Dear Grade 7 learner

Your last year in primary school has started. This year will prepare you for your high school career. In Natural Sciences you will learn how to ask questions and obtain solutions in creative ways.

Natural Sciences has to do with everyday things and nature. You will conduct very interesting investigations, practical tasks and activities.

You will need the following skills:

• “Common sense”
  There is a lot of logic in science because it deals with everyday events like cars that crash, rugby balls being kicked and many more.

• Reading skills
  You will receive a lot of information in written form. Learn to read with insight and to emphasize the facts that you need with a highlighter or by drawing a circle around it.

• Draw pictures.
  There is nothing like a picture to help you think logically.

• Practise, practise, practise.
  It is still the best way to learn anything. This means that you should always do your homework yourself. Work through old exam papers; it is valuable experience.

• Regular revision
  Natural Sciences contain a lot of information and facts. To learn all the facts you will have to do revision often.

In this workbook there are explanations, examples, summaries, mind maps and exercises which will help you to overcome any obstacle in Natural Sciences.

Also visit our website for more tips and the latest information.

Enjoy all the exciting information that Natural Sciences will unlock for you.

Doc Scientia
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All four of the earth’s spheres are important to make life possible. Let us look at the properties of each sphere that are important for life.

1.1 Different spheres

What are the different spheres?
The spheres (parts) are:
- Biosphere (plants and animals)
- Lithosphere (land)
- Hydrosphere (water)
- Atmosphere (air)
See if you can identify each sphere.

1.1.1 Biosphere

The word biosphere is derived from the Greek words *bios* which means “life” and *sphaira* which means “sphere” or “circle”. It is therefore literally “the sphere in which life occurs”.

Life exists and develops due to the unique combination and interaction of the components of spheres.

The biosphere can be defined as follows:

The biosphere is the part of the earth in which all life exists.

Each of the spheres can be seen in the photos below. See if you can name a component from each sphere in both photographs.
The components are ideal for life.
Each part of the planet, from the Poles to the equator, sustains some form of life.
The biosphere is where all plants, animals and single-celled organisms (microbes) live.
The biosphere stretches to the uppermost parts of the atmosphere where birds and insects can be found. It also stretches deep under ground and to the bottom of the ocean.
The biosphere includes any place on earth where life in any form is found.

“\textbf{The Blue Marble}” is a well-known photo of earth that was taken in 1972 from a spacecraft, while on its way to the moon. The three components of the biosphere can clearly be seen on the photo.

\textbf{Interesting facts:}
The actual thickness of the biosphere on earth is difficult to measure. Small living microscopic organisms have even been found at depths of 5 km below the earth’s surface.
Birds usually fly at a height of 650 to 1 800 metres above the earth’s surface. However, Rüppell’s vultures have been seen at heights of 11 300 metres above the earth’s surface.
There are fish in the Puerto Rico trough in the Caribbean sea, that go as deep as 8 372 metres under the surface of the water.
Microscopic organisms have been found at depths of more than 10 km in the Mariana sea trough south of Japan.

\textbf{1.1.2 Lithosphere}

\textbf{The lithosphere is the hard outer layer of the earth.}

The lithosphere is the hard outer layer of the earth. 
Life occurs on the surface, but can also exist deep inside the earth’s surface. 
There are living organisms that can be found deep under the surface of the earth. 
Most life exists above the earth’s surface. 
All life is dependent on the lithosphere. The lithosphere provides mineral salts for green plants so photosynthesis can take place. 
That is the start of all food chains on earth.

\textbf{Quick facts:}
Photosynthesis is the process whereby green plants produce starch.
There are different types of soil, e.g. clay, sand and loam soil. Life for different organisms, plants and animals are adapted to the different parts of the lithosphere.

**Examples:**
- Earthworms can be found in loam soil, but not in sand.
- Quiver trees grow in sandy soil.
- Klipspringers and hyraxes live in rocky areas.

### 1.1.3 Hydrosphere

The hydrosphere is all water in different forms on earth.

Water is found above and under the earth’s surface, as well as in the form of water vapour in the atmosphere.

The hydrosphere includes the following:
- Oceans
- Rivers
- Lakes
- Underground water
- Ice at the Poles
- Moisture in the air

No life on earth would be able to survive without water. The earth’s favourable temperature makes it possible for water to occur in all three states (solid, liquid and gas) in nature.

**Quick facts:**

- Water is the only substance that occurs naturally as solid, liquid and gas.

The water cycle ensures that the water on earth never runs out, but is recycled continuously. Here is a simplified flow diagram representing the water cycle.

Water evaporates. → Water vapour condenses. → Precipitation in the form of, for example, rain → Run-off from rivers to the sea → Water in lakes, rivers and the sea → Water evaporates.
Interesting facts:
Only 1% of all water on earth is found as fresh water in rivers and lakes. Can you see how important it is that we conserve this water and limit water wastage and water pollution?

1.1.4 Atmosphere
The atmosphere of the earth is a layer of gases around the planet.

The gases are attracted to the surface by the earth's gravitational force.

