Solutions for all Natural Sciences

Grade 9 Learner’s Book

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MACMILLAN
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</tbody>
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How to use the Solutions for all Natural Sciences Learner’s Book

Welcome to the Solutions for all Natural Sciences Grade 9 Learner’s Book.

The content in the Solutions for all Natural Sciences Grade 9 Learner’s Book is organised according to topics and each topic is structured in the same way:

**Topic opener page:** The topic starts with a full-colour photograph of something that is related to the content of the topic. ‘What you will learn about in this topic’ lists the content to be covered in the topic. There is also a section called ‘Let’s talk about …’ which gives you an opportunity to start thinking about new things you will learn about in the topic.

**Units and lessons:** Each topic is divided into units that are broken up into lessons. A lesson consists of content and then a Classroom activity. Sometimes there is a Practical task. Some of the Classroom activities might be started in class but completed at home. The lessons break the work up into little chunks of information. This helps you to make sure you know and understand a certain section of the work before moving on to the next section of work. One Practical task per term is a suggested Formal Assessment Task. You could be assessed on these tasks, so watch out for them.

**Extra practice:** The Extra practice at the end of each topic has been included as an additional activity. Use the questions for extra practice.

**Summary:** Each topic ends with a summary of the work covered in the topic. You could use these summaries as study notes, just to recap what you should know at the end of the topic.

Other features to look out for are:

**Word bank:** These contain difficult words that you may not understand or that you may have encountered for the first time. An explanation for the word is given to enable you to understand its meaning better. Always keep a dictionary handy because if you understand a word, learning will be a lot easier.

**Illustrations and photos:** Illustrations and photos have been included to help you understand the written text. Use the illustrations and photos when working through the text. When you see something, you will remember it a lot better.

The publisher and authors wish you all the best in your study of Natural Sciences Grade 9.

Good luck!
Cells as the basic units of life

Let’s talk about cells as the basic units of life

The learner in the photograph is using a light microscope to view cells from a living organism. Did scientists know about cells before microscopes were invented? Why do we need to use microscopes to study cells? Do you expect all plant and animal cells to have the same size, shape and structure?

What you will learn about in this topic

- Cell structure
- Differences between plant and animal cells
- Cells in tissues, organs and systems
Unit 1 Living organisms are made of cells

What you already know

You have learnt that living things are called organisms. Plants and animals are organisms. Living, or biotic, organisms have all seven of the characteristics of life. Non-living, or abiotic, organisms do not have all seven characteristics of life.

Check myself

1. Write the letters ‘MRS GREN’ in a list down a page. Next to each letter, write a characteristic of life starting with the same letter. Use the pictures to help you.

2. Explain each characteristic of life in your own words.

Figure 1.1 Characteristics of living things
Lesson 1
Microscopes are used to view cell structure

All living organisms are made of cells. The cell is the basic structural and functional unit of life. Animals and plants are made up of many cells that are packed tightly together, similar to the bricks of a house. The cells of the leaf in Figure 1.2 are so small that you need to use a microscope to see them.

The discovery of microscopes led to the discovery of cells

Hundreds of years ago scientists used glass lenses to magnify objects. The lenses did not magnify well and very small objects could not be seen. By the 16th century, scientists used microscopes, but they also did not magnify objects very well. It was only during the 17th century that microscopes with stronger lenses and greater magnifying power were developed. These improved microscopes enabled people to see cells and study them.
Hans Janssen and his son (Zaccharias) invented the compound microscope in 1590. This is the microscope that is often used in schools today. In 1665, the English scientist Robert Hooke improved on Janssen’s design. A compound microscope is also known as a light microscope.

Figure 1.3 Robert Hooke’s compound microscope was similar in structure to modern-day light microscopes

In 1674 Anton van Leeuwenhoek designed and built microscopes with single lenses. The lenses he made could magnify objects 270 times. Figure 1.4 shows this microscope. He placed a small glass bead (the lens) in a hole between two metal plates. The object or specimen being looked at was placed on a spike at the end of a rod in front of the lens. The rod could move up and down so that the specimen could be seen clearly. He was the first scientist to observe sperm cells and blood cells as well as micro-organisms such as bacteria.

The compound or light microscope

A light microscope uses light and lenses to magnify the specimen that you are looking at. Light microscopes cannot magnify a specimen more than a thousand times. So, when you use a light microscope, you will not be able to see much detail within cells.
The microscope has many different parts. The eyepiece lens and objective lens are both used to magnify the object. The revolving nosepiece, to which the objective lenses are attached turns. This means that different objective lenses can be used. There are usually three objective lenses each with a different magnification. There are two focus knobs; the coarse focus knob moves the tube to bring an object being viewed using the low-magnification objective lens into focus. The fine focus knob brings an object being viewed using the high-magnification objective lens into focus. The stage provides a platform on which to place the microscope slide. The specimen that is being viewed is placed above the hole in the centre of the stage. Clips on the stage are used to hold the microscope slide in place. A mirror reflects light or a light source shines light through the hole in the stage the microscope slide and the specimen. The arm is used as a handle to hold or carry the microscope.

**The electron microscope**

The transmission electron microscope (TEM) was invented in Germany in 1930 by Ernst Ruska. Unlike the light microscope, the electron microscope uses a beam of electrons to magnify the specimen. It is much more powerful than the light microscope and can magnify a specimen millions of times. The TEM allows you to see cross-sections of cells and their internal details. You can see in more detail cell structure with this microscope. In 1981 Gerd Binnig and Heinrich Rohrer invented the scanning electron microscope (SEM). In this microscope, electrons bounce off the surface of the specimen, and so let you see the surface of cells and cell structures in three dimensions.
Photographs of specimens taken through a microscope are called **micrographs**. If these photographs are taken through a light microscope, they are called **photomicrographs**. Photographs taken using an electron microscope are called **electron micrographs**.

### Classroom activity 1

**Individual**

Look at the electron micrograph of the sperm cell in Figure 1.6 and then answer the following questions.

*Figure 1.6 Micrograph of a human sperm cell: magnification 2 000 X*
1. What type of electron microscope was used to take the micrograph? Give a reason for your answer.

2. Create a timeline to show the history of the invention of different microscopes. Explain how each microscope improved over time.

3. Tabulate the different parts of the light microscope and give the function of each part.

4. Distinguish between the following terms: micrograph, photomicrograph and electron micrograph.

---

**Lesson 2**

**The basic structure of a cell**

A cell is similar to a factory. It has a control centre that tells it what to do, a power plant to generate energy and machines to make products or perform services. There are two types of cells: plant cells and animal cells. Plant and animal cells vary in shape and function, but they have some features in common. The cells in Figure 1.7 are from the inside lining of a human cheek, as seen under a light microscope. The micrograph will help you to identify the different parts of the cells.

