

# LIFE AND LIVING





## NEW WORDS

- atmosphere
- biosphere
- depend
- environment
- habitat
- microorganism
- organism

## KEY QUESTIONS:

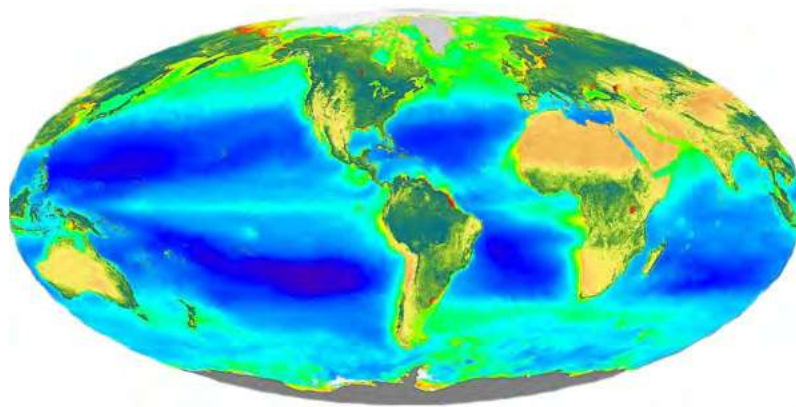
- What is the biosphere?
- What are the coldest or hottest places where life can exist?
- How deep can you go in the sea before you do not find anything living anymore?
- Are there living organisms on top of the world's highest mountains?
- How can you tell if something is alive or if it was never alive?
- What do organisms need to stay alive?
- How come some organisms can live in certain places while others cannot?

Let's start exploring the world around us and how it works! Remember that this is your book! You must use it to explore and ask questions about the world around you, and also to learn about yourself and who you are. Do not be afraid to take notes in the margins of this book - make your own scribbles and notes to yourself about points to remember or questions you would like to ask. Be curious! Explore and imagine the possibilities of what you can do with science!

## 1.1 What is the biosphere?

Have you heard the word 'sphere' before? Do you know what it means? A sphere is normally used when talking about a round shape (like a ball). Now, what do we mean when we talk about the **biosphere**? The prefix 'bio-' indicates something to do with life. For example, 'biology' is the study of living organisms. So, can you put these two meanings together to work out what 'biosphere' means?

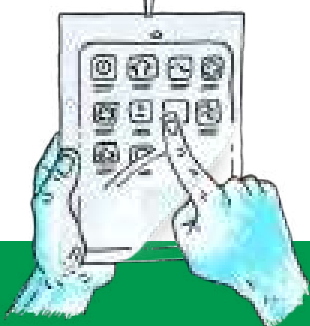
The biosphere is the place where life exists on planet Earth. When we talk about the biosphere, we are talking about a huge system (the whole world!) and how all the different parts work together to support life. We will look at these different parts in more detail a bit later.



*The biosphere is where life exists on our planet, including the soil and rocks, water and air.*

## TAKE NOTE

All the 'New words' listed in the boxes in the margin are defined in the glossary at the end of this strand.



We can also use the term biosphere in different ways. When we speak of all life on Earth as it interacts with the non-living rocks and soil, water and air (**atmosphere**), we call this the biosphere.



*Biosphere 2 is a man-made research centre in America, in the Arizona desert, where scientists have built a large enclosed artificial biosphere.*




We can also call a specific part or region on Earth that supports life, a biosphere, especially when we refer to the living organisms and the **environments** in which they live.

**ACTIVITY:** Where do you think life exists on Earth?

**INSTRUCTIONS:**

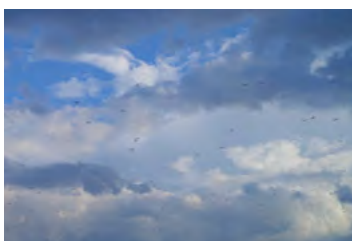
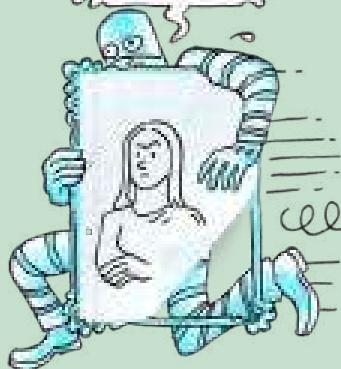
1. The following table contains some photos of different places on Earth. Describe what each photo is showing.
2. Then decide if you think life exists there or not. If you do think so, list some of the organisms which you think live in this place.

A place on Earth	What is this image showing?	Do you think there is life there? If so, what?
		



### TAKE NOTE

The 'Visit' boxes in the margins contain links to interesting websites and videos. Simply type the link exactly as it is into the address bar in your browser.