Dry air contains:
- nitrogen,
- oxygen,
- argon,
- carbon dioxide and
- other gases (neon, helium, methane, krypton and hydrogen).

Air also contains a certain amount of water vapour. This is water molecules that occur in the form of a gas in the atmosphere.

Quick facts:
If the air is very dry (e.g. over deserts), almost no water vapour is found in the air.
The air in rainforests contains a lot of water vapour.

All living organisms need oxygen and carbon dioxide. These gases occur as a mixture in the atmosphere.

The atmosphere protects life on earth by:
- absorbing harmful ultraviolet rays from the sun.
- keeping the heat of the sun inside the atmosphere so the temperature on earth can remain warm.
- decreasing fluctuations in temperatures between day and night.

Interesting facts:
The closer we are to the surface of the earth, the denser the atmosphere.
The atmosphere becomes thinner and thinner the further you move away from the surface of the earth.
Exercise 1

1. Describe each of the following terms.
   1.1 Biosphere

   ______________________________________________________

   1.2 Lithosphere
   ______________________________________________________

   1.3 Hydrosphere
   ______________________________________________________

   1.4 Atmosphere
   ______________________________________________________

2. Name the sphere that is represented by each number on the sketch below.

   1. ____________________________________________________
   2. ____________________________________________________
   3. ____________________________________________________

Example
3. Give two examples of water in each of the following states as it occurs in nature on earth.

3.1 Solid

______________________________________________________________________________

______________________________________________________________________________

3.2 Liquid

______________________________________________________________________________

______________________________________________________________________________

3.3 Gas

______________________________________________________________________________

______________________________________________________________________________

4. Draw a flow diagram of the water cycle. Use all the words in the list below in your flow diagram. Remember to use arrows to indicate the direction.

   Water vapour, clouds, runoff, river, evaporate, sea, condensate, precipitate
5. Which gases are found in dry air?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

6. Mountaineers sometimes suffer from a condition called “mountain sickness”. It happens when they climb up to the mountain peaks that are very high above sea level. Why do you think they experience this condition?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

7. Name three ways in which the atmosphere protects life on earth.

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

8. With which sphere would you associate each of the following terms?

<table>
<thead>
<tr>
<th>Which sphere?</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.1 Mineral salts</td>
</tr>
<tr>
<td>8.2 Condensation</td>
</tr>
<tr>
<td>8.3 Argon</td>
</tr>
<tr>
<td>8.4 Rocks</td>
</tr>
<tr>
<td>8.5 Carbon dioxide</td>
</tr>
<tr>
<td>8.6 Glaciers</td>
</tr>
<tr>
<td>8.7 Drakensberg mountains</td>
</tr>
<tr>
<td>8.8 Evaporation</td>
</tr>
<tr>
<td>8.9 Air pressure</td>
</tr>
<tr>
<td>8.10 Sand</td>
</tr>
</tbody>
</table>
1.2 Life on earth

The unique combination of factors on earth is ideal for sustaining life. No other planet in our solar system can sustain life.

Quick facts:
Some textbooks or sources also refer to the living component of the biosphere as the ecosphere.

The biosphere consists of a non-living component (abiotic) and a living component (biotic). The biosphere can be divided as follows:

When living organisms die they form dead organic material in the soil.

This dead organic material differs from soil and rocks, water and air. All non-living substances are called inorganic substances. This means that these substances have never lived, and will never live.
Examples:

Examples of inorganic substances or non-living substances:
- Sand, rocks and mineral salts in the soil
- Gases in the air
- Water

These molecules are very small.
The water (H₂O) molecule is shown in the figure.

Here is a flow diagram that shows what happens to a plant or animal when it dies.

Living plant or animal → Plant or animal dies and forms organic material. → Dead plant or animal is decomposed by microorganisms (e.g. bacteria). → Inorganic molecules like water, gases and minerals remain.

Dead organic material consists of giant molecules, because it was part of a living organism at some time.

This organic material is broken down to smaller parts by microorganisms in nature (fungi and bacteria). The particles become part of the hydrosphere, lithosphere or atmosphere in the form of mineral salts, water or gas molecules.

These smaller parts are absorbed again by living organisms. This way the particles on earth are constantly circulated and form part of a cycle.

Exercise 2

1. Draw a diagram to show the composition of the biosphere.

Date:
2. Describe each of the following terms and give three examples of each.

2.1 Abiotic factors

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

2.2 Biotic factors

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

2.3 Inorganic substances

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

2.4 Organic substances

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

2.5 Microorganisms

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

3. Complete the flow diagram below to indicate how molecules on earth are recycled.

[Diagram showing the flow of molecules from Living plant or animal to various stages of recycling]

4. Place each of the terms that follow into the correct columns. (Some of the terms can be written in more than one column.)

