CONTENTS

How to use this Learner’s Book ..............................................................................vii
Completing a Technology Assessment Task............................................................ ix

LIFE AND LIVING

Topic 1 Photosynthesis .......................................................................................... 1
Unit 1 Plants and food.............................................................................................. 2

Topic 2 Nutrients in food ...................................................................................... 13
Unit 1 Nutrients in food.......................................................................................... 14

Topic 3 Nutrition ................................................................................................... 29
Unit 1 Balanced diets.............................................................................................. 30

PROCESSING

Topic 4 Food processing ......................................................................................... 42
Unit 1 Processing food............................................................................................ 43
Unit 2 Technology project: Design and make a healthy breakfast snack bar .......... 55

LIFE AND LIVING

Topic 5 Ecosystems and food webs ....................................................................... 66
Unit 1 Different ecosystems and living and non-living things in an ecosystem ....... 67
Unit 2 Food webs.................................................................................................... 77
# Contents

## Systems and Control

**Topic 14** Systems to solve problems ................................................................. 211  
Unit 1  Using electrical circuits ............................................................................ 212  
Unit 2  Technology project: Design, make, evaluate and present a system that uses a circuit to produce light ......................... 216

## Matter and Materials

**Topic 15** Mains electricity ............................................................................. 231  
Unit 1  Fossil fuels and electricity .................................................................... 232  
Unit 2  Renewable ways to generate electricity ............................................... 243

## Planet Earth and Beyond

**Topic 16** The Solar System ........................................................................... 251  
Unit 1  Objects in the Solar System .................................................................. 252  
Unit 2  Moons .................................................................................................. 267  
**Topic 17** Movements of the Earth and planets ........................................... 274  
Unit 1  Rotation and revolution of the Earth .................................................... 275  
**Topic 18** The movements of the Moon ....................................................... 286  
Unit 1  The rotation and revolution of the Moon ............................................. 287

## Systems and Control

**Topic 19** Systems for looking into space .................................................... 298  
Unit 1  Systems for looking into space ............................................................ 299  
**Topic 20** Systems to explore the Moon and Mars ........................................ 310  
Unit 1  Vehicles used for exploring the Moon and Mars ............................... 311  
Unit 2  Technology project: Design, make and evaluate a model space rover ................................................................. 317

## Glossary .......................................................................................................... 329
How to use this Learner’s Book

Welcome to the Science and Technology Grade 6 Learner’s Book.

The content in the Science and Technology Grade 6 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. The ‘What you will learn about’ box 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, which are divided into lessons. A lesson consists of content followed by a Classroom activity. Some lessons also include Practical tasks. Some of the Classroom activities might be started in class but completed at home. The lessons break up the work into small 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 new section of work. One Practical task per term is suggested as a Formal Assessment Task. You could be assessed on these tasks, so watch out for them.

**Check what you learnt:** These are assessment activities. The questions are aimed to check your knowledge and test if you can do what you should be able to do at the end of the topic.

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

**Extra practice:** The Extra practice at the end of each topic has been included as an additional activity. You can use the questions to practise what you have learnt.
Other features to look out for are:

**Word bank:** These contain words that you may not understand or that you may have encountered for the first time in the text. 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:** The 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 a picture of something, you will remember it a lot better.

The publisher and authors wish you all the best in your study of *Science and Technology Grade 6*.

Good luck!
Completing a Technology Assessment Task

Solving problems to meet people’s needs is what Technology is all about. The skills taught in Science and Technology will give you the skills you will need to solve various technological problems.

Steps to follow when completing a Technology Assessment Task
During this year you need to complete two Technology Assessment Tasks. This section explains the steps you need to follow when completing a Technology Assessment Task.

It starts with a problem...
In the Technology Assessment Task, the problems are based on real-life examples. You design and make something to solve a given problem. Before you begin designing and making a solution to a given problem, you need to understand the problem and what is required.

Understanding the given problem
To understand the given problem and work out what you need to design and make, draw up:
- a list of specifications
- a list of constraints
- a design brief.
Specifications, constraints and design briefs
Specifications are those things that must be included in your product or system.

Constraints are all the limitations that have been placed on you as the designer.

To draw up your list of specifications and list of constraints, ask yourself these questions:
- What do I need to make?
- What will it be used for?
- Who will use it?
- How big does it need to be?
- Do I need to use any specific materials?
- Should I include anything specific in my design?

Once you have drawn up your list of specifications and constraints, you can work out a brief statement of what you have to design and make to solve the problem. This is called a design brief.

A design brief always starts with ‘Design and make a…’. The design brief, and your list of specifications and constraints, will help you to understand the problem and what you need to do to solve the given problem.

Help tasks
Before you can begin solving a given problem, you may need to gain some new technological skills. You then need to work through different help tasks to learn these skills.

Help tasks could include learning how to cut, saw, hammer or join. You may need to work through more than one Help task per problem.

Solve the problem using the technological design process
Once you understand the problem and you have learnt all the skills needed to solve the problem, you can begin solving it. To solve a problem you need to work through the technological design process.
The design process has five main steps. These are:

- investigating
- designing
- making
- evaluating
- communicating.

Usually you will work through these steps of the design process in this order, but sometimes you may find it easier to change the order, depending on the problem you want to solve.

**Communicating** also forms part of the design process. You need to communicate the steps of the design process to others. There are a few ways of doing this. One way is to record everything in a book or portfolio. Another way is to do a presentation.

In the design process each step leads on to another. There is no definite place where you have to stop working through the design process. Sometimes, after evaluating a design idea or the finished product, you may find the need to work through the design process again. There is nothing wrong in doing this. It is how technology solutions are improved.
How then do we work through each step of the design process?

**Investigating**
When you investigate, you gather information about a specific thing. Before solving a problem you need to collect information that you could use to solve the problem. You can get information in different ways. The ways that you choose to use to collect the information depend on the problem. Sometimes you may need to find information in books or magazines, or on the internet. Sometimes you need to ask other people questions to gather information. Learning a new skill is also part of investigating.

**Designing**
After you have investigated the problem, you will have some information to help you solve the problem. You may also have a few ideas of possible solutions to the problem. You are now ready to begin designing a solution to the problem.

Start the designing part of the process with several ideas. Make drawings of the different ideas. The drawings should be neat and detailed, and should always have labels. The labels explain the drawing.

Choose the design idea that will best solve the problem. Write down the reasons for the choice that you have made. Make a clear final drawing of the best idea.

**Making**
After completing the design you can make the product or system that is a solution to the problem. Before you make the product or system, you need to draw up a step-by-step plan of how to make the product or system. In the step-by-step plan you need to indicate necessary safety precautions to take and the tools and materials that should be used to make the product or system.