All cells are surrounded by a thin layer called a cell membrane. The cell membrane holds the cell together and gives it its shape. The membrane also acts like a barrier to control the movement of substances in and out of cells. Water and gases move in and out of cells, but larger molecules cannot move through the membrane so they are kept inside or outside of cells. This is called a semi-permeable membrane. Each cell is filled with a clear jelly-like substance called cytoplasm. Most of the chemical reactions and processes that are needed for life take place in the cytoplasm. Floating in the cytoplasm are tiny structures called **organelles**.

---

**Word bank**

- **organelles**: tiny structures found floating within the cells
- **offspring**: the young of an organism
- **species**: group of living organisms that are capable of breeding
- **cellular respiration**: a process that uses food to make energy
- **cellulose**: the main building block of plant cell walls; this is a plant fibre
- **pigment**: colour
The nucleus is a small, round or oval structure in the cytoplasm. It is seen under the microscope as a dark spot within the cytoplasm. The nucleus controls all vital functions within a cell and is involved in cell division. The nucleus is surrounded by a nuclear membrane, which separates the nucleus from the cytoplasm. Inside the nucleus are small spagetti-like structures called chromosomes.

Chromosomes are made of Deoxyribonucleic Acid (DNA), which carries the inherited characteristics of the cell. These characteristics, such as eye colour, are passed down from parent to offspring during reproduction. DNA is unique to each individual, which makes individuals of a species different from each other. This is called species variation.

All cells need energy for the chemical reactions and processes that take place in the cytoplasm. The mitochondrion is the ‘power plant’ of a cell. During a process called cellular respiration it uses food and oxygen to produce and release energy for these chemical reactions and processes.

Plant cells have several features in common with animal cells, but there are some differences.

Plant cells have a tough cell wall on the outside of the cell membrane. The cell wall is made of a substance called cellulose. The wall protects the structures inside the cell and gives the plant strength and support. Floating inside the cytoplasm of plant cells are flat, round organelles called chloroplasts. Chloroplasts contain a green pigment called chlorophyll. In Grade 8 you learnt that chlorophyll traps light energy from the sun during photosynthesis. This energy is used to turn carbon dioxide and water into sugar and oxygen.

Plant cells have a fluid-filled sac inside the cell called a vacuole. The fluid consists of water and dissolved sugars and salts. The vacuole is used for storage of substances. When the vacuole is full, it helps to keep the cell firm. Usually animal cells do not have vacuoles. If vacuoles are found in animal cells, they are either small or temporary.

**Classroom activity 2**

**Individual**

1. The cells in Figure 1.8 are from the leaf of a water plant. The cells have been magnified 100 X. Identify the different parts of the plant cell.
2. Figure 1.9 shows a diagram of a cell. Study the diagram carefully and then answer the questions.

![Diagram of a cell]

Figure 1.9 Diagram of a cell

a) Is the cell in Figure 1.9 from a plant or an animal?
b) Give two reasons from the diagram to explain your answer.
c) Provide labels for the parts labelled A–F.

3. The nucleus is called the ‘control centre’ of the cell. Explain why.

4. Name the structures in a plant or an animal cell that perform the following functions:
   a) Supports and protects the cell and holds its shape
   b) Produces food using sunlight
   c) Controls what enters or leaves a cell
   d) Controls cell activities
   e) Releases energy during cellular respiration

Practical activity 1

Pairs
Make a three-dimensional (3D) model of a plant cell – PRESCRIBED

You will need:
A shoe box, clear plastic or large clear plastic bags, wool, cotton, glue, scissors, cardboard, paper, crayons, felt-tip pens and various objects such as a tennis ball, buttons or sweets to represent organelles.

Method:
1. Construct a 3D model of a plant cell.
2. Include the cell wall, cell membrane, nucleus, mitochondrion, cytoplasm, vacuole and chloroplast.
3. Label all the parts of the cell shown in your model.
Lesson 3

Differences between plant and animal cells

Plant cells are different from animal cells. Plant cells have a cell wall and large vacuoles. They also have chloroplasts, which absorb light energy during photosynthesis. Table 1.1 gives the differences between plant cells and animal cells.

Table 1.1 Differences between plant and animal cells

<table>
<thead>
<tr>
<th></th>
<th>Plant cells</th>
<th>Animal cells</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell wall</td>
<td>Non-living, made of cellulose</td>
<td>Absent</td>
</tr>
<tr>
<td>Cell membrane</td>
<td>Lines the inside of cell wall</td>
<td>Surrounds the cell</td>
</tr>
<tr>
<td>Vacuole</td>
<td>Usually one large one or a few small ones</td>
<td>Usually none, or if present, very small</td>
</tr>
<tr>
<td>Chloroplasts</td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td>Shape</td>
<td>Regular</td>
<td>Irregular</td>
</tr>
</tbody>
</table>

In Practical activity 2 you will use a microscope and learn how it works. You will prepare microscope slides with plant and animal cell specimens that you are going to look at. The specimens must be very thin so that light can pass through them.

Practical activity 2

**Pairs or Groups**

**Look at cells with a microscope – PRESCRIBED**

**Aim:**
To use a microscope to observe plant and animal cells

**You will need:**
An onion, a sharp knife or scalpel, clean glass microscope slides, some water, a dropper, iodine *solution*, glass cover slips, a microscope, methylene blue (to stain the cells), absorbent paper such as filter paper, a toothpick and dissecting needle.

**Method:**

A Set up the microscope

Step 1: Carry the microscope in an upright position with two hands, one hand holding the arm and the other hand supporting the base. Do not touch the lenses.
Step 2: Place the microscope on a level surface away from the table edge, with the arm facing towards you.

Step 3: Switch on the light if your microscope has one. If not, turn the mirror so that its flat surface is at the top and it is tilted towards a source of light such as a window or a lamp.

Step 4: Turn the revolving nosepiece so that the objective lens with the lowest magnifying power clicks into place and is over the centre of the stage.

Step 5: Adjust the light by looking through the eyepiece lens and moving the mirror and the diaphragm if your microscope has one. Tilt the mirror until you see a bright circle of light.

B Prepare a microscope slide of onion cells

Make a slide of onion cells by following the steps and referring to Figure 1.10.

Figure 1.10 How to make a microscope slide of onion cells

Step 1: Remove the fleshy leaf from an onion bulb.
Step 2: Cut a triangular piece from the fleshy part of the onion.
Step 3: Peel the tip of the piece of onion outwards until it snaps. Then pull the tip downwards carefully, until there is just a thin transparent layer holding the pieces together.
Step 4: Put the transparent onion layer onto the microscope slide. Add a drop of water, and carefully spread the transparent onion layer until it is flat.
Step 5: Add a drop of iodine solution to the onion layer. The iodine solution stains the onion cells.
Step 6: Working from one side of the slide, put the cover slip down slowly onto the slide. Try not to get any air bubbles between the slide and the cover slip.