### NEW WORDS

- adapt
- aquatic
- component
- hydrosphere
- lithosphere
- marine
- matter
- organic
- photosynthesis
- respire



After doing this activity, did you see that life exists everywhere on Earth? From the highest mountains to the deepest oceans, from the hottest deserts to the thickest jungles, there is life. Did you also notice that when describing the places on Earth where life exists, you used words such as soil, rocks, water, air? These are all part of the biosphere and have special names.

### Components of the biosphere

In the previous activity we saw that life can be found in water, soil and rocks or the air around us. These **components** form part of the biosphere and have special names:

- **Lithosphere** which includes the soil and rocks.
- **Hydrosphere** which includes all the water.
- **Atmosphere** which includes all the gases.

The biosphere includes the lithosphere, hydrosphere and atmosphere. The biosphere includes all living organisms, and also dead **organic matter**.

## **ACTIVITY:** Describe the components of the biosphere

### **INSTRUCTIONS:**

1. Study the following photo that shows the components of the biosphere.
2. Identify and describe the elements of the lithosphere, hydrosphere and atmosphere that you can see in the photo.



*The lithosphere, hydrosphere and atmosphere on Earth.*

1. Lithosphere:

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2. Hydrosphere:

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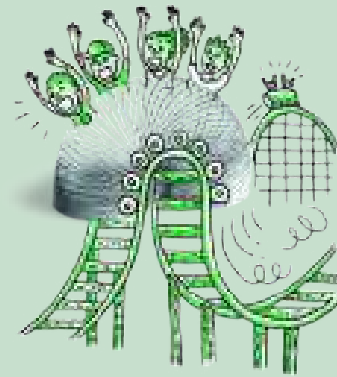
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3. Atmosphere:

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### **VISIT**

A fun infographic about the atmosphere

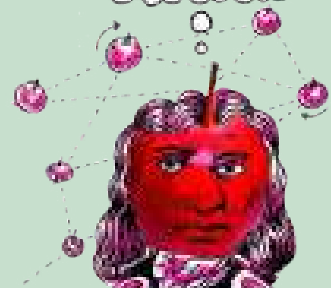
[bit.ly/132W0U0](http://bit.ly/132W0U0)



### **DID YOU KNOW?**

The Earth's atmosphere has changed over time.

Our oxygen rich atmosphere was formed by algae millions of years ago.





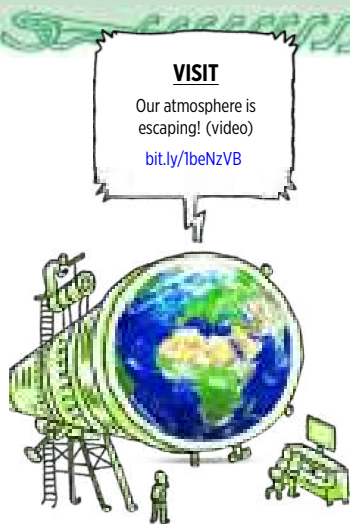
4. Even though you cannot see living organisms in this photo, there are many living and dead plants and animals that could live on a beach such as this one. Make about 10 plausible (believable) guesses of the types of organisms which would live in this environment. (Hint: think about what might be living in the sea, sand or air.)

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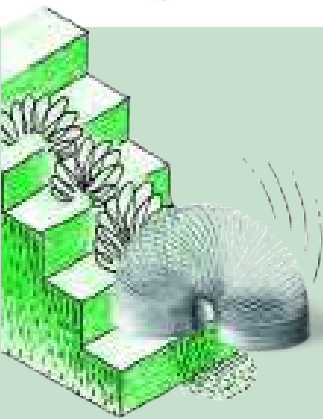
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Different organisms can exist in different places in the biosphere. Let's have a look at the different components of the biosphere and which types of organisms exist there.

### Atmosphere

The atmosphere is the layer of gases that surrounds the Earth. The three most important gases in the atmosphere are nitrogen, oxygen and carbon dioxide. The atmosphere is made up of several layers.



## ACTIVITY: The atmosphere

### QUESTIONS:

1. Discuss with your partner whether you think organisms could live on Earth without the atmosphere. Explain why you think so.

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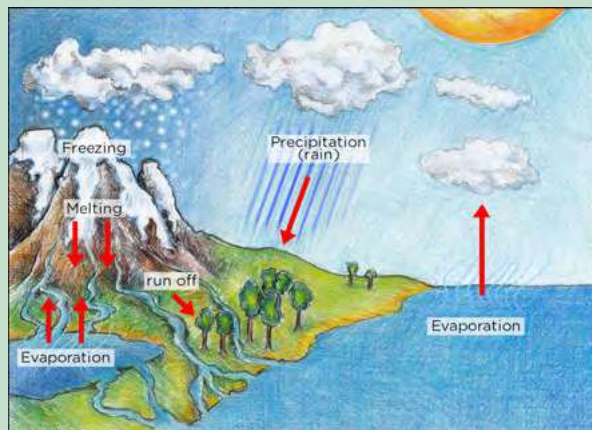
### Hydrosphere

The hydrosphere consists of all water on Earth in all its forms.