Using the step-by-step plan you then make the product or system, skilfully and safely, using the right tools and materials.
**Evaluating**

Once the product or system has been made, you need to test it or evaluate it. This means that you need to see if it solves the problem it is meant to. Suggest where and how the design could be improved or modified to make it solve the problem better.

**Communicating**

Communicating is an important part of the design process. When you communicate you are making a record of how you progressed through the design process until you found a solution to the problem.

Remember that there can be many ways to solve a problem; not everyone will solve a problem in the same way.

Enjoy doing technology!
What you will learn about in this topic

- Plants and food
- Plants and air

Let’s talk about photosynthesis

Look at the picture of the pot plant on the window sill. What does the plant need to grow? How does the plant get food? Why do you think are most plants green? Why are plants important for other organisms?
What you know already

Plants are living things. All living things need food for the processes of life like growth and reproduction. Animals depend on plants for food. Green plants make their own food using water, carbon dioxide from the air and light (energy) from the sun. Energy is transferred from the sun to plants to animals through a food chain. When plants make food they use carbon dioxide from the air and release oxygen into the air. Animals use the oxygen for breathing.

1. List three things that plants need to grow and to make their own food.
2. Where do plants get energy from to make food?
3. What is the name of the gas that plants need to make food?
4. What is the name of the gas that plants release in the air when they make food?

Lesson 1
Plants and food

Plants need energy from food to carry out life processes. Plants make their own food using water, sunlight and carbon dioxide through a process called photosynthesis. Photo means ‘light’ and synthesis means ‘making’.

Photosynthesis is therefore a process where food is made using light energy from the sun. This process takes place mainly in the leaves of the plant.

Figure 1.1 Photosynthesis takes place mainly in the leaves.
• **Energy from the sun:** The light energy from the sun is **absorbed** by the plant. This happens during the day when the sun is shining. Plants use this energy to make food.

• **Water from the soil:** Water is needed for a plant to make food and grow. The roots absorb water from the soil. The water moves from the roots to the leaves where photosynthesis takes place.

• **Carbon dioxide from the air:** Plants use a gas in the air called carbon dioxide during photosynthesis. The carbon dioxide enters the plant through small openings in the leaves. Oxygen gas is formed as a **product** of the process of photosynthesis and is released into the air.

• **Green leaves:** Photosynthesis takes place in the green parts of the plant, mainly the leaves. The leaves are suited to the process of photosynthesis. The green leaves of a plant contain a **pigment** called chlorophyll, which gives the leaves and other parts of a plant its green colour. Energy from sunlight is absorbed by the chlorophyll in the leaves.

• **Glucose is stored as starch:** The food that is produced during photosynthesis is made in the form of glucose sugar. **Glucose sugar** is changed into **starch**, which is stored by plants in leaves, stems, roots, flowers, fruits and seeds. This stored food is used by the plant to grow and reproduce.

---

**Classroom activity 1**

1. Explain what the words *photo* and *synthesis* mean.
2. Study Figure 1.2. Then answer the questions that follow.

**Figure 1.2 The process of photosynthesis**
a) Provide labels for 1, 2 and 3.
b) Name the type of energy represented at 4.
c) Name the gases labelled 6 and 7.
d) What is absorbed from the soil at 5?
e) What is made during photosynthesis?
f) Where does the plant store the food that it makes?
g) When does photosynthesis take place in a plant? Explain your answer.

3. Rewrite the sentences and fill in the missing words.
Photosynthesis takes place in the a)___________ parts of plants such as the leaves. Roots absorb b)___________ from the soil. The green leaves absorb c)___________ during the day. Special openings in the leaves allow the leaves to take in d)___________ ___________ from the air. During photosynthesis the plant releases e)___________ into the air. Food is stored as f)___________ in the leaves.

Lesson 2
Plants and air

The atmosphere that surrounds the surface of the Earth is made up of different gases, including oxygen and carbon dioxide. During the process of photosynthesis green plants make their own food using water, energy from sunlight and carbon dioxide from the air. Plants release oxygen into the air as a product of photosynthesis.

Animals and plants need oxygen to stay alive. One of the life processes of animals and plants involves the taking in of oxygen and the giving off of carbon dioxide. When animals breathe, they inhale the oxygen that plants release during photosynthesis. Animals exhale carbon dioxide. Plants use carbon dioxide for photosynthesis. Animals and plants depend on each other in this way.

Word bank

exhale: to breathe out
inhale: to breathe in
Figure 1.3 shows how plants and animals depend on each other to produce the gases that each needs for life processes. Plants play an important role in balancing the carbon dioxide and oxygen levels in the air. Plants remove carbon dioxide from the air and replace it with oxygen during the process of photosynthesis.

Figure 1.3 Plants give off oxygen for animals and humans to breathe.

Classroom activity 2

Figure 1.4 shows a fish tank with fish, a snail and water plants. The fish tank is airtight. Explain how the animals and the water plants are able to survive in the tank.

Figure 1.4 All the organisms in this fish tank depend on one another.

Challenge
Find out why forests are called the lungs of the Earth.
Lesson 3
Practical activities: Food tests

Plants make their own food through the process of photosynthesis. The food is made in the form of glucose sugar. The plant is able to change glucose sugar into another form of food called starch. Starch can be stored in different parts of the plant, such as leaves, stems and roots, flowers, fruits and seeds.

We can do investigations or tests to find out which foods contain starch. Foods that contain starch are easily identified because iodine solution reacts with the starch and changes colour from brown to blue-black. Iodine solution is called an indicator.

Practical activity 1

*Compare glucose sugar and starch by taste and colour*

**Prescribed activity**

**Aim**
To compare the taste and colour of glucose powder and starch powder

**You will need:**
- saucer or watch glass with starch powder (maize flour)
- saucer or watch glass with glucose powder (which is used to make glucose sweets)
- pencil and eraser
- notebook

**Safety warning**
It is not safe to taste substances in the laboratory and so tasting is never allowed. In this practical activity, however, it is allowed because the substances that are

Word bank

**indicator:** a chemical such as iodine solution, which changes colour when a specific substance is present
being worked with are known foodstuffs. Remember that you should never taste any substances unless you have been told to do so by the teacher.

Method
1. Look at the colour of the starch powder and that of the glucose powder.
2. Use your finger to taste the starch.
3. Use your finger to taste the glucose powder.

Results
Copy the following table. Record your observations.

<table>
<thead>
<tr>
<th></th>
<th>Starch powder</th>
<th>Glucose powder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taste</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Conclusion
Write a conclusion for the investigation. In the conclusion, compare the taste and colour of starch powder and glucose powder.
Practical activity 2

Testing for the presence of starch using an indicator

Prescribed activity

Aim
To test for starch using iodine

You will need:
- iodine solution
- dropper
- starch (maize flour)
- glucose powder
- 2 saucers or tiles
- spoon

Safety warning
Be careful when working with chemicals such as iodine. Keep all chemicals away from your skin, especially the face and eye area. Wash your hands with soap and water afterwards.