The cover slip holds the specimen flat, making it easier to focus on. It also keeps the specimen moist and keeps the objective lenses clean if they touch the slide.

Step 7: Use a piece of filter paper to gently remove excess liquid from the slide.
Questions:
1. Examine the slide, first under low power and then under high power objective lenses. Figure 1.11 shows what the epidermal cells of an onion look like under a compound microscope.
2. Draw a few cells.
3. Compare your drawing with the photograph of onion cells in Figure 1.11. Label the structures that you can identify in your drawing.
4. Describe the shape of one of the onion cells. Why is the onion cell this shape?
5. Do the onion cells in the fleshy part of the onion have many chloroplasts? Explain your answer.
6. Suggest which parts of the onion plant have cells with many chloroplasts? Explain your answer.

![Figure 1.11 Onion cells seen through a microscope](image)

C Prepare a microscope slide of cheek cells

Step 1: Clean a toothpick with alcohol to sterilise it.
Step 2: Use the sterilised toothpick to gently scrape the inside of your cheek.
Step 3: Put the scraping onto the middle of a clean microscope slide and spread it out.
Step 4: Use the dropper to put a drop of methylene blue onto the cells.
Step 5: Use the dissecting needle to gently lower the cover slip over the cells.
Step 6: Use a piece of filter paper to gently remove excess liquid from the slide.
Step 7: Examine the slide, first under low power and then under high power objective lenses. Figure 1.12 shows what human cheek cells as seen under a microscope:

![Micrograph of human cheek cells](image)

*Figure 1.12 A micrograph of human cheek cells: magnification 100 X*

Questions:
1. Make a drawing of a few cells that you see under the microscope with the higher power objective lens.
2. On your drawing, label any cell parts that you know.
3. Draw a table like the one below in your exercise book. Compare the two types of cells using the points in the table.

<table>
<thead>
<tr>
<th></th>
<th>Plant cell: Onion cells</th>
<th>Animal cell: Cheek cells</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shape</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cell wall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vacuole</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When you have finished viewing the microscope slide, turn off the light (if the microscope has one). Move the low-power objective lens back into position over the centre of the stage and turn the coarse focus knob to move the lens and stage far apart. Remove the slide, wipe the microscope with a soft cloth and put it back into its box, or cover it for storage.
Classroom activity 3

*Individual*

The micrographs below are of plant and animal cells.

![Micrographs of plant and animal cells](image)

1. Choose one of the micrographs. Examples of plant cells are a) and c) and animal cells are b) and d).

2. Make a drawing of two or three cells that you see in the micrograph you have chosen.

3. On your drawing, label any cell structures that you know.

4. Copy the table below into your exercise book. Complete the table by listing the differences between plant and animal cells, and describing their function.

<table>
<thead>
<tr>
<th>Cell organelle</th>
<th>Plant</th>
<th>Animal</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell wall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cell membrane</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chloroplast</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mitochondrion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cytoplasm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nucleus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vacuole</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Lesson 4
Cells in tissues, organs and systems

In Grade 8, you learnt that micro-organisms such as bacteria and protists can only be seen with a microscope. Most micro-organisms are made of one cell. We call them unicellular organisms because ‘uni’ means one. The amoeba, which you can see in Figure 1.15, is a unicellular organism. The amoeba is found in rivers, dams and ponds. Unicellular organisms perform similar life processes to multi-cellular organisms.

Figure 1.14 A micrograph of an amoeba

Macroscopic organisms, such as plants and animals, are made of millions of cells. We call them multi-cellular organisms because ‘multi’ means many. In multi-cellular organisms, the different cells are specialised to do different and specific jobs. Various cells work together to ensure the survival of the organism.

Cells come in different shapes and sizes and are adapted to perform specific functions

Specialised cells come in different shapes and sizes. When you learnt about sexual reproduction in Grade 7, you learnt that sperm cells are adapted to swim to the egg during intercourse so that fertilisation can occur. Table 1.2 shows five examples of different body cells that are adapted to perform a specific function.
### Ciliated epithelial cell (Animal cell)

<table>
<thead>
<tr>
<th>Where is it found?</th>
<th>Lining the nose, windpipe and lungs</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is its function?</td>
<td>To move and carry dust particles and germs away from these areas to keep them healthy</td>
</tr>
<tr>
<td>How is its structure adapted to its function?</td>
<td>Ciliated epithelial cells have tiny hairs called cilia, which regularly brush mucus away to move particles of dust and germs. These cells have many mitochondria to make energy for the cilia to move.</td>
</tr>
</tbody>
</table>

**Figure 1.15 Ciliated epithelial cells**

### Sperm cell (Animal cell)

<table>
<thead>
<tr>
<th>Where is it found?</th>
<th>In the testes of the male</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is its function?</td>
<td>To carry heritable characteristics (DNA) to the egg when fertilisation occurs</td>
</tr>
<tr>
<td>How is its structure adapted to its function?</td>
<td>Sperm cells have a tail to swim up the vagina to find the egg cell in the Fallopian tube. Many mitochondria give it energy needed to swim. Special chemicals in the head help dissolve the ovum’s membrane. A sperm cell contains heritable characteristics (DNA) from the father to the new baby.</td>
</tr>
</tbody>
</table>

**Figure 1.16 Sperm cells**

### Root hair cell (Plant cell)

<table>
<thead>
<tr>
<th>Where is it found?</th>
<th>The surface of plant roots</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is its function?</td>
<td>To increase the root’s surface area to absorb more water and minerals</td>
</tr>
<tr>
<td>How is its structure adapted to its function?</td>
<td>Root hair cells have long, thin parts. These parts reach outwards into the soil to increase the surface area of the root in contact with the soil. Root hair cells also have very thin cell walls to allow water and nutrients to pass from the soil into the root.</td>
</tr>
</tbody>
</table>

**Figure 1.17 Root hair cells**
### Palisade cell (Plant cell)

**Where is it found?**
In the upper surface of the leaf

**What is its function?**
To trap sunlight energy during photosynthesis

**How is its structure adapted to its function?**
Palisade cells are long and are shaped like cylinders. They have many chloroplasts, which contain the green pigment called chlorophyll to trap the sun’s energy for photosynthesis. Each cell has a large surface area to increase the area for gaseous exchange.

### Red blood cells (Animal cell)

**Where is it found?**
The blood of animals

**What is its function?**
To carry oxygen from the lungs to parts of the body

**How is its structure adapted to its function?**
Red blood cells have round, flat shapes and are thicker at the edges than in the middle. They are very flexible so that they can squeeze through thin blood vessels without breaking. They contain a red pigment called haemoglobin, which carries oxygen.

### Tissues, organs and systems

Similar cells group together to form tissues, such as nerve, blood or muscle tissues. Different tissues form organs, such as the heart, brain and lungs. These organs carry out the various life processes. Groups of organs work together to form systems within an animal and a plant. The oesophagus, stomach, intestines and liver are part of the digestive system. Other examples of animal systems are nervous and circulatory systems. You will learn more about these systems in Topic 2. Groups of systems working together form an organism such as an animal or plant.