## **ACTIVITY:** The water cycle

### **INSTRUCTIONS:**

1. Study the following diagram describing the water cycle on Earth.
2. Answer the questions that follow.



### **QUESTIONS:**

1. Do you remember learning about the different states of matter? The hydrosphere includes all water in all the states of matter. Look at the diagram of the water cycle and identify water in the different states of matter.

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2. The water cycle shows different sources of freshwater and saltwater. Many plants, animals and microorganisms have adapted to live in an aquatic habitat. A very small percentage of the world's water sources are freshwater and the rest is saltwater. Write down as many different types of aquatic habitats that you can think of where different organisms exist.

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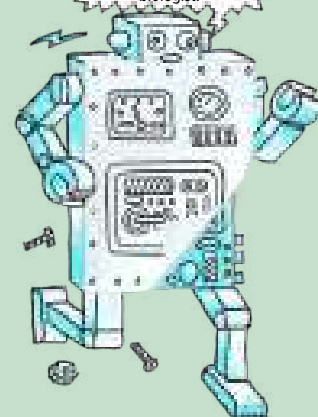
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#### **TAKE NOTE**

The word 'aquatic' is used to describe something to do with water. Therefore aquatic animals are animals that live in or near water. The word 'marine' describes organisms that live in saltwater or the sea. So someone studying the organisms in the sea is called a marine biologist.



## Lithosphere

As we have said, the lithosphere includes the rocks, soil and sand on Earth. Organisms **depend** on the lithosphere in many different ways. We find out how in the next activity.



### ACTIVITY: How do organisms depend on the lithosphere?

#### INSTRUCTIONS:

1. Below are several photos depicting different ways that organisms depend on and interact with the lithosphere.
2. Use these images to write a paragraph about how different organisms depend on the lithosphere in different ways.



*Bird nests*



*A rock pool*



*A termite mound*



*A tree growing in the ground*





*An earthworm in soil*



*A mud hut*

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#### NEW WORDS

- abiotic
- cellular respiration

We have now looked at the different parts of the biosphere and seen that there are many different types of organisms that exist. Each of the organisms that we have seen so far needs to be able to stay alive in those specific conditions. We say they need to **adapt** to live in their particular habitat. What does it mean to stay alive though?

### Characteristics of living plants and animals

There are seven processes that all living organisms perform that determine whether they are alive or not. Let's have a look at the seven life processes:

1. All living things need to be able to **move**. Moving does not have to consist of big movements. Even plants move, for example as the flowers and leaves turn to face the sun during the course of the day.
2. All living things need energy to perform the life processes. Organisms release energy from their food by a process called **cellular respiration**.
3. All living things need to be **sensitive** to their environment. Think of an example of why animals need to sense their environment and write it down below.

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4. All living things need to be able to **grow**.

5. All living things need to be able to **reproduce** so that they do not die out.



#### VISIT

Video about the seven life processes  
[bit.ly/1cxrrZT](https://bit.ly/1cxrrZT)



### NEW WORDS

- favourable
- requirement
- sustain



6. All living things need to be able to **excrete** waste.
7. All living things need **nutrition**, as they need to break down nutrients during cellular respiration to release energy.

Now that we can determine whether something is living or not, we can take a look at what living things need to survive. In other words, what are the requirements for life?

## 1.2 Requirements for sustaining life

After studying the seven life processes, we now know what animals, plants and other living organisms need to *do* in order to be classified as living. In order to stay alive these living organisms **require** (need) certain things or specific conditions. In this section we are going to study the requirements necessary to **sustain** life.

### ACTIVITY: Identify the requirements for sustaining life

Imagine that you are the design team for the first International Moon Space Station, similar to the International Space Station already orbiting Earth, but situated on the Moon!



*The international space station that orbits Earth, seen from above.*

### VISIT

Find out more about life on the International Space Station as astronauts perform their everyday tasks.

[bit.ly/178CXVe](https://bit.ly/178CXVe) or  
[bit.ly/1cfDcF7](https://bit.ly/1cfDcF7)

### INSTRUCTIONS:

1. Work in groups of four.
2. What do you think the astronauts and plants living on the new Moon Station will need in order to live? Discuss the five most important requirements that you need to provide in order for the astronauts and plants to remain alive on your Moon Space Station.
3. Explain why your group chose these five requirements as the most important to sustain life. Write down your notes from your group discussion on the lines provided. Decide which member of your group is going to report back your findings to the rest of the class.
4. Have a class discussion after you have finished discussing this in your group.