Method
1. Place a small amount of starch powder on one tile. Place a small amount of glucose powder on the other tile.
2. Note the colour of the starch and the glucose powder.
3. Place a drop of iodine onto both the starch and the glucose.
4. Note the colour of the starch and the glucose powder.

Figure 1.6 Testing for starch using iodine
Questions
1. Are there any colour changes? Write down your observation.
2. How is iodine an indicator of starch?
3. Why is the glucose powder also tested in this investigation?

Practical activity 3

Testing foods for starch
Prescribed activity

Aim
To test various foods for starch

You will need:
- iodine solution
- dropper
- a cavity tile or 7 small Petri dishes
- cooked rice
- flour
- sliced potato
- sliced bread
- oil
- sliced boiled egg
- sliced cheese

Figure 1.7 Testing food for starch
Safety warning
Be careful when working with chemicals such as iodine. Keep all chemicals away from your skin, especially the face and eye area. Wash your hands with soap and water afterwards.

Method
1. Place each food separately on a tile or Petri dish.
2. Add a drop of iodine solution to each food.
3. Observe any colour changes that take place.

Results
Copy and complete the table by recording your observations. One example has been done for you.

<table>
<thead>
<tr>
<th>Food</th>
<th>Colour change after adding iodine solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooked rice</td>
<td></td>
</tr>
<tr>
<td>Flour</td>
<td></td>
</tr>
<tr>
<td>Potato</td>
<td></td>
</tr>
<tr>
<td>Bread</td>
<td></td>
</tr>
<tr>
<td>Oil</td>
<td></td>
</tr>
<tr>
<td>Boiled egg</td>
<td>No colour change</td>
</tr>
<tr>
<td>Cheese</td>
<td></td>
</tr>
</tbody>
</table>

Conclusion
Write a conclusion about the types of foods that contain starch, using the observations recorded in the table.
Check what you learnt

1. Explain in your own words how the process of photosynthesis takes place. (4)
2. Draw a labelled diagram to illustrate the explanation in question 1. Give the diagram a suitable heading. (6) [10]

Extra practice

1. Name the process that plants use to make their own food.
2. In what form is food made during photosynthesis?
3. In what form is food stored in plants?
4. Where in plants is the food stored?
5. Name the gas that plants release during photosynthesis.
6. Which gas do animals and humans breathe out that plants need for photosynthesis?
7. What would happen to the oxygen in the air if there were no plants?
8. Name the indicator used to test for the presence of starch.
9. Suggest four foods that will turn blue-black in colour when a drop of iodine is placed on them.
Plants make their own food through the process of photosynthesis. Plants use sunlight energy, carbon dioxide and water to make glucose sugar.

Animals inhale oxygen and exhale carbon dioxide. Iodine is an indicator used to test for starch.

Plants take in carbon dioxide and give off oxygen. Starch is stored in leaves, stems, flowers, fruits and seeds. Glucose sugar is changed into starch when it is stored.
What you will learn about in this topic

- Food groups
- Natural foods and processed foods

Let’s talk about nutrients in food

Look at the picture showing different groups of food. Name some of the foods in the picture. Which of the foods do you eat regularly? Which other foods do you eat regularly that are not shown in the picture? Why is it important to eat healthy food?
Unit 1 Nutrients in food

What you know already

Plants use the energy from the sun to make their own food by a process called photosynthesis. Plants make food in the form of glucose sugar. Plants store food as starch. All animals and humans depend on plants as their primary source of food. Animals and humans get energy from food to carry out the life processes. Food is a fuel.

1. Why do we need to eat food?
2. Where does the energy in food come from?
3. In what form is food produced in plants?
4. In what form is food stored in plants?
5. In what parts of the plant is food stored?

Lesson 1
Food groups

The human body needs energy and nutrients to grow and stay healthy. Food provides the human body with the energy and nutrients it needs. Nutrients are the substances found in food that are important for growth and healthy bodies. Food is usually made up of more than one type of nutrient. Each nutrient has a specific function in the body to keep it healthy. The energy that is supplied by food is used for life processes such as breathing, moving and growing as well as reproducing. Food also gives humans energy to work, think and exercise.

What you eat is called your diet. Your diet includes all the food that you eat and liquids that you drink. You will learn more about healthy diets in Topic 3 (Nutrition).

Word bank

- **diet**: the food and liquids that you consume every day
- **nutrients**: the substances in food that help you grow and keep you healthy
Food can be grouped according to the main nutrients the food contains and their functions in the body. The **food groups** are:

- carbohydrates for energy
- proteins for growth and repair
- oils and fats for storing energy in the form of body fat, and providing **insulation** and protection for nerves and organs
- vitamins and minerals for strong bones and teeth and protection against infections and disease.

**Foods for energy: Carbohydrates**

Carbohydrates are the nutrients made by plants during photosynthesis, such as glucose sugar and starch. Sugars are found in jam, honey, fruit, sweets, cakes and biscuits. Starches are found in potatoes, rice, bread, cakes, mealie meal and pasta.

When you eat food containing carbohydrates, the carbohydrates are broken down in the body. This process releases energy, which your body uses to perform life processes. Carbohydrates are the body’s main source of energy.

*Figure 2.1 Examples of foods that contain carbohydrates*
**Foods for growth and repair: Proteins**

When you eat proteins, they are broken down in your body. Proteins are the building blocks of the body. Proteins are needed for growth. Proteins are also important for repair of the body. For example, when you injure yourself, proteins help to repair the wound.

There are two types of proteins: animal proteins and plant proteins. Proteins from animals are found in meat, chicken, eggs, fish, milk and cheese. Proteins from plants are found in beans, peas, wheat, soya beans and nuts.

![Figure 2.2 Examples of foods that contain protein](image)

**Foods for storing energy and providing insulation and protection: Fats and oils**

Fats and oils are found in foods such as margarine, cooking oil, butter and nuts. Fats and oils are stored in the body in the form of body fat. Body fat helps to insulate the body against cold. Body fat also protects the nerves and organs.

Fats and oils are energy-rich nutrients. The energy content of fats and oils is more than that of carbohydrates. Fats are, however, not the main energy source for the body because they are not
easily broken down in the body. This means that energy from fats is not readily available to the body.

**Figure 2.3 Examples of foods that contain fats and oils**

**Foods for health: Vitamins and minerals**

Vitamins and minerals are nutrients that help build strong bones and healthy teeth. Strong bones do not break easily and healthy teeth do not **decay**. Vitamins and minerals also play an important role in keeping the **immune system** healthy. A healthy immune system protects the body from infection and **disease**, so that you do not get ill easily.