### Stem cells

Stem cells are special cells in the human body that have the ability to divide and develop into many different cells, such as muscle cells or nerve cells. Stem cells are found in the bone marrow and the umbilical cord of a developing embryo. It is thought that stem cells can be used to treat many diseases, for example, eye diseases and to help repair spinal cord injuries. Stem cells are easily grown in the laboratory. It is believed that stem cells can be transplanted into people with certain diseases to help cure or treat the disease. Stem cells could also be
used to grow new organs which could be used for organ transplants. The use of stem cells to repair or replace damaged tissues is called therapeutic cloning. Some countries have laws that prohibit therapeutic cloning, while other countries allow therapeutic cloning. Because the use of stem cells is such a sensitive issue, it is important to have laws in place to make sure that ethical and moral issues connected with therapeutic cloning are protected.

**Classroom activity 4**

**Pairs**

1. a) Give a suitable definition for each of the following terms: cell, tissue, organ, system, organism.
   b) Give two examples of each term.

2. Read the information given by Dr Naidoo and Dr Moloi and answer the questions that follow.

   ‘Embryonic stem cells are usually obtained from aborted foetuses or embryos that have been produced in the laboratory by *in vitro* fertilisation.’

   ‘Stem cells collected from umbilical cord blood following the birth of a baby can be stored as frozen cells. If the child or a close family member needs stem cells to cure a disease or to grow a new organ in future, the stem cells would provide a perfect genetic match for the child and a close genetic match for a family member.’

   ‘Scientists have used embryonic stem cells to treat paralysed rats. Embryonic stem cells were used to make nerve cells and the nerve cells were injected into the damaged spinal cords of rats. After nine weeks the rats were able to walk again.’

   ‘Many people believe that it is morally wrong to use human embryos for research, as any human embryo, whether created in the laboratory or by natural methods, has the potential to develop into a living person.’
a) Give two arguments against embryonic stem cell research.
b) Give two arguments that support embryonic stem cell research.
c) Do you think embryonic stem cell research should be performed? Give reasons for your opinion.

**Extra practice**

*Individual*

1. The diagrams in Figure 1.20 show cells as seen through a microscope.
   What cells do diagrams A–O show? (4)

![Diagram of different cells seen through a microscope](image)

*Figure 1.20 Diagrams of different cells seen through a microscope*

2. Look at diagrams A and B below. State which cell (A or B) is an animal cell. Give a reason for your answer. (3)

![Diagram of cells](image)

*Figure 1.21 Diagrams of cells*

3. Read the following descriptions of the parts of cells below. Write the name of the part it describes.
   a) Contains chlorophyll
   b) Control centre of a cell
   c) Made of cellulose (3)

4. Draw and label a human cheek cell. (10)

Total: 20 marks
Summary

- Microscopes are used to magnify small images. We can study simple features of cells with a light or compound microscope.
- Before the 17th century, scientists knew very little about cells because they did not have microscopes to study them.
- A light microscope uses light and lenses to magnify a specimen more than a thousand times.
- The electron microscope uses a beam of electrons to magnify a specimen millions of times.
- Organisms are made up of tiny building blocks called cells.
- All cells are surrounded by a cell membrane to give shape to the cell and control the movement of substances in and out of the cell.
- The cytoplasm is a clear jelly-like liquid where chemical reactions take place.
- The nucleus controls vital functions and has chromosomes made of DNA.
- Mitochondria use food to produce and release energy.
- Plant cells have a cell wall that protects and gives strength and support.
- Chloroplasts contain chlorophyll to trap light energy from the sun during photosynthesis.
- The vacuole holds water and dissolved sugars and salts. Animal cells usually do not have vacuoles.
- Cells become specialised because they can perform particular functions.
- A group of similar cells forms a tissue; similar tissues form organs; groups of organs work together as part of a system and all the systems together form an organism.
- Stem cells can divide and develop into different cells. Stem cells may be used to treat diseases and help repair spinal cord injuries and brain damage.
The marathon runners in the photograph are breathing to take in oxygen. What system helps them to breathe? The organs in your body work together in systems. What other systems in the body help these runners complete their race? What structures make up systems?
In Topic 1 you learnt about tissues, organs and systems. Specialised cells group together to form tissues, and different tissues of similar structure and function form organs. These organs carry out the various life processes. Organs work together to form different systems within the body.

Figure 2.1 shows the organisation of life ranging from organelle to organism. Study the diagram carefully to answer the questions that follow.

1. Provide labels for A–D on the diagram.
2. Provide a suitable definition for the labels A–D on the diagram.
3. Give two other examples of A–D on the diagram.
Lesson 1
Life processes happen in body systems

Your body works every moment of the day, even while you are asleep. Your heart pumps to send blood through all your blood vessels. Your chest moves air in and out of your lungs. Your kidneys and lungs get rid of the wastes that your body does not need. Nerve signals carry information from your sense organs to your brain, and carry messages from the brain to all parts of your body. Organs work together to form body systems that carry out these life processes. The human body consists of several systems working together. Figure 2.2 shows the seven systems found in the human body.

Figure 2.2 The seven systems found in the human body
Practical activity 1

Pairs
Explore the systems in the human body – PRESCRIBED

You will need:
A sheet of A3 paper, coloured pencils, glue, scissors, pen and pencil, the outline of the human body and an organs sheet.

Method:
1. Cut out the outline of the human body from the sheet your teacher gives you.
2. Glue it in the centre of the sheet of A3 paper.
3. At the top of the A3 sheet write a heading: The human body systems.
4. Cut out each organ on the organ sheet that your teacher gives you and place them in their correct positions on the body. Use Figure 2.3 to help you identify and place your organs.
5. Once you are sure they are in the correct place glue them down. **NOTE: Do not label anything, you will do this later.**
6. On the bottom left-hand side of the page make a key to name the different seven body systems. Each system must be represented by a different colour.
7. Keep your sheet in a safe place as you will label the different organs when you do each body system in this topic.

**Figure 2.3 The organs inside your body. Organs working together form systems.**
Life and Living

Lesson 2
The digestive system

Food gives your body energy. Food needs to be broken into smaller units so that it can pass into the blood. The breaking down of food is called digestion.

The alimentary canal is a long tube with many functions, that leads from the mouth to the anus. Food is digested in the stomach and small intestine. Digested food is absorbed into the bloodstream, which takes these dissolved foods to all parts of the body. Food is used to keep our body cells alive, to build new cells, and to replace worn-out body cells.

The main organs found in the digestive system

The main organs in the digestive system are the mouth, oesophagus, stomach, small and large intestines, and the liver. Read each description in Figure 2.4 to learn the function of each organ.