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#### VISIT

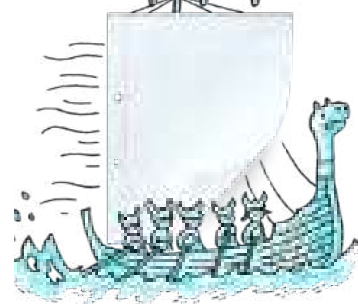
Learn more about the seven life processes

[bit.ly/16Cj2jz](http://bit.ly/16Cj2jz)



#### TAKE NOTE

'Sustain' means to keep things alive or in existence. We also use the word sustainable when we want to say that something can continue or be continued for a long time.



Living organisms require certain conditions or things to be able to stay alive. We say that these things or conditions sustain life.

You would have discussed some of these requirements in the last activity. Did you come up with the same or similar requirements? Living organisms require the following to survive:

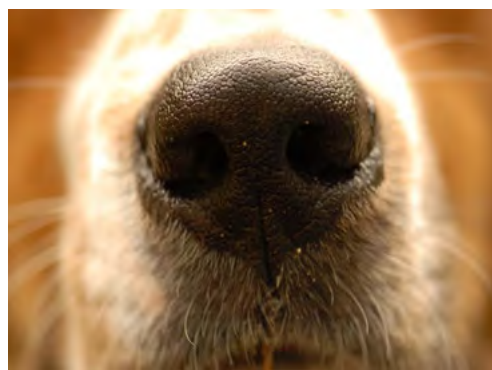
- energy
- gases
- water
- soil
- favourable temperatures

Next, we look at these in a bit more detail.

**Energy:** All living organisms need energy to stay alive and perform the life processes. Plants need energy from sunlight in order to photosynthesise. Other organisms get their energy from the food that they eat.



*All living things need a source of energy. The grass and trees get their energy from the Sun to photosynthesise. The cow gets its energy by eating the grass.*



*All living things need oxygen to respire, such as this dog which is breathing air in through its nose.*

### DID YOU KNOW?

When astronomers search for life outside of our solar system, they search for planets that might contain liquid water, believing that where there is water there may be life.



**Gases:** All living things require oxygen for cellular respiration. Oxygen is used to release energy from nutrients and carbon dioxide and water is produced as a waste product of respiration. Green plants also need carbon dioxide to photosynthesise.

**Water** is vital to life. Every organism on our planet needs water to live.



*Water is vital for life on Earth.*



*Most plants need soil to grow in.*

**Soil** sustains life on Earth. Most plants depend on soil for support, minerals and water. Without the soil, plants would not be able to produce the food that animals and other organisms depend on.

**Favourable temperatures:** All organisms are adapted to live in a particular temperature. In general, our planet has favourable temperatures to support life. Earth is at an optimal distance from the sun so that it is not too hot, like on Mercury, and not too cold, like on Neptune.

Let's find out what the requirements are to grow seedlings. We will learn how to conduct a scientific investigation to do this.



## **INVESTIGATION:** What are the requirements to sustain life in plants?

In this investigation, we are going to germinate bean seeds (or any other seeds that your teacher provides you with). Each group in the class is going to be testing a different requirement for germination and growth of the seedling.

### **AIM:**

A scientific investigation always has an aim or question that needs to be answered. What is the aim of this investigation? Write down what you aim to find out.

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## HYPOTHESIS:

A hypothesis is where you propose (suggest) what the outcome of the investigation will be. It is a prediction of what the results will be. Write a hypothesis for this investigation.

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## VARIABLES:

Scientists often use investigations to search for cause and effect relationships. This means that they design experiments to investigate how changes to one part will cause an effect on another. These changing quantities are called **variables**. There are usually three kinds of variables:

1. **Independent variables:** This is the thing that you are changing in the investigation. You are in control of the independent variable. For example, if you wanted to investigate if eating a lot of sugar makes you gain weight, then the amount of sugar you eat is the independent variable. You control how much sugar you eat. We want to achieve something called a FAIR TEST which means that only ONE independent variable is changed at one time. Once the independent variable has been changed the scientist then observes what the effect will be. In the example of investigating if sugar makes you gain weight, you cannot at the same time investigate whether exercise makes you lose weight. This would not be a fair test.
2. **Dependent variables:** The dependent variable is the thing that you observe in an investigation. You do not change it. The dependent variable will change depending on the independent variable. For example, in the investigation to see if eating a lot of sugar makes you gain weight, then the dependent variable will be how many kilograms you gain (or lose) as a result of eating sugar. How much weight you gain depends on how much sugar you ate. Dependent variables should be measured in an objective way using numbers as far as possible.
3. **Controlled variables:** These are the quantities that a scientist wants to remain the same or unchanged throughout the experiment. The controlled variable needs to be carefully monitored to make sure that it stays the same. In the example to see if sugar makes you gain weight, you could have one person eat a lot of sugar and the other person eat no sugar and then see the changes in weight. There are some things that need to stay the same for both of these people so that it is a fair test. For example, both people must do the same amount of exercise so that this does not influence their weight. This is a controlled variable.