**Word bank**

- **decay**: to break down or rot
- **disease**: an unhealthy condition in the body caused by an infection or an unhealthy diet
- **immune system**: the system in the body that fights infections and disease

**Figure 2.4 Examples of foods that contain vitamins and minerals**
Vitamins are made by plants. We need specific vitamins for specific functions in the body. Vitamins are named according to the letters of the alphabet. For example, vitamin A, B, C, D, E and K. Vitamin C plays an important role in keeping the immune system healthy and therefore preventing illness. Most vitamins and minerals are found in fresh fruit and vegetables.

Minerals are absorbed from the soil by plants. Calcium, sodium and iron are examples of minerals. Calcium is an important mineral to have in the diet because it is involved in building healthy bones and teeth. It is found in vegetables such as broccoli and dairy products such as milk, yoghurt and cheese. Sodium is a mineral that is found in salt. It is important to have just the right amount of sodium in the diet. If there is too much salt in the diet, it can cause health problems. Iron is an important mineral that is found in red meat. Iron is important for healthy blood.

People who do not get enough vitamins and minerals from their diet often have to take vitamin supplements.

**Classroom activity 1**

1. Sort the list of foods into the four different food groups. The first one has been done as an example. Some foods may fit into more than one group.

   - bread; fish; beans; tomatoes; chips; broccoli; nuts; carrots; milk; bananas; meat; sweets; strawberries; cheese; rice; mealie meal; sugar; pasta; chicken breast; butter; cabbage; eggs; apples; spinach; seeds
2. The diagrams of beans, milk, eggs and meat in Figure 2.5 shows the relative amount of nutrients found in each food. This means it shows the amount of the nutrient as a fraction of the whole food. Study Figure 2.5 and answer the questions that follow.

<table>
<thead>
<tr>
<th>Carbohydrates</th>
<th>Proteins</th>
<th>Oils and fats</th>
<th>Vitamins and minerals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bread</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Figure 2.5 The nutrient content of various foods*
Lesson 2
Natural foods and processed foods

When you walk through a grocery store you will see many foods in packages, boxes, bottles or tins. Some foods, however, look just the way you would find them on a farm. Packaged foods are usually processed foods. Foods that look the way they are found on a farm are natural foods.

Natural foods

Natural foods are raw and mainly unchanged. The food is in the same condition it was in when the farmer harvested the crop. Most natural foods contain more than one nutrient group. For example, fresh milk contains carbohydrates, fat, proteins and vitamins and minerals such as calcium. Natural foods contain only nutrients that are naturally found in the food. No other nutrients or substances have been added into the food. A diet
that is made up of a variety of natural foods will give the body all the nutrients needed for growth and a healthy immune system.

Figure 2.6 Natural foods are healthy.

**Processed food**
Sometimes food is processed or manufactured. Processed foods are not raw and have been changed in some way from the natural product. Food processing changes foods in some way to make them look more attractive, last longer or be more convenient to cook and eat.

Various processing methods such as salting, cooking, canning, baking and drying usually make the food last longer, taste better or look more attractive. You will learn more about food processing in Topic 4 (Food processing).

Processed foods sometimes have **additives** including salt, sugar, **preservatives**, **flavourings** and **colourants**. These added substances are not always good for the body, but the food looks and tastes good while staying fresher for longer.
Manufacturers of processed foods have to inform the consumer of exactly what is in the food, so that the consumer knows what is being bought. The law states that the labels on food packaging must have information on what nutrients the food contains and what additives have been added. The label should also say if there are any allergens in the processed food. The consumer needs to know what has been done to the food before buying it.

A food label, such as the one in Figure 2.8, gives the nutritional information per serving of food or per 100 g of food. A serving is an estimate of how much of the food a person should eat at one time. Some nutrients are measured in small units such as milligrams (mg) and grams (g).

The nutritional information on a food label should list at least the following information:
- the energy content of the food, measured in kilojoules (kJ)
• the ingredients used to make the food
• the amounts of the main nutrients the food contains
• any additives that the food contains
• any possible allergens.

Food labels give important information to the consumer. Food labels help people to make healthy food choices and plan healthy, balanced diets. They also help prevent people with allergies from eating something that could cause an allergic reaction.

<table>
<thead>
<tr>
<th>Favourite Bran Breakfast cereal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ingredients</strong></td>
</tr>
<tr>
<td>Wheat (whole wheat, gluten), Sugar, Malt extract, Salt, Vitamin A, Vitamin C, Vitamin B&lt;sub&gt;1&lt;/sub&gt;, Vitamin B&lt;sub&gt;6&lt;/sub&gt;, Fibre</td>
</tr>
<tr>
<td><strong>Allergens</strong></td>
</tr>
<tr>
<td>Wheat (gluten)</td>
</tr>
</tbody>
</table>

**Typical nutritional information**
Serving size: 40 g = 250 ml = 1 cup
Number of servings per pack: 12

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Per 100 g</th>
<th>Per 40 g serving</th>
<th>% NRV* Per 40 g serving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>1 146 kJ</td>
<td>458 kJ</td>
<td></td>
</tr>
<tr>
<td>Protein</td>
<td>11,0 g</td>
<td>4,5 g</td>
<td>8%</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugar</td>
<td>11,0 g</td>
<td>4,0 g</td>
<td></td>
</tr>
<tr>
<td>Starch</td>
<td>40,0 g</td>
<td>16,0 g</td>
<td></td>
</tr>
<tr>
<td>Fat</td>
<td>2,5 g</td>
<td>1,0 g</td>
<td></td>
</tr>
<tr>
<td>Dietary fibre</td>
<td>18,0 g</td>
<td>7,0 g</td>
<td>25 – 30 g per day</td>
</tr>
<tr>
<td>Sodium</td>
<td>705 mg</td>
<td>202 mg</td>
<td></td>
</tr>
</tbody>
</table>

**Vitamins**

- Vitamin A: 450,0 mg → 180,0 mg → 20%
- Vitamin C: 50,0 mg → 20,0 mg → 20%
- Vitamin B<sub>1</sub>: 0,6 mg → 0,2 mg → 20%
- Vitamin B<sub>6</sub>: 0,7 mg → 0,3 mg → 20%

**Minerals**

- Iron: 9,0 mg → 3,6 mg → 20%

*Nutrient Reference Values (NRV)*

*Figure 2.8 Food label of processed food*
Classroom activity 2

Use the examples of nutritional information found on food packaging shown in Figure 2.9 to answer the questions.