- **Mouth**: Food is mixed in the mouth with saliva and is chewed into small pieces.
- **Oesophagus**: The tube from mouth to stomach has muscles round it that push food down to the stomach.
- **Liver**: A large organ where extra sugar is stored, and alcohol and other poisons are broken down.
- **Stomach**: A bag-like organ which mixes and digests food to make it soluble in water.
- **Large intestine**: A wide tube in which water is absorbed into the bloodstream.
- **Small intestine**: A long narrow tube, where food is digested and made soluble. The digested food is absorbed through the intestine walls into blood vessels.

Figure 2.4 The main organs of the digestive system

Word bank

- **digestion**: the process in which ingested food is broken down
- **anus**: opening that faeces passes through at the end of the large intestine
- **ingestion**: the process of taking in food for chewing and grinding
- **absorption**: when soluble food molecules from the intestine are taken up into the bloodstream
- **eversion**: the process of getting rid of undigested food as faeces
- **sanitation**: public health facilities for drainage and sewage disposal
Important processes in the digestive system
The main processes in the digestive system include ingestion, digestion, absorption and egestion.

- **Ingestion** is the process of taking in food and chewing it into small pieces.
- **Digestion** takes place when ingested food is further broken down into smaller, soluble pieces.
- **Absorption** occurs when soluble food molecules from the intestine are taken up or pass into the bloodstream.
- **Egestion** is the process when undigested food is removed from the body as faeces.

Health issues that can affect the digestive system
There are many conditions that affect the digestive system, such as ulcers, diarrhoea, liver cirrhosis and anorexia nervosa.

**Ulcers**
The stomach is lined with a thick mucous layer that protects it from strong stomach acids and chemical substances that digest food. Sometimes a small area of the mucous lining breaks down and the stomach wall is damaged by the stomach acid. The acid eats away into the stomach wall, forming an ulcer. Ulcers can cause bleeding and a lot of pain in the stomach.

**Diarrhoea**
Sometimes bacteria and protists get into our drinking water and infect people causing diseases such as cholorea and amoebic dysentery. These are called waterborne diseases. In many informal settlements, there are inadequate sanitation and water purification facilities. An infected person will suffer from diarrhoea and vomiting, which causes the person to become dehydrated. As the person dehydrates, they lose weight, the skin wrinkles and the eyes become sunken. If fluids and electrolytes are not replaced, the person will fall into a coma and eventually die.

**Liver cirrhosis**
Liver cirrhosis is the long-term damage of the liver. Excessive amounts of alcohol, viral infections or bad reactions to some medicines damage the liver. Damaged liver cells form scar tissue, and large areas of scar tissue separate the working liver cells so that the liver cannot work properly.
Anorexia nervosa
The name ‘Anorexia’ is from a Greek word meaning the lack of appetite. *Anorexia nervosa* is an eating disorder where a person will stop eating even though they have access to healthy foods. It is more common amongst teenagers, especially girls. Anorexia is a very dangerous disease because the person can become so thin that they damage their kidneys and reproductive systems. Sometimes this damage can lead to death.

*Figure 2.5 An anorexic person*

**Classroom activity 1**

*Individual*

1. What is the name of the tube that goes into the stomach?
2. Food moves from your stomach into your intestines. How long are the intestines? Think carefully about this.
3. Name four processes that take place in the digestive system.
4. What is the function of the liver?
5. On the sheet you created in Practical activity 1, colour in all the organs that are part of the digestive system. Use the same colour as your key.
6. Label and explain what happens in each organ.
Lesson 3
The circulatory system

Blood carries oxygen and food to the cells and carbon dioxide and waste products away from the cells. The body cells need a constant supply of oxygen and food to survive.

The main organs in the circulatory system
The main organs of the circulatory system are the heart, blood vessels such as arteries, veins and capillaries, and blood.

Read each description in Figure 2.6 to learn about the function of each organ.

**Heart**: Your heart beats day and night to keep the blood moving around one circulatory system.

**Capillaries**: These are very thin tubes that join the arteries with the veins. The blood always stays inside these branching tubes.

**Arteries**: Blood rich in oxygen goes from your heart through arteries to all the other parts of your body.

**Veins**: Blood containing lots of carbon dioxide is carried back to your heart in veins.

**Blood**: Your blood circulates around your body. The blood carries many kinds of substances such as food, gases and wastes to and from all the body cells.

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**Important processes in the circulatory system**

Blood flows through two circuits in the body.

- One circuit transports blood between the heart and the lungs so carbon dioxide can be released into the lungs and oxygen picked up and taken back to the heart.
- In the other circuit, the heart pumps oxygen and food to the rest of the body cells. Carbon dioxide and wastes are returned to the heart.
Health issues that can affect the circulatory system
High blood pressure, heart attacks and strokes are examples of conditions that can affect the circulatory system.

High blood pressure
High blood pressure is caused when arteries leaving the heart are coated with a fatty substance that makes them very narrow. The narrow arteries force the heart to work even harder. As a result, the heart needs to pump blood under a very high pressure so that it can still move blood around the body. Long-term high blood pressure can cause health problems.

Heart attack
A heart attack occurs when the blood flow to part of the heart muscle is blocked. The muscle dies because it does not get oxygen and food. The damaged heart may beat unevenly and so not be able to pump enough blood to the rest of the body. A heart attack can lead to death.

Stroke
A stroke is caused when the brain cells suddenly die because they do not get enough oxygen. This happens when an artery that carries blood to the brain is blocked or bursts open. The person may suddenly not be able to speak, lose their memory or become paralysed on one side of the body.

Classroom activity 2

Individual
1. What organ is found between the lungs?
2. Explain what happens during a heart attack.
3. On your A3 sheet of the human body, colour in all the organs that are part of the circulatory system. Use the same colour as the key.
Lesson 4
The respiratory system

The respiratory system exchanges gases in the lungs. Oxygen is transported by the blood to the body parts where it is needed for respiration. Your cells produce carbon dioxide during respiration, which is carried to the lungs to be exhaled.

The main organs found in the respiratory system

The main organs are the nose, mouth, trachea, bronchi, bronchioles, lungs and blood. Read each description in Figure 2.8 to learn about the function of each organ.

Word bank

respiration: a chemical process in all living cells when oxygen and food are used to make energy and carbon dioxide

chemotherapy: a chemical drug that destroys cancer cells

radiation therapy: X-rays using high-energy particles such as gamma rays to destroy cancer cells

asbestos: a fine fibrous material used to make fireproofing, and which can cause lung cancer

4. Label each part and explain what happens in each part.

Homework

5. There are two main types of strokes. Use a library or the internet to find out what they are. Use the following as subheadings under each type of stroke; causes, symptoms, risk factors, how a stroke can be prevented. Your information must be no more than two pages.
Important processes in the respiratory system
The main processes in the respiratory system include breathing, gaseous exchange and respiration.