You can also do a control test. For example, in this investigation about the growth of plants, you will be taking away one of the requirements for growth. You need to do a control test where another plant is given all the requirements, including the one you took away in the other plant. You can then compare your plant where you took one requirement away to the control plant which has that requirement to see if there is a difference.

Identify the variables for this investigation.

1. **Independent variable.** What will you change?
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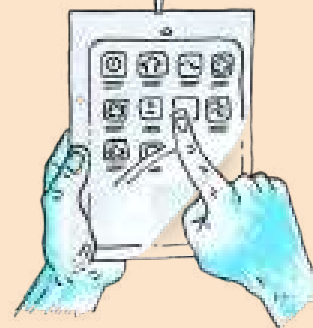
### NEW WORDS

- dependent variable
- hypothesis
- independent variable
- scientific method
- variables



### TAKE NOTE

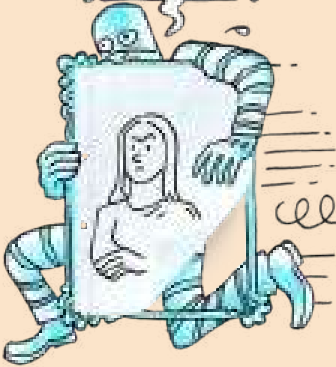
A hypothesis is an educated guess about what the outcome of the investigation will be. The hypothesis is stated before starting the investigation and must be written as a statement and must be in the future tense.



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2. **Dependent variable.** What will you measure to see the effect of the independent variable on the germination and growth of the plant?
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**TAKE NOTE**

Remember your control group is a special kind of comparison group.



3. **Controlled variables and control group.** What will your control test be and what will you keep the same between the control plant and the tested plant?
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**METHOD:**

In your group, plan how you are going to do the investigation. Think about which requirement you are testing and how you will take this requirement away. For example, if you are looking at light, where could you place the seeds so that they do not receive light? Remember, if you are looking at light, then you need to make sure the control and test seeds both receive the same amount of water. Once you have planned the investigation on rough paper and discussed it with your teacher, write up the method below (in numbered steps) explaining what you will do.

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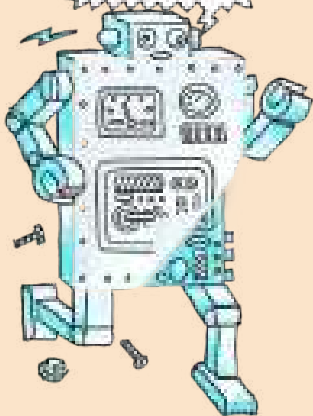
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**TAKE NOTE**

In Natural Sciences, when we use the word 'favourable' we mean something that is advantageous, helpful, or optimal. For example, we can talk about favourable conditions for life.



**MATERIALS AND APPARATUS:**

Write a list of all the materials and apparatus that you will be using in this investigation.

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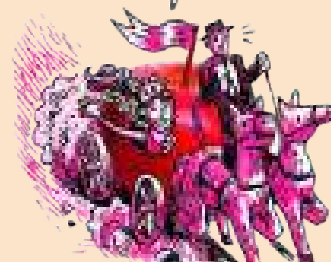
## RESULTS AND OBSERVATIONS:

Use this space to record the results for your investigation. If you are seeing whether plants germinate or not, then you need to draw a table to show this. If you are measuring how much the plants grow, then you will also need a table for this.

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### DID YOU KNOW?

Every solar system has a 'Goldilocks' zone which is a region that is not too hot (close to the sun), and not too cold (far from the sun) to be able to sustain life. Earth is in the middle of our solar system's Goldilocks zone!



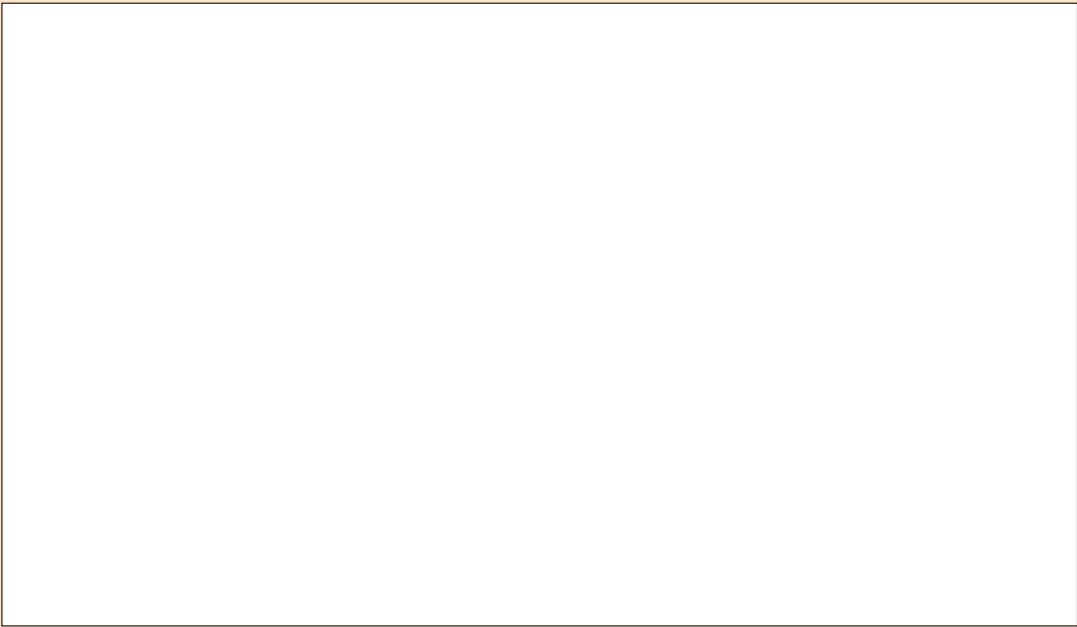
## ANALYSIS:

Once we have collected our results in a scientific investigation, we need to analyse them. This often involves drawing a graph. If you measured the growth of the seedlings over time, then you can draw a line graph to show this. If you have counted the number of seeds that germinated you can express this using a bar chart (provided you used the same number of seeds in each group), or you can express the percentage of seeds that germinated as a pie chart. Your teacher will help you do this.

### VISIT

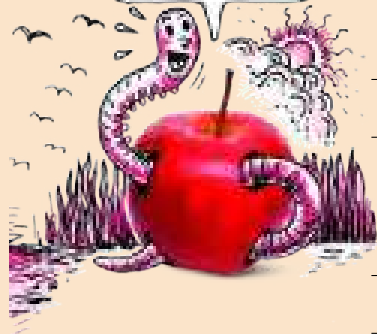
Read more about the 'Goldilocks Zone' [bit.ly/13ITCQU](http://bit.ly/13ITCQU) and [bit.ly/11OIY9R](http://bit.ly/11OIY9R)





**DID YOU KNOW?**

Not all plants need to grow in soil. Epiphytes, such as mosses and orchids, are a group of plants which grow on other plants or rocks. They get their moisture and minerals from the air and rain.



**CONCLUSION:**

After collecting all your results and drawing a graph using these results, you will need to use this to draw a conclusion about the requirements to sustain life in plants. The following questions will guide you in drawing your conclusion.

1. I found out...

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2. I know this because...

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3. The investigation was fair because...

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4. I can trust the results because...

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5. While I conducted (did) this investigation I also discovered that...

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6. If I did this investigation again I could improve it by...

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### What did you learn from doing this scientific investigation?

Write 3 to 5 sentences explaining what you learnt from doing this scientific investigation following the scientific method.

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#### VISIT

Watch a timelapse of bean plants growing.  
[bit.ly/1467Mlj](http://bit.ly/1467Mlj)



Each organism is able to survive and continue to survive in their environment because they have acquired the characteristics that allow them to do things in a special way in their particular environment. We say they have adapted to life in their particular type of environment.

### Adapted for life

Do you think you could put a polar bear in the Kalahari desert or a gemsbok in Antarctica and they would survive? Why, or why not?

These animals are specifically adapted to live in their specific environments. All organisms are adapted to their specific environments. In the next activity we examine some more examples of how organisms are adapted to their environments.

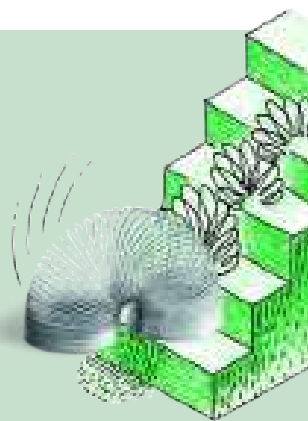
## ACTIVITY: Adaptations in organisms

### INSTRUCTIONS:

1. Study the photos below showing different organisms in different environments.
2. Answer the questions.
3. You might need to do some extra research in books and on the Internet to complete your answers.

### QUESTIONS:

Look at the photos of a penguin in the water and an eagle flying in the air. Both of these are birds, but they live in very different environments that make the penguin adapted for the water and the eagle adapted for flight.







*A penguin in the water.*



*A flying fish eagle about to catch some food.*

1. How do you think the penguin is adapted to swim in water? Hint: What are its wings used for? Does it have small or large feathers? How do you think this helps?

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2. How do you think the eagle is adapted to fly and catch its prey? Hint: Look at its feathers and wings.

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South Africa is home to two very skilled predators, the great white shark and the lion. Both of these animals are very skilled at catching their prey, but in very different environments.