Food A

<table>
<thead>
<tr>
<th>NUTRITIONAL INFORMATION</th>
<th>Per 100 g (Dry product)</th>
<th>Per 100 ml serving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical values</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy</td>
<td>1 367 kJ</td>
<td>246 kJ</td>
</tr>
<tr>
<td>Protein</td>
<td>5,61 g</td>
<td>1,01 g (1,8%)</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>73,9 g</td>
<td>13,3 g</td>
</tr>
<tr>
<td>Total fat</td>
<td>2,42 g</td>
<td>0,44 g</td>
</tr>
<tr>
<td>Total dietary fibre</td>
<td>0,27 g</td>
<td>0,05 g</td>
</tr>
<tr>
<td>Sodium</td>
<td>4 950 mg</td>
<td>891 mg</td>
</tr>
</tbody>
</table>

Food B

<table>
<thead>
<tr>
<th>NUTRITIONAL INFORMATION</th>
<th>Per 100 g (as packed)</th>
<th>Per 4 g serving (as packed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical values</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy</td>
<td>1 612 kJ</td>
<td>65 kJ</td>
</tr>
<tr>
<td>Protein</td>
<td>0 g</td>
<td>0 g</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>99,5 g</td>
<td>4 g</td>
</tr>
<tr>
<td>of which sugar</td>
<td>99,5 g</td>
<td>4 g</td>
</tr>
<tr>
<td>Total fat</td>
<td>0 g</td>
<td>0 g</td>
</tr>
<tr>
<td>saturated fat</td>
<td>0 g</td>
<td>0 g</td>
</tr>
<tr>
<td>trans fat</td>
<td>0 g</td>
<td>0 g</td>
</tr>
<tr>
<td>monounsaturated fat</td>
<td>0 g</td>
<td>0 g</td>
</tr>
<tr>
<td>polyunsaturated fat</td>
<td>0 g</td>
<td>0 g</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>0 mg</td>
<td>0 mg</td>
</tr>
<tr>
<td>Total dietary fibre</td>
<td>0 g</td>
<td>0 g</td>
</tr>
<tr>
<td>Sodium</td>
<td>1 mg</td>
<td>0,04 mg</td>
</tr>
</tbody>
</table>

**Figure 2.9**  Nutritional information can be used to make healthy food choices.

1. What amount is in a serving of:
   a) Food A?
   b) Food B?

2. Which food contains the most carbohydrates per 100 g?

3. a) Which food contains the most fat per 100 g?
   b) How much fat does it contain per serving?
4. Which food contains the most energy (kJ) per serving?
5. Sodium is a mineral found in table salt. Generally it is not good for your health to eat a lot of sodium. Which of the two foods (A or B) contains the most sodium?
6. What is listed in the nutritional information label for food B that is not listed on the label of food A?

Challenge
Bring food packaging with nutritional information labels to class.
a) Group the food packaging according to the main nutrients found in the food as shown on the labels.
b) Make a list of all the kinds of additives found in these processed foods.
c) Draw a bar graph to show how many products have additives.
d) On some of the packaging you may find ‘% NRV’. What does this mean?

Check what you learnt
The following table shows different foods.
a) Draw a table with three columns: carbohydrates, proteins, and fats and oils. Sort the foods into the appropriate nutrient groups.
b) Put a star next to each food that you think contains a good supply of vitamins and minerals.

<table>
<thead>
<tr>
<th>Nuts</th>
<th>Butter</th>
<th>Beef</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>Oats</td>
<td>Tomatoes</td>
</tr>
<tr>
<td>Olive oil</td>
<td>Cheese</td>
<td>Macaroni</td>
</tr>
<tr>
<td>Pork chops</td>
<td>Turkey</td>
<td>Potatoes</td>
</tr>
<tr>
<td>Sunflower oil</td>
<td>Ice cream</td>
<td>Plums</td>
</tr>
</tbody>
</table>
## Asparagus Custard Oranges
Cabbage Fat free milk Duck
Lentils Carrots Chicken
Barley Broccoli Haddock
Maize Pineapple Hake
Canola oil Apples Peaches
Rice Cake flour Salmon
Margarine Peanut butter Tuna
Couscous Anchovy paste Sunflower seeds
Fresh milk Onions Baked beans
Yoghurt Bread Spaghetti

### Extra practice
1. a) List the four nutrient groups.
   b) Give a food example of each nutrient group.
   c) Give the function of each nutrient group in the body.
2. Describe the difference between natural and processed foods.
3. Most cans or packets of food have a label that tells you how much protein, carbohydrate, fat and vitamins there are in 100 g of the food. Which foods are made up of mostly carbohydrates?
4. Look at the labels for the chicken mayonnaise in Figure 2.10 and rice crackers in Figure 2.11.
   a) Which food contains the most protein?
   b) Which food contains the most carbohydrate?
   c) The foods have similar amounts of sodium per serving. What is sodium?
Typical nutritional information
Single serving = 75 g

<table>
<thead>
<tr>
<th></th>
<th>Per 100 g</th>
<th>Per single serving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein (g)</td>
<td>15,0</td>
<td>11,3</td>
</tr>
<tr>
<td>Carbohydrate (g)</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Total fat (g)</td>
<td>14,0</td>
<td>10,5</td>
</tr>
<tr>
<td>Dietary fibre (g)</td>
<td>0,0</td>
<td>0,0</td>
</tr>
<tr>
<td>Total sodium (mg)</td>
<td>419</td>
<td>314,3</td>
</tr>
</tbody>
</table>

Nutritional information as packed.

Figure 2.10 Nutritional information for ready-made chicken mayonnaise

NUTRITIONAL INFORMATION
Single serving = 75 g

<table>
<thead>
<tr>
<th></th>
<th>Per serving</th>
<th>Per 100 g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>418 kJ</td>
<td>1 670 kJ</td>
</tr>
<tr>
<td>Protein</td>
<td>1,7 g</td>
<td>6,8 g</td>
</tr>
<tr>
<td>Total fat</td>
<td>1,1 g</td>
<td>4,2 g</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>20,6 g</td>
<td>82,5 g</td>
</tr>
<tr>
<td>Sugars</td>
<td>Less than 1 g</td>
<td>2,9 g</td>
</tr>
<tr>
<td>Sodium</td>
<td>308 mg</td>
<td>1 230 mg</td>
</tr>
</tbody>
</table>

Figure 2.11 Nutritional information for rice crackers

5. Peter found some foods in his kitchen. Using information in the labels, he sorted them into two groups: fats and proteins.

Fats: butter; margarine

Proteins: cheese; corned beef; peanuts; sardines; sausages
a) Peter’s teacher says he could put the foods cheese, corned beef, peanuts, sardines and sausages in the space where the two circles overlap. Why would she say that?

b) Which of the foods contain mostly fats?

c) Which of the foods will help Peter to grow?

