that most children design with their hands, not only with pencil and paper. As they work with materials they get more ideas, and their design improves. So we should think of designing and making as more or less the same stage of a project.

E stands for Evaluating. After you have made the model of a skeleton, you need to evaluate it to see if it followed the specifications, for example, can it stand up by itself? Is the model 3D and realistic? Is it a stable structure? Are there any improvements to be made?

C stands for Communicating. Learners must show other people how they decided on their solution to the problem. The learners should be drawing and writing all through the project. Don't leave the writing to the end, because they find it boring at that stage. When they are getting new ideas they often enjoy writing because they are writing about their own ideas; this is a great strength of technology in school. A technology project gives the children reasons for reading and reasons for writing. And so we can address the literacy problem through the subject of science and technology.

The local museum has asked your school if they have any models of vertebrate skeletons for a display. Farrah has an idea. She loves making things and she also loves animals. So, Farrah has suggested making our own animal skeleton models. We can then better understand the idea of skeletons as structures and use these models to put on display.

As a project, you need to design and make a skeleton for a vertebrate. This will be a frame structure.

You may use the following materials:

- Drinking straws

- Rolled up paper for members and struts.
- Wooden dowels or sticks (30cm x 10 mm)
- Cellotape
- Metal paper fasteners

INVESTIGATE:

Let's investigate and do some research around how to build a shell or frame structure. We looked at different ways to strengthen structures using special shapes and struts. Remember this when you are investigating and designing your skeleton.

DESIGN:

Now you need to use the information we found out to come up with a design for your skeleton. Your skeleton should have the following specifications:

- It must be 3-dimensional
- It must look realistic
- It must have/show the basic parts, i.e. skull, backbone, ribs
- It must be strong and rigid and so it can stand on its own

Your design has the following constraints:

- You cannot make your skeleton at home - you must make it at school.
- You are confined to using some of the following tools and materials: waste paper (A4 and A3), card, brass paper fasteners, glue, scissors, sositie sticks and nails (to make holes).

VISIT

Need ideas on how to build a skeleton from rolled-up newspaper?
goo.gl/5BhaI

Once you have thought about these specifications, you need to answer these questions:

1. What do you need to design?
2. What will the size and shape of your skeleton be? Remember that your skeleton must stand up straight for at least 3 minutes.
3. What materials are you going to use to build your skeleton. Make a list of all the materials you will need.
4. What tools are you going to need to make your skeleton?
5. Are there any other specifications and constraints that you can think of for your skeleton?

Now you need to draw some designs for your skeleton. 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 what materials you are going to use for the different parts.

MAKE:

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

Once you have all finished making your skeletons, you need to show your classmates what you made and tell you what you did to make your skeleton. This is called presenting your design.

EVALUATE:

Answer the following questions about your skeleton.

1. Did your skeleton stand up for 3 minutes without your support?
2. What could you change in your skeleton to make it work better?
3. Did your skeleton fulfill all the requirements in the specifications given to you?
4. If you ever had to build this skeleton 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 Farrah about the skeleton

DID YOU KNOW?

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

that you built, what worked and what did not work, so that she can also learn from what you did and also build a model skeleton to put on display at the museum.



KEY CONCEPTS

- Structures can be shaped as a shell or frame.
- Structures have specific functions - to protect, support, enclose or help to move.
- Shell and frame structures in nature.
- Structures can be strengthened.
- Struts can strengthen structures.

REVISION:

1. Complete the following table by stating whether the structures are frame or shell structures.

Structure	Shell or frame structure?
Jungle gym	
Eggshell	
Dog skeleton	
A cellphone tower	
A crab skeleton	
Scaffolding	
A car	
A basket holding fruit	

Structure	Shell or frame structure?
<i>Jungle gym</i>	<i>Frame</i>
<i>Eggshell</i>	<i>Shell</i>
<i>Dog skeleton</i>	<i>Frame</i>
<i>A cellphone tower</i>	<i>Frame</i>
<i>A crab skeleton</i>	<i>Shell</i>
<i>Scaffolding</i>	<i>Frame</i>
<i>A car</i>	<i>Shell</i>
<i>A basket holding fruit</i>	<i>Shell</i>

2. How would you strengthen a square shape? Give two different ways.
Place a diagonal strut across from one corner to the next. Or put a gusset on the corners.
3. Give two examples of animals with skeletons that are frame structures. What is the name given to this type of skeleton?
Endoskeletons - dog, human, birds, fish, etc
4. Give two examples of animals with skeletons that are shell structures. What is the name given to this type of skeleton?
Exoskeletons - crab, insect, etc
5. What are the advantages to humans for having a frame structure as a skeleton? Explain your answer.
Frames provide support for the muscles for movement. The frame provides protection to the internal organs. The frame structure does these while allowing the human to still grow as the bones are on the inside (endoskeleton). This means humans do not need to get a new skeleton when they grow as animals with exoskeletons do.