*A great white shark in Gansbaai, Western Cape.*



*A lioness attacking a buffalo in Kruger National Park.*

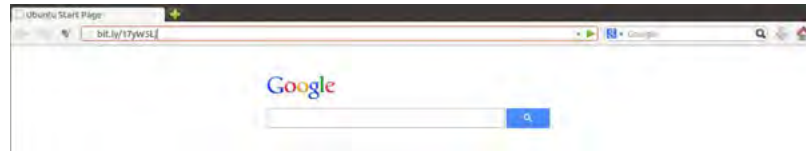
3. What characteristics does the shark have that makes it adapted to living and feeding in the sea? Hint: Look at its streamlined body shape and sharp teeth.

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4. What characteristics does a lion have that makes it adapted to living and hunting in the savanna? Hint: Look at the colour of its fur and the colour of the grass and its strong limbs.
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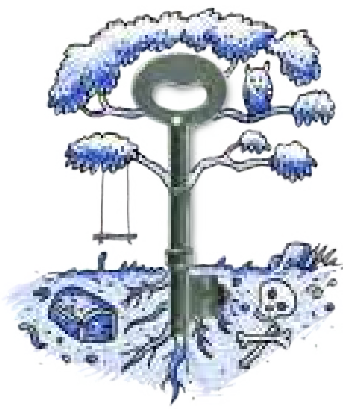


We have now looked at how a few of the animals on Earth are adapted to their environments. There are many, many more organisms with very unique and interesting adaptations. In the next chapter we will learn more about the diversity of plants and animals on Earth.

Have you noticed the **VISIT** boxes in the margins which contain links? You simply need to type this whole link into the address bar in your Internet browser, either on your PC, tablet or mobile phone, and press enter, like this:

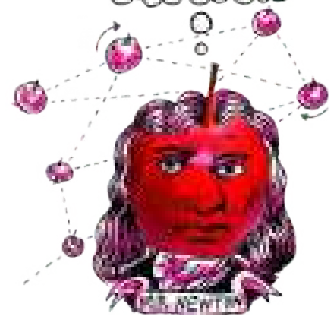


It will direct you to our website where you can watch the video or visit the webpage online. **Be curious and discover more online on our website!**



#### DID YOU KNOW?

The first person to use the term 'biosphere' was the geologist Eduard Suess in 1875 when he wrote a definition for the biosphere as *'the place on Earth's surface where life dwells'*.



## SUMMARY:

### Key Concepts

- Life on planet Earth exists in the biosphere.
- The biosphere consists of the lithosphere, hydrosphere and atmosphere, as well as the many living organisms and dead, organic matter.
- Many different kinds of living organisms exist in the biosphere.
- Things can be classified as living if they perform the seven life processes:
  - Movement
  - Reproduction
  - Sensing the environment
  - Growth
  - Respiration
  - Excretion
  - Nutrition
- Living things need energy, gases, water, soil and a favourable temperature to survive.
- Living things are suited or adapted to the environment in which they live.

### Concept Map

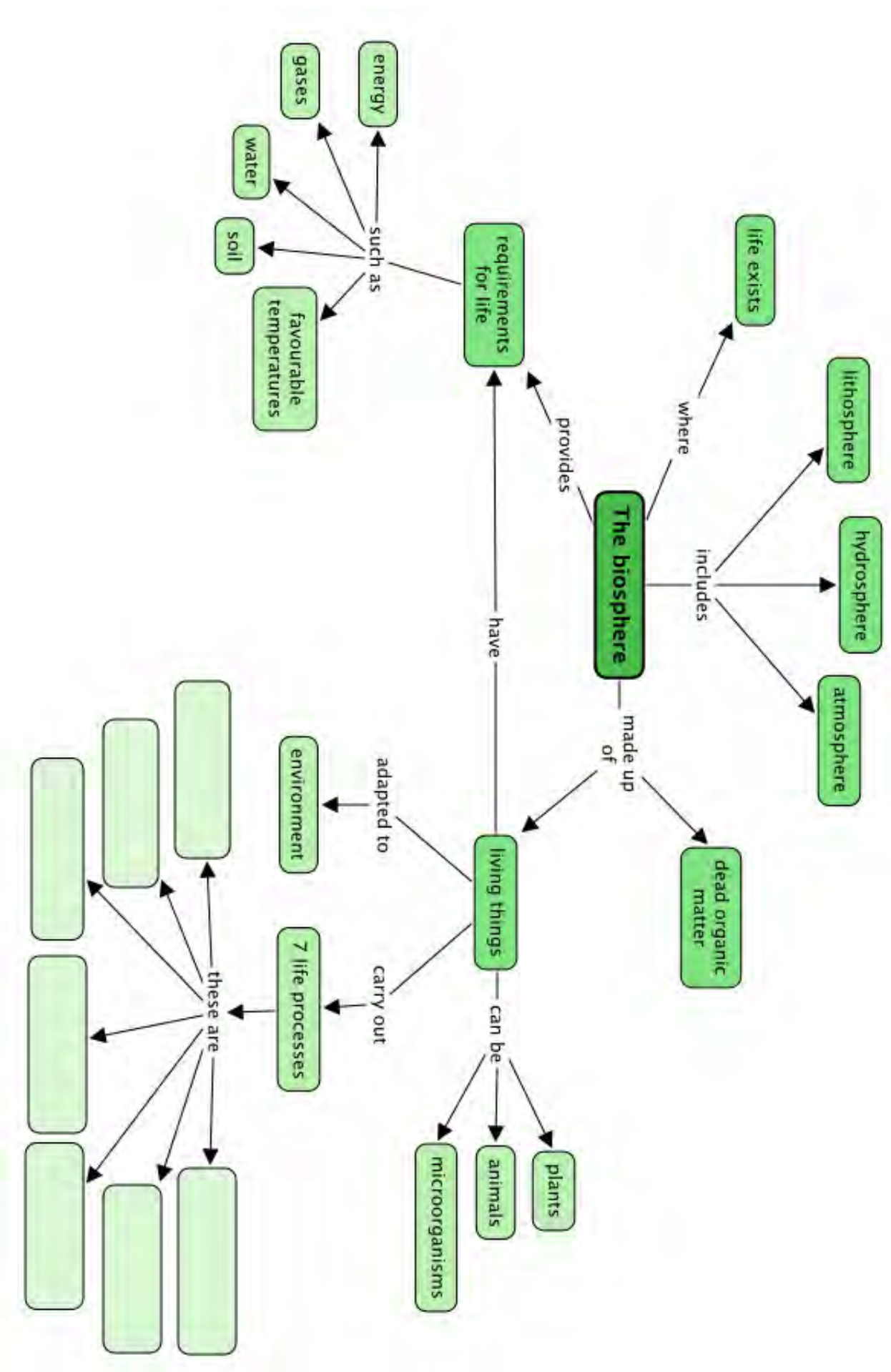
Do you know what a concept map is? This year in Natural Sciences, we are going to learn more about how to make our own concept maps.