Summary

- There are four nutrient groups in food:
  - carbohydrates
  - proteins
  - fats and oil
  - vitamins and minerals.
- Carbohydrates provide energy. Carbohydrates can be found in foods such as bread, sugar, mealie meal, potatoes, rice and pasta.
- Proteins are important for growth and repair. Foods such as eggs, beans, meat, fish and cheese contain protein.
- Fats and oils are essential for insulation and stored energy. Margarine, butter and cooking oil contain fats and oil.
- Vitamins and minerals are important for building bones and teeth and a healthy immune system. Milk, fruit and vegetables have vitamins and minerals.
- Foods can be natural foods or processed foods.
- Food labels give nutritional information about processed foods.
What you will learn about in this topic

- Balanced diets

Let’s talk about nutrition

Look at the picture of the family having a meal. What type of food are they eating? Which foods on the table are natural? Which foods are processed? Are they eating a healthy meal? Explain your answer.
Unit 1 Balanced diets

What you know already

Foods are grouped according to the nutrients they contain and the function of the nutrients in the body. Carbohydrates are nutrients that supply energy. Proteins are used for growth and repair. Fats and oils are used to store energy, insulate our bodies and protect our nerves and organs. Vitamins and minerals are important for building bones and teeth and keeping the immune system healthy. Processed food is manufactured food that has been changed in some way. Natural foods are raw foods that have not had anything added and have not been changed in any way.

Check myself

1. Summarise the four food groups in a suitable table. For each food group, give an example of a food from the group and list the function of each nutrient group.
2. What are processed foods? Give an example.
3. What are natural foods? Give an example.

Lesson 1
A balanced diet

No single food contains all the nutrients the body needs to remain healthy and strong. To get all the nutrients the body needs, people need to eat many different foods from different nutrient groups. A diet refers to the selection of foods that is eaten every day. A balanced diet contains sufficient quantities of a variety of food from all four nutrient groups, as well as water and fibre.

A balanced diet has the right nutrients in the right amounts to keep your body healthy.
A balanced diet must contain:
- carbohydrates for energy
- proteins for growth and repair
- fats and oils for insulation, protection of nerves and organs, and for stored energy
- vitamins and minerals for building bones and teeth and keeping the immune system healthy
- water
- fibre.

A balanced diet should include water and fibre. Fibre is not a nutrient because it cannot be broken down in the body, but it is a necessary part of a balanced diet. We get fibre from plant foods, for example fruit, vegetables and grains. Fibre is roughage that helps the digestive system to process food and absorb vitamins and minerals. Together with water, fibre cleans out the digestive system and ensures that the bowel is healthy, preventing constipation. We need water in our diets because many processes in the body need water, including the removal of waste products from the body. The body gets water from food such as fruit and vegetables, but this alone is not enough. People need to drink about six glasses of water per day, and more when physical exercise is being done.

If a diet is not balanced, the body may have too little or too much of a specific nutrient. A diet that is made up of mainly processed foods is not healthy. Much of the nutritional value of processed foods is lost during manufacture. It is important to include as much fresh fruit and vegetables in the diet as possible. A diet that is based on fizzy cooldrinks, sweets, cakes and fatty foods can lead to health and weight problems.

**Planning a balanced diet**

Figure 3.1 is an example of a food pyramid. A food pyramid gives some guidance on what a balanced diet should be.
The food pyramid is a diagram that shows the different foods that should be included in the diet. It also shows the relative amounts of each nutrient group that should be eaten daily.

Regular exercise is also an important part of a healthy lifestyle. Young people should do at least one hour of exercise every day. Doing a sport at school throughout the year, such as soccer or netball, will be enough exercise.

![Food pyramid diagram]

*Figure 3.1 Food pyramid*

It is recommended that for a healthy, balanced diet, the following should be eaten every day:
- one cup of grains
- two and a half cups of vegetables
- two cups of fruit
- three cups of milk
- half to one cup of meat and beans.

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32 • Topic 3 Nutrition
The food pyramid shows you how much of each food group should be eaten:

- Fruit and vegetables should take up the biggest part of any daily diet.
- Carbohydrates such as bread and grains should make up a smaller part of the daily diet. Sugar must be a very small part of the diet.
- Proteins can make up to a cup per day of the diet, especially for young people who are still growing.
- Dairy (milk and milk products) such as cheese and yoghurt are important in a young person’s diet as they contain calcium. Calcium is a mineral that is important in building strong bones and teeth.
- The oil and fats that are needed by the body should come from fish, nuts and vegetables. Fats that are found in meat, cooking oil and butter should be limited because they are not healthy.

**Classroom activity 1**

The information in the table shows the foods that two Grade 6 learners ate in one day. Answer the questions that follow.

<table>
<thead>
<tr>
<th>Learner A</th>
<th>Learner B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Breakfast</strong></td>
<td><strong>Breakfast</strong></td>
</tr>
<tr>
<td>1 banana</td>
<td>1 cup of coffee</td>
</tr>
<tr>
<td>1 bowl of mealie meal porridge</td>
<td>3 teaspoons milk and sugar</td>
</tr>
<tr>
<td>1 cup of milk</td>
<td>3 teaspoons sugar</td>
</tr>
<tr>
<td><strong>First break at school</strong></td>
<td><strong>First break at school</strong></td>
</tr>
<tr>
<td>1 sandwich of two slices whole-wheat bread with 1 teaspoon of peanut butter</td>
<td>1 packet of hot chips from the tuck shop</td>
</tr>
<tr>
<td>1 apple</td>
<td>1 fizzy cooldrink</td>
</tr>
<tr>
<td>1 glass of fruit juice</td>
<td></td>
</tr>
</tbody>
</table>
1. Does the diet of learner A include food from all four food groups?

2. Does the diet of learner B include enough vitamins and minerals? Explain your answer.

3. Is there enough fibre in the diet of learner B? Explain your answer.

4. a) Is there enough fibre in the diet of learner A?
   b) Which foods supply fibre to learner A?

5. Why is fibre needed in the diet?

6. a) Copy and complete the table to analyse the diets of learners A and B for this particular day. The learners’ breakfasts have been recorded as an example for you.

<table>
<thead>
<tr>
<th>Food groups</th>
<th>Foods learner A ate</th>
<th>Foods learner B ate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food for energy</td>
<td>Mealie meal</td>
<td>3 teaspoons sugar</td>
</tr>
<tr>
<td>Food for growth and repair</td>
<td>1 cup of milk</td>
<td>3 teaspoons milk</td>
</tr>
</tbody>
</table>
Lesson 2
Diet and disease

People need to eat healthy food in the correct amounts to grow and stay healthy. If one food group is missing from the diet over a long period of time it could cause disease. Eating too much food is also not healthy and can also lead to health problems. **Malnutrition** is a condition that develops from having an unbalanced diet.

**Tooth decay**

A diet with lots of sweets and fizzy cooldrinks can cause tooth decay. Sweets and fizzy cooldrinks contain a lot of sugar. Bacteria in your mouth feed on the sugars in your mouth and change the sugars into acid. The acid makes holes or **cavities** in your teeth. This is known as tooth decay.