- Breathing is the process where air is moved in and out of the lungs. The process involves inhalation (breathing in) and exhalation (breathing out).
- When gases move across the cell membrane or a surface in opposite directions, it is called gaseous exchange. Gaseous exchange is needed to provide cells with enough oxygen for respiration, and to remove the carbon dioxide that the cells produce.
- In the cells of your body, glucose is broken down to release energy. This chemical process is called respiration.

Health issues that can affect the respiratory system
There are many conditions that affect the respiratory system, such as asthma, lung cancer, bronchitis, and asbestosis.

Asthma
People who suffer from asthma may have asthma attacks and find it difficult to breathe. When someone has an asthma attack, their air passages become irritated and swollen. The muscles of the air passages contract and more mucus is produced in them so that very little air can pass through. Symptoms of asthma include wheezing, coughing, chest tightness and shortness of breath. In severe cases the person may die.

Lung cancer
Lung cancer is one of the main causes of death among South Africans. About 90% of lung cancers are caused by the inhaling of cancer-causing substances in cigarette smoke. Cancer cells in the lungs divide to form harmful masses of tissue called tumours. These cells then spread to other parts of the lungs and sometimes to other parts of the body. Some symptoms of lung cancer include a cough, coughing up blood, chest pain and shortness of breath. Sometimes the tumour can be treated using chemotherapy or radiation therapy or can be removed by a doctor.

Figure 2.9 A coloured X-ray showing a cancerous tumour (yellow-orange mass) in the lung
Bronchitis
Bronchitis is when the air passages in the lungs become irritated and swell. Bronchitis may be caused by a virus or bacterial infection, pollution or smoking. The irritated air passages produce more mucus which blocks up some air passages, so less air is able to enter or leave the lungs. Symptoms include shortness of breath and coughing.

Asbestosis
Asbestosis is a dangerous lung disease that develops when a person inhales asbestos dust. Tiny asbestos fibres settle in the lungs and cause permanent lung damage. The person will struggle to breathe properly. The symptoms do not occur immediately but only years after being exposed to asbestos dust. There is no cure and the disease often leads to the death of the person.

Classroom activity 3

1. How many lungs do you have?
2. a) How many large tube-like structures are in your neck?
   b) What substances move within these tube-like structures?
3. What is the name of the tube-like structures that go into the lungs?
4. On your A3 sheet of the human body, colour in all the organs that are part of the digestive system. Use the same colour as the key.
5. Label each part and explain what happens in each part.

Lesson 5
The musculoskeletal system

The main function of the musculoskeletal system is to support and protect. Without this system, you would be like a blob of jelly. Muscles are attached to bones to help you move. Other muscles make up your heart so that it can pump blood. Muscles are antagonistic and work in pairs. Some bones protect delicate organs from damage. Bones store minerals such as calcium. Blood cells develop in the red bone marrow of long bones.

The main organs found in the system
The main organs are bone, cartilage, muscles, ligaments and tendons. Read each description in Figure 2.10 to learn about the function of each organ.
**Muscles:** Muscles are made of strings of muscle cells called muscle fibres. Muscles can get shorter so that the ends of the muscle pull towards each other.

**Bones:** There are 206 bones that make up the skeleton. The bones are hard and stiff, but they have joints at their ends which help movement.

**Tendons:** Tendons attach muscles to bones. When muscles contract and get shorter, they pull on the bone to make it move.

**Ligaments:** These are very strong tissues that hold two bones together in a joint.

**Cartilage:** This is a rubbery tissue that holds parts of the skeleton together and reduces friction at joints when bones rub against each other.

*Figure 2.10 The main organs of the musculoskeletal system*

**Important processes in the musculoskeletal system**
The main processes in the system are locomotion and movement, and the contraction and relaxation of muscles.

- The upper and lower limbs allow for locomotion and movement, of arms, legs, hands, feet, fingers and toes.
- Muscles work in pairs. When one muscle contracts, the other one relaxes. For example, the biceps and triceps of the arm form an antagonistic pair of muscles. This is because each muscle moves the bones in opposite directions when they contract. When a muscle gets shorter, we say that it contracts.

**Health issues that can affect the musculoskeletal system**
Some health issues that affect the musculoskeletal system are rickets, arthritis and osteoporosis.

**Rickets**
Rickets is a disease in children that is caused by a shortage of vitamin D, which makes the bones bend and become deformed. Your body can make its own vitamin D by exposing the skin to sunlight or by eating dairy products, fish and cereals.
Arthritis
Arthritis is caused when the cartilage covering the ends of the bones at the joints breaks down and becomes very thin. The joints swell and become very stiff and sore. In some cases, the joints become deformed as shown in Figure 2.12.

Osteoporosis
As a person gets older, their bones lose large amounts of their protein and calcium. This loss causes the bones to become spongy and very fragile, and they can break easily.
Classroom activity 4

*Individual*
1. Draw a mind map showing the functions of the musculoskeletal system.
2. a) The shortage of which vitamin causes rickets in children?
   
   b) List five signs of rickets in babies.
3. a) Where are your biceps and triceps?
   
   b) Explain why are biceps and triceps referred to as antagonistic muscles?
4. On your A3 sheet of the human body, colour in all the organs that are part of the digestive system. Use the same colour as the key.
5. Label each part and explain what happens in each part.

Lesson 6
The excretory system

Excretion is the process by which your body gets rid of waste substances. The body cells produce waste products that can become poisonous if they are not removed from the body. To stay healthy, the kidneys filter all the poisonous waste products out of the blood to urine. Urine is excreted from the body. The kidneys also control the amount of water that we have in our bodies.

The main organs found in the excretory system
The main organs in the excretory system are the kidneys, bladder, ureter and urethra.

Read each description in Figure 2.13 to learn about the function of each organ.

Word bank

nephrons: structures in the kidney that filter waste products from the blood
Important processes in the excretory system

The main processes involved are filtration, absorption, diffusion and excretion.

- **Filtration of blood**: Inside the kidney, the blood, containing waste products, is filtered into tiny tubules called nephrons. The waste products are dissolved in water, which will eventually form urine. Urine contains poisonous waste products and excess salts and water.

- **Absorption**: As the filtrate passes through the kidney tubules or nephrons, useful substances such as food molecules, vitamins, minerals and water are moved back into the blood.

- **Diffusion**: Diffusion is the movement of particles from an area of high concentration to an area of low concentration down a concentration gradient. There is a high concentration of waste products in blood. The waste products move by diffusion into the kidney tubules where there is a lower concentration. The process of diffusion does not use energy from cells.

- **Excretion**: Excretion is the removal of waste products from the blood in the kidneys.

Health issues that can affect the excretory system

There are many conditions that affect the excretory system. These include kidney failure, bladder infections and kidney stones.