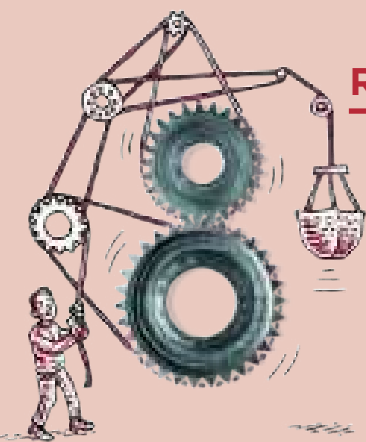
Above you have the 'Key concepts' for this chapter. This is a written summary and the information from this chapter is summarised using words. We can also create a concept map of this chapter, which is a map of how all the concepts (ideas and topics) in this chapter fit together and are linked to each other. A concept map gives us a more visual way of summarising information.

Different people like to learn and study in different ways: some people like to make written summaries, whilst others like to draw their own concept maps when studying and learning. These are useful skills to have, especially for later in high school and after school!

Have a look at the concept map for 'The Biosphere' on the next page. Complete the concept map by filling in the 7 life processes in the blank spaces.







## **REVISION:**

1. Explain what the biosphere is. [2 marks]

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2. Give an example of something that is found in each of the following:  
[3 marks]

a) Lithosphere:

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b) Hydrosphere:

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c) Atmosphere:

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3. Discuss why the atmosphere is important for life on Earth. [2 marks]

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4. Imagine an alien creature arrives on Earth attached to a meteorite (fallen space rock). You were tasked with deciding whether it lives in the conventional way that we understand organisms to live. Draw up seven questions to determine how this organism lives and whether it can be classified as alive. [7 marks]

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5. What are the requirements for sustaining life on Earth? [5 marks]

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6. Look at the following photos of different organisms in their environments.  
Answer the questions about how they are adapted.

a) Giraffe



How are giraffe adapted to eat their food? Hint: They eat the leaves of trees. [1 mark]

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b) A cactus



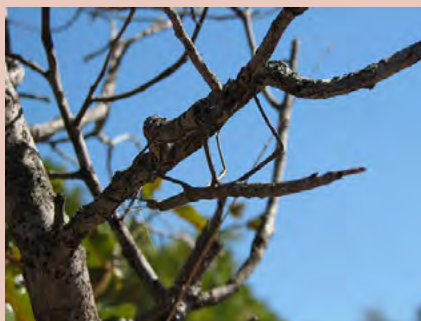
This cactus is adapted to live in hot environments? How do you think it stores water for long periods? Hint: Look at its leaves. [1 mark]

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How do you think the cactus has adapted to prevent other animals from eating it? Hint: What is on the leaves? [1 mark]

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Can you see the stick insect in this photo? How do you think it is adapted, especially to hide away from predators? [1 mark]

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7. Think back to the scientific investigation you did in this section. Evaluate how well you think you followed the scientific method to make your experiment fair or not fair. [2 marks]
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Total [25 marks]



Here is your chance to discover the possibilities. What can this apple become?