---

**Word bank**

- **cavities**: holes in the teeth created by tooth decay
- **malnutrition**: poor nutrition caused by an unbalanced diet

---

**Figure 3.2 Teeth showing tooth decay**
Tooth decay can be prevented by:
- avoiding or cutting down on sugar and sticky sweets
- brushing your teeth in the morning and before going to bed
- going to the dentist as soon as possible if a tooth is sore
- going to the dentist once a year for a check-up.

**Obesity**

Obesity is a condition that leads to a person having too much body fat for someone of that age and height. An obese person is very overweight. One of the ways in which someone can become obese is by eating too much energy-rich foods without doing enough exercise. Eating large amounts of foods that contain carbohydrates and fat and oils, such as fried chips, cakes, sweets and fizzy drinks contribute to weight problems. These foods all fall into the category of processed foods. People who are obese often develop other health problems, for example back and heart problems and diabetes.

![Figure 3.3 An obese person eating unhealthy, processed food](image)

Obesity can be prevented by eating a balanced diet and doing regular exercise.

**Diabetes**

Diabetes is a disease that affects how the body uses glucose sugar. A healthy person has a certain amount of glucose sugar in the blood. People with diabetes have too much or too little glucose sugar in the blood. Diabetics need to test the amount of glucose in the blood regularly. A special measuring instrument is used to test the amount of glucose sugar in the blood (Figure 3.4). Some diabetics need injections every day to help their body
lower the amount of glucose sugar in the blood and to keep it at the normal amount. The treatment for diabetes can only be done with the help of a doctor or through a clinic. People with diabetes need to follow a special diet that takes into account the sugar content of foods.

You can prevent some forms of diabetes by:
- eating a balanced diet
- losing weight if you are overweight or obese
- exercising regularly.

Deficiency diseases

Deficiency diseases related to diet can be divided into two groups:
- diseases caused by not taking in enough proteins and carbohydrates
- diseases caused by not taking in enough vitamins and minerals

Kwashiorkor is a deficiency disease that is caused by not taking in enough protein. Kwashiorkor occurs in areas of famine or poor food supply. The diets of people who develop this deficiency are made up mostly of other food groups, such as carbohydrates. Children suffering from kwashiorkor have stunted growth and have a swollen belly, large head and very thin arms and legs. Taking in enough protein will prevent and treat kwashiorkor.

Rickets is a deficiency disease that is caused by not taking in enough vitamins and minerals. The bones of the skeleton become soft and painful because there is not enough vitamin D and calcium in the diet. The diet is not the only source of vitamin D. Vitamin D is also made in
the body when a person spends enough time in the sun. People with rickets have bowed legs and weak muscles. The disease can be treated by adding vitamin D and calcium to the diet, which helps the bones to grow and straighten.

![Bowed legs of a person with rickets](image)

**Figure 3.6 Bowed legs of a person with rickets**

---

**Classroom activity 2**

1. Rewrite the sentences. Fill in the missing words:
   
   All the food you eat is called your ________________.
   
   A ________________ diet contains sufficient quantities of food from all four ________________ groups, as well as ________________ and ________________.

2. Name the disease that a person can suffer from if they eat too much energy-rich food.

3. Name the deficiency disease that a person suffers from if they do not get enough vitamin D.

4. How can tooth decay be prevented?

5. Which diet-related disease would someone suffer from if the level of glucose sugar in their blood is too high?

**Challenge**

Find more information about diabetes or a deficiency disease. Make an information pamphlet about the disease explaining how to prevent the disease and how it can be treated.
Check what you learnt

Different people have different dietary needs. What activities people do, their age and their state of health change the types and amounts of food they need to live healthy lives. For example, a young child who is growing needs a different balanced diet from an adult athlete. Work out a menu for a balanced diet for one day for the young child and the female athlete shown in Figure 3.7. Use pictures to illustrate the menu.

Figure 3.7 Different people have different nutritional needs.
1. Look at the pictures of two boys who have different lifestyles. Then answer the questions that follow.

A.

B.

Figure 3.8 Different lifestyles

a) Name two diet-related diseases that person A can suffer from.

b) Person B eats a balanced diet. Explain what this means.

c) Which food groups does person A most likely eat too much of?

d) Give an example of a healthy lunch that person B will most likely eat.

e) Who do you think eats sweets and fizzy cooldrinks? Why do you think he makes unhealthy food choices?

f) What good advice can you give person A to start living a healthier life?

g) Which boy has the healthier lifestyle?
2. Dumisani has drawn a pie chart to show the amount of food he eats from different food groups (Figure 3.9). Make one suggestion that would make Dumisani’s diet more balanced.

Figure 3.9 Pie chart showing Dumisani’s diet

Summary

- A diet refers to all the different food we eat every day.
- A balanced diet contains enough food from all four food groups:
  - carbohydrates for energy
  - proteins for growth
  - fats and oils for insulation and protection of nerves and organs
  - vitamins and minerals for a healthy immune system
  - water
  - fibre.
- If one food group is missing from your diet over a long period of time it could cause a deficiency disease.
- Tooth decay, obesity, diabetes and deficiency diseases are examples of diseases that are diet related.
What you will learn about in this topic

- The need for processing food
- Methods for processing foods

Let’s talk about food processing

Look at the people in this photo. What are they doing? Do you ever prepare food? To prepare a meal, you might cut the food, mix different foods together, cook it, fry it or bake it. These are just some of the ways a person might change food. Are there other ways in which food can be prepared? What is the process called when food is changed from one form to another?
What you know already

We get energy from the food we eat. There are four main nutrient groups: carbohydrates, proteins, fats and oils, and vitamins and minerals. We need to eat the correct amount from each of these groups every day. This is called a balanced diet. Natural foods have not had anything added or been changed in any way. Processed (manufactured) food has additives added to it and has been changed in some way.

Look at the two plates of food in Figure 4.1. Answer the questions that follow:

Figure 4.1 Two different meals

1. Which of these meals would be a balanced meal? Explain your answer.
2. Which of these meals is unbalanced? Explain your answer.
3. On the plate with the balanced meal, identify which food:
   a) contains mostly protein
   b) will give the most vitamins and minerals
   c) is a carbohydrate
   d) has some fat.
4. Which of these meals has food with additives? List the foods on the plate with additives.
Lesson 1
The need for processing food
When something is processed it is changed from one form to another. In Grade 5 you learnt that we can process wood to make furniture, grass to make baskets, clay to make pots and fabric to make clothes. Food can also be processed.

People process food all the time. In our homes and in restaurants, food is chopped, beaten, mixed, mashed, dried and cooked. These actions change the form of the food. We say it has been processed.

Food provides people with the energy needed to live and maintain healthy bodies. Eating and processing food is a part of our daily lives. We process food for different reasons such as to make it edible, to make it last longer and to improve the nutrient value of the food.

Food is processed to make it edible: preparing and cooking
We usually prepare and cook food to make it edible. Vegetables are prepared by cutting off the parts that cannot be eaten, for example the leaves of carrots and the skin of pumpkin. Vegetables are then sliced or chopped into smaller pieces, washed and cooked.