**Kidney failure**

Your kidneys remove waste products so your body is kept healthy. If excess water and salts are not removed from the blood, this build-up can cause strain on the heart. If a person’s kidneys are diseased and stop working, the person dies. One way to save a person’s life is to link them up to an artificial kidney called a dialysis machine. This machine filters their blood each day. The other way is to have a kidney transplant. However, it is so difficult to get a kidney, many people die while waiting for a new kidney.

![Figure 2.14 A patient connected to a dialysis machine](image-url)
Bladder infections
Sometimes bacteria and other micro-organisms get into the bladder and cause an infection. Bladder infections are more common in women as their urethra is shorter and closer to the anus than in men. The first signs of an infection are smelly, cloudy urine and a burning sensation when the person urinates. A bladder infection can be treated using antibiotics.

Kidney stones
Kidney stones are one of the most common disorders of the kidney. Sometimes, hard crystals of calcium and salts form inside the kidney. These are called kidney stones. They can block the tubules and cause terrible pain. The stones can be as small as a grain of sand or as large as a golf ball. Most kidney stones pass out of the body on their own, without treatment, but others may have to be removed by surgery. Symptoms include a sharp pain on the side of the body or blood in the urine. You can reduce the chance of getting kidney stones by drinking lots of water.

Classroom activity 5

Pairs
1. How many kidneys do you have?
2. Write down the names of two substances that are excreted from our bodies.
3. How is the blood leaving the kidney different from blood entering it?
4. How do waste products leave your body?
5. What is the function of the bladder?
6. What is the name of the tube that takes urine to the bladder?
7. On your A3 sheet of the human body, colour in all the organs that are part of the excretory system. Use the same colour as the key.
8. Label each part and explain what happens in each part.

Lesson 7
The nervous system
The nervous system receives and helps the body to respond to stimuli. Nerves carry information between the brain and other body parts. There are thousands of nerves that reach almost every part of your body.

Word bank
stimuli: causes of a reaction
meningitis: inflammation of the membranes that surround the brain and spinal cord
diabetes: a disease in which there is usually too much sugar in the blood
cataract: an eye disease that involves the clouding of the natural lens, causing blindness
The main organs found in the nervous system
The main organs are the brain, spinal cord, nerves, ears, nose, eyes, skin and tongue. Read each description in Figure 2.15 to learn about the function of each organ.

Brain: Your brain is inside your skull. It controls all the functions in the body and is responsible for your memory and feelings.

Spinal cord: The spinal cord is a thick bundle of nerves that goes down from your brain to the bottom of your spine. The vertebrae of your spine protect the spinal cord. Most of the messages that come from the nerves of your body travel through your spinal cord on their way to the brain.

Nerves: The nerves carry information to the spinal cord and brain, and carry messages away to the rest of the body.

Sense organs: These are the organs used to pick up stimuli for the body. They are the nose, tongue, eyes, ears and the skin.

Important processes in the nervous system
The main processes involved are seeing, hearing, feeling, tasting, smelling, sending and receiving impulses and regulating temperature.

- Sensing with our sense organs: The sense organs pick up stimuli for the body. The nose is used for smelling and the tongue is used for tasting. You see with your eyes and hear with your ears. The skin is used to sense changes in temperature as well as, feel pain and pressure.

- Sending and receiving impulses: The five sense organs (eyes, ears, nose, tongue and skin) send messages to the brain via nerves to tell it what is happening. These nerves are called sensory nerves. The brain responds to the stimuli by sending messages along another set of nerves. These nerves are called motor nerves.
• **Regulating temperature:** The brain regulates the temperature of the body. The brain controls the amount of heat produced and the amount of heat lost by the skin to keep the body temperature constant at 37 °C. The skin plays an important role in the regulation of body temperature.

**Health issues that can affect the nervous system**
There are many conditions that affect the nervous system. These conditions include deafness, blindness, short-sightedness and the effects of drugs and alcohol on the brain.

**Deafness**
When a person is deaf, they cannot hear with one or both ears. Infectious diseases such as meningitis, exposure to very loud noises and damage to the head in an accident can cause deafness. When one or more relatives are born deaf there is a higher chance of deafness being inherited.

**Blindness**
A person who is blind is not able to see properly. Blindness can be caused by infections, damage to the head in an accident, diabetes and/or eye muscle deterioration. Sometimes the lens becomes white and the person cannot see. This is called a cataract. Cataracts can be removed during surgery.

**Short-sightedness**
People who are short-sighted can only see near objects clearly, but objects that are far away are blurred. Short-sightedness occurs when the eyeball changes shape. This results in the image not falling on the layer that picks up light in the eye. Glasses, contact lenses or laser surgery can be used or carried out to correct the problem.

**Effects of drugs and alcohol on the brain**
There are many chemical substances that can enter your brain to change the way that you think and feel. Illegal drugs such as dagga (marijuana, grass, boom), tik, cocaine, mandrax and heroin change the way the nerves in the brain pass messages to each other. Drugs may also damage the nerves in the brain that are involved in memory and learning, and there is a risk of permanent brain damage. People become addicted to drugs, which can destroy them and their family’s lives.

Alcohol is a drug that has similar effects to drugs on the brain. Alcohol can easily fool a person into thinking that they are smarter or good fun to be with. In fact, it makes them less able to judge their own behaviour. This is often seen when drunk drivers cause accidents that kill many people each year.
Classroom activity 6

Pairs

1. On your A3 sheet of the human body, colour in all the organs that are part of the nervous system. Use the same colour as the key.

2. Label each part and explain what happens in each part.

3. Table 2.1 shows the drug and alcohol use amongst young offenders and young non-offenders in South Africa.

Table 2.1 Drug and alcohol use of young offenders and young non-offenders

<table>
<thead>
<tr>
<th>Drug</th>
<th>Offenders</th>
<th>Non-offenders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td>82%</td>
<td>31%</td>
</tr>
<tr>
<td>Marijuana</td>
<td>61%</td>
<td>5%</td>
</tr>
<tr>
<td>Cocaine</td>
<td>14%</td>
<td>0,3%</td>
</tr>
<tr>
<td>Mandrax</td>
<td>29%</td>
<td>0%</td>
</tr>
</tbody>
</table>


a) Draw a bar graph to represent the information in the table.
b) Which drug is used most by both offenders and non-offenders?

4. Prepare a poster to be displayed in schools and at youth centres. You must include in your poster:

a) How drugs can affect a person’s health and life.
b) Why it is important not to take drugs (promote healthy lifestyle choices).

Lesson 8
The reproductive system

The reproductive system is very important in continuing a species by producing offspring. In the female the ovaries produce eggs. In the male the testes produce sperm. Fertilisation occurs when an egg and sperm fuse (join).

The main organs found in the reproductive system

The main organs in the female reproductive system are the Fallopian tubes, ovary, uterus and vagina. The penis and testes are the organs found in males. Read each description in Figure 2.16 to learn the function of each organ.