<table>
<thead>
<tr>
<th>Wind</th>
<th>Sand</th>
<th>Oxygen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Layer of gas around earth</td>
<td>Dead leaves</td>
<td>Starfish</td>
</tr>
<tr>
<td>Ferns</td>
<td>Stones</td>
<td>Toadstools</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>Water molecules</td>
<td>Air pressure</td>
</tr>
<tr>
<td>Sunflowers</td>
<td>Whales</td>
<td>Sea currents</td>
</tr>
<tr>
<td>Skeleton of a rat</td>
<td>Bread mould</td>
<td>Waterfall</td>
</tr>
<tr>
<td>Bacteria</td>
<td>Mineral salts</td>
<td>Pine tree</td>
</tr>
<tr>
<td>Rabbit</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Atmosphere</th>
<th>Hydro-sphere</th>
<th>Lithosphere</th>
<th>Inorganic molecule</th>
<th>Organic material</th>
<th>Plants</th>
<th>Animals</th>
<th>Micro-organisms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.3 Variety of life

There is a great variety of living organisms on earth. By 2010, scientist had already identified more than 1,7 million animal, plant and algae species.

However, there are still many species that need to be identified. There are also species that become extinct every year. The number of described species on earth changes almost daily.

Quick facts:
The insects is the largest group of living organisms. Approximately one million of the species on earth are insects. Mammals are one of the smallest animal groups.
**Interesting facts:**

Below is the table of the number of species of each plant, animal, fungi and algae group that had been described by 2010. (You do not have to know this table.)

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertebrates, like mammals, etc.</td>
<td>62 305</td>
</tr>
<tr>
<td>Invertebrates, like insects, etc.</td>
<td>1 305 250</td>
</tr>
<tr>
<td>Plants</td>
<td>321 212</td>
</tr>
<tr>
<td>Other, like mushrooms, etc.</td>
<td>51 563</td>
</tr>
</tbody>
</table>

Life exists in every possible environment in the hydrosphere, lithosphere and atmosphere. Let us look at life in these three spheres.

**Hydrosphere:**

Plants and animals live in:
- fresh water (rivers, dams, lakes, streams);
- sea water (oceans and rock pools).

**Lithosphere:**

- Plant roots are anchored in the soil.
- Many animals, like earthworms and meerkats, live or make their nests under the soil.

**Atmosphere:**

- Flying animals can fly through the air from one place to another, e.g. birds and insects.
- Seeds and pollen from plants are distributed by the wind.

### 1.4 Life processes

Any living organism, however small or big, performs seven basic life processes.

These life processes are what distinguish living from non-living organisms.

There are seven life processes:
### Life process

<table>
<thead>
<tr>
<th>Life process</th>
<th>Example of this in an animal</th>
<th>Example of this in a plant</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Feeding</strong></td>
<td><img src="horse_eating_grass.jpg" alt="Example of feeding in an animal" /></td>
<td><img src="poinsettia_photo.jpg" alt="Example of feeding in a plant" /></td>
</tr>
<tr>
<td>All living organisms require food. Green plants produce their own food through photosynthesis. Animals are dependent on plants or other animals for their food.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **Growth**   | ![Example of growth in an animal](gorilla_and_baby.jpg) | ![Example of growth in a plant](seedling_in_soil.jpg) |
| Any living organism can grow. This means that the organism increases in size from birth (animals) or germination (plants) until it is mature. |

<p>| <strong>Reproduction</strong> | <img src="tiger_and_cub.jpg" alt="Example of reproduction in an animal" /> | <img src="dandelion_seeds.jpg" alt="Example of reproduction in a plant" /> |
| Living organisms can all produce offspring through the process of reproduction. This way the survival of the species is ensured. |</p>
<table>
<thead>
<tr>
<th>Life process</th>
<th>Example of this in an animal</th>
<th>Example of this in a plant</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Respiration</strong></td>
<td>All living organisms can produce energy in their bodies from food and oxygen. This energy is used to perform all their life processes. The process of energy production is called respiration.</td>
<td><img src="image1" alt="Oxygen flow" /> oxygen <img src="image2" alt="Oxygen flow" /> oxygen</td>
</tr>
<tr>
<td><strong>Excretion</strong></td>
<td>Living organisms all produce waste products. The body must get rid of these waste products (e.g. CO₂). If the body does not do that, it becomes toxic and will die. This process is called excretion.</td>
<td><img src="image3" alt="Carbon dioxide flow" /> carbon dioxide <img src="image4" alt="Carbon dioxide flow" /> carbon dioxide during respiration</td>
</tr>
<tr>
<td><strong>Sensitivity</strong></td>
<td>Living organisms can all react to changes in their environments (e.g. temperature that changes). That way, they can adapt to the changes and ensure their survival.</td>
<td><img src="image5" alt="Animal senses" /> Animals have senses with which they observe changes in their environment. <img src="image6" alt="Sunflower" /> Sunflowers are sensitive to the position of the sun and can react to it.</td>
</tr>
<tr>
<td><strong>Movement</strong></td>
<td>All living organisms (even plants) can move to collect food, for example, or to absorb more sunlight.</td>
<td><img src="image7" alt="Gepetto" /> Sunflowers can turn their heads to the direction of the sun. <img src="image8" alt="Sunflowe" /> Monarch butterfly flying towards flowers.</td>
</tr>
</tbody>
</table>