Meat is prepared by cutting it into smaller pieces. Cooking meat and vegetables changes their taste and texture. Very often, salt, spices and sauces are added to food during cooking to make it tastier. Cooking also makes food softer and easier to chew.

Word bank
edible: can be eaten
nutrient value: how nutritional a food is

Figure 4.2 Food is prepared and cooked to make it more edible.
Food is processed to make it last longer: preserving

Fresh foods do not last long and go off quickly. **Micro-organisms** such as ‘bad’ bacteria and mould are responsible for making food rot. Food is **preserved** to make it last longer and more convenient to use. There are many different ways of preserving food. You will learn more about preserving food in Lesson 2 (Methods of processing food).

**Figure 4.3** This bread cannot be eaten because it has mould growing on it.

Preserving food is one way of preventing micro-organisms such as bacteria and mould from growing on or in our food.

**Food is processed to improve the nutrient value: fermenting and fortification**

**Fermenting** is the process when good micro-organisms such as bacteria and yeast are added to food to change it. Allowing food to ferment under controlled conditions makes some food more nutritious and easier to digest, so the nutrients are better preserved.
absorbed by the body. Most raw foods can be fermented, for example fruit, vegetables, dairy, grains and meats.

Depending on the process used, some foods and drinks produce alcohol during fermentation, for example when grape juice is fermented to make wine and sorghum is fermented to make beer. Other foods such as yoghurt, bread, cheese and sauerkraut do not produce alcohol during fermentation. Yoghurt is made from fermented milk and contains bacteria that are good for the digestive system.

Yeast is a micro-organism that is added to bread dough. The yeast gives off carbon dioxide gas, which forms bubbles in the dough and makes it rise. Traditionally bread was made with sourdough, a mixture of yeast and several types of bacteria. In this process the bacteria and yeasts would react with each other and dramatically increase the nutrient value of the bread.

Figure 4.4 Yeast and ‘good’ bacteria are used to ferment food.
Sometimes vitamins and minerals are added to a food to improve the nutrient value of the food. When vitamins and minerals are added the food is more nutritious than it was before. This is called food **fortification**. Most of the corn and rice breakfast cereals that are sold in supermarkets have been fortified. Other examples of fortified foods are bread, yoghurts, fruit drinks and baby formula.

_Figure 4.5 Foods such as maize meal are fortified in South Africa._

**Processing may cause food to lose some of its nutrient value**

Food processing may cause food to lose nutrients and so some of its nutrient value. Nutrients can be lost when food is frozen, dried, cooked and reheated. When food is cooked in water and the water is drained, nutrients are lost. This water, which is usually poured away, is full of nutrients that have been lost during cooking.

**Classroom activity 1**

1. Suggest three methods of food processing. Give reasons why food is processed using this method.
2. Why does cooking food make it easier to eat?
3. What causes food to go off or rot?
4. Suggest two processing methods that can increase a food’s nutrient value.
5. Identify three processing methods that decrease a food’s nutrient value.

Word bank

**fortification**: adding a nutrient deliberately to a food to increase its nutrient value
Challenge

a) Find out more about the history of processing food. When did humans start cooking, preserving and fermenting food? What were the reasons? Write a report. Illustrate the report with pictures.

b) Sometimes the government of a country may decide that certain foods need to be fortified with specific vitamins and minerals. Write a short report describing what foods are fortified in South Africa. List the vitamins and minerals added to these foods and bring the packaging of an example of the food to school.

Lesson 2

Methods of processing food

There are different ways to process food. Different cultures process food in different ways.

Chopping and combining food

Food is processed by chopping and cutting it up into smaller pieces. Mixing different foods together is another method of processing that is done to make the food tastier. This is called combining. Flour, eggs, milk and sugar are mixed together before being baked to make a cake. A fruit salad is a tasty snack that is made by chopping up different kinds of fruit and mixing them together. The nutrient content of the snack or meal is increased by mixing different foods together because the foods have different vitamins and minerals.

Word bank

combining: mixing together
Practical activity

**Combining foods**
Optional activity

**Aim**
To make a fruit salad

**You will need:**
- one fruit from each member of your group
- chopping boards
- knives
- wooden spoon
- a mixing bowl and serving bowls
- spoons

**Safety warning**
- Be careful with knives. Do not run around the class with a knife. Keep your fingers out of the way when cutting.
- Always wash your hands very well with soap and warm water before you start working with food. Afterwards, all the utensils need to be washed thoroughly.

**Method**
1. Wash your hands and the fruit.
2. Some fruit will need to have its skin removed. Your teacher can help you with this.
3. On the chopping board, use the knife carefully to chop the fruit into bite-size pieces.
4. Once the fruit is cut, place it into a big mixing bowl.
5. Use a wooden spoon and combine the fruit by stirring it.
6. Dish the fruit salad into the bowls and enjoy.
Questions
1. List the types of fruit included in the fruit salad.
2. Which nutrient groups does the fruit salad contain?
3. Explain why eating a fruit salad is more nutritious than eating a single fruit.
4. Do you think it is a good idea to add sugar and cream to a fruit salad? Give a reason for your answer.

Food processing methods that preserve food
Food is preserved to stop it from going off (rotting) and to make it last longer. There are different ways to preserve food.

Cooking and canning
During cooking and canning the food is cooked at a high temperature. The heat kills any micro-organisms that may be present. Once it is cooked, the hot food is placed into sterilised tin cans or glass bottles and sealed. Cooked food that has been sealed in an airtight container can stay edible for years. Many fruit and vegetables are cooked and canned. Sauces in bottles are also cooked before being placed in the bottle.

Freezing
Meat and vegetables can be frozen. During freezing the temperature of the food is dropped so low that micro-organisms in the food stop growing. The micro-organisms are still present because they cannot be killed during the freezing process. Food can be preserved for months in a freezer. However, food must be eaten soon after it has defrosted and it cannot be refrozen.

Drying
Drying is a common way of preserving some foods. Examples of dried food include rice, pasta, lentils, fruit, nuts and cereal. Drying is a method of removing moisture from food. This prevents the

Word bank
airtight: not allowing air to escape or pass through
defrost: to thaw something that is frozen
moisture: water or other liquid
sealed: closed so that it does not leak
sterilised: treated to be free from bacteria or micro-organisms
micro-organisms from growing because they do not have any water. When food is dried it becomes lighter and **compact**. Biltong is a popular South African snack. Biltong is dried meat, usually beef or game. Biltong is lighter than raw meat and lasts longer. Most fruits can be dried.

![Figure 4.7 Dried food can stay preserved for a long time.](image)

**Pickling**

Pickling is the process where some foods, usually vegetables, are soaked in vinegar and then bottled in a sealed, airtight container. The vinegar is an acid and acids stop micro