Word bank

gestation: the period of development from conception until birth
Life and Living

Ovary: There are two ovaries that produce the female sex or egg cells. An egg cell is called an ovum (plural: ova).

Uterus: The uterus is a pear-shaped structure where the baby develops during pregnancy. It has strong muscular walls and a layer of spongy tissue that lines the inner wall of the uterus.

Vagina: The vagina has muscular walls that stretch during childbirth.

Fallopian tube: There are two Fallopian tubes and the ova travel along these tubes from the ovaries to the uterus.

Testes: The testes produce male sex cells. Each testis is held in a sack of skin called the scrotum, outside the body. The testes produce millions of sperm each day.

Penis: The penis has special tissue that can be filled with blood, to make the penis stiff or erect. The penis needs to be erect to transfer sperm cells into the female during intercourse.

Figure 2.16 The main organs of the male and female reproductive systems

Important processes in the reproductive system
The main processes include cell division and growth, maturation, copulation, ejaculation, ovulation, menstruation, fertilisation and implantation.

- **Cell division and growth**: The fertilised egg divides and grows into an embryo. The period from conception to birth is called the gestation period.
- **Maturation**: Puberty is the stage in the human life cycle when sexual organs mature.
- **Copulation**: This occurs when a man and a woman have intercourse and sperm are released.
- **Ejaculation**: This occurs when the erect penis releases sperm.
- **Ovulation**: This occurs when an ovum is released from an ovary every 28 days.
- **Menstruation**: When the ovum is not fertilised, it passes through the uterus and out the vagina. The spongy tissue layer (endometrium) of the uterus breaks down and passes through the vagina. This flow of blood is called menstruation.
- **Fertilisation**: This is the process when the sperm fuses with the egg.
- **Implantation**: A few hours after fertilisation, the fertilised egg divides many times into a ball of cells. The ball of cells embeds into the endometrium that lines the uterus.
Health issues that can affect the reproductive system
There are many things that can go wrong with the reproductive system. Conditions include infertility, foetal alcohol syndrome and sexually transmitted diseases (STDs).

Infertility
A person who has gone through puberty that cannot reproduce is referred to as infertile. Men can be infertile if their testes cannot produce sperm or the sperm produced are abnormal, for example has no tail or cannot swim properly. A woman is infertile when she is unable to ovulate, her Fallopian tubes are blocked or the uterus lining is not suitable for implantation to occur.

Foetal alcohol syndrome (FAS)
When a pregnant mother drinks too much alcohol during her pregnancy, the newborn baby is usually smaller and not as healthy. Some babies are born brain-damaged, and will suffer permanent learning disabilities.

Sexually transmitted diseases (STDs)
STDs are diseases passed from one person to another during intercourse. The germs causing the disease pass from the infected person to the other person in sperm, vaginal fluid or blood. There are many kinds of STDs. Examples include herpes, gonorrhoea, syphilis and AIDS. Each of these diseases has their own type of symptoms. There will usually be sores, blisters, yellow or greenish discharge, unpleasant smell or a rash around the penis, vagina or anus. The need to urinate often and a burning feeling or pain when passing urine are also signs of an STD. However, there can also be some symptoms in other parts of the body, such as fever, headache, sore throat and swollen glands in the groin, armpits and neck.

Figure 2.17 Sores caused by syphilis
Classroom activity 7

Groups
1. On your A3 sheet of the human body, colour in all the organs that are part of the reproductive system. Use the same colour as the key.
2. Label each part and explain what happens in each part.
3. Design a poster or a pamphlet to inform people about the dangers of STDs and the importance of practising safe sex. Use pictures or diagrams as well as text and make your poster or pamphlet eye-catching, colourful and informative.

Extra practice

Individual
Read the cartoon strip story about what Paul and Thando do in a day, and answer the questions.

1. Find places in the story where one of the boys is:
   a) sensing something from outside his body (3)
   b) getting rid of something that his body does not need (2)
   c) getting things that his body needs (2)
   d) thinking (2)
   e) growing. (1)
2. Name three other things that happen all the time in your body. Include one thing that happens even while you are sleeping. (3)

3. How does it help you if your body does the following things:
   a) sweats (3)
   b) breathes deeply (2)
   c) smells something (2)
   d) makes the heart beat faster? (2)

   Total: 22 marks

Summary

- Organs work together to form body systems to carry out life processes. The human body consists of several systems working together.
- The systems of the human body include the digestive, circulatory, respiratory, musculoskeletal, excretory, nervous and reproductive systems.
- The digestive system uses the mouth, oesophagus, stomach, intestines and the liver to break food into smaller units so that nutrients can pass into the blood.
- The main processes in the digestive system include ingestion, digestion, absorption and egestion.
- There are many conditions that affect the digestive system such as ulcers, anorexia nervosa, diarrhoea and liver cirrhosis.
- The circulatory system carries substances in blood vessels to all parts of the body. The main organs are the heart, the blood vessels such as arteries, veins and capillaries, and blood.
- Blood flows through two circuits in the body.
- High blood pressure, heart attacks and strokes are examples of conditions that can affect the circulatory system.
- The respiratory system exchanges gases in the lungs. The main organs are the nose, mouth, trachea, bronchi, bronchioles, lungs and blood.
- The main processes involved with the respiratory system include breathing, gaseous exchange and respiration.
- There are many conditions that affect the respiratory system, such as asthma, lung cancer, bronchitis, and asbestosis.
- The main function of the musculoskeletal system is to support and protect. Muscles are attached to bones to help you move. The main organs are bone, cartilage, muscles, ligaments and tendons.
- The main processes in the musculoskeletal system are locomotion and movement, and the contraction and relaxation of muscles.
- Some health issues that affect the musculoskeletal system are rickets, arthritis and osteoporosis.
- Excretion is the process by which your body gets rid of waste.
- The main organs are the kidneys, bladder, ureter and urethra.
- The main processes in excretion are filtration, absorption, diffusion and excretion.
- There are many conditions that affect the excretory system. These include kidney failure, bladder infections and kidney stones.
- The nervous system receives and helps the body respond to stimuli. Nerves carry information between the brain and other body parts.
- The main organs are the brain, spinal cord, nerves, ears, nose, eyes, skin and tongue.
- The main processes involved with the nervous system are seeing, hearing, feeling, tasting, smelling, sending and receiving impulses and regulating temperature.
- There are many conditions that affect the nervous system, such as deafness, blindness, short-sightedness and the effects of drugs and alcohol on the brain.
- The reproductive system is very important in continuing a species by producing offspring. The main organs in the female reproductive system are the Fallopian tubes, ovaries, uterus and vagina. The penis and testes are the organs found in males.
- The main processes in the reproductive system include growth, cell division, maturation, copulation, ejaculation, ovulation, menstruation, fertilisation and implantation.
- There are many things that can go wrong with the reproductive system. Conditions such as infertility, foetal alcohol syndrome and STDs are some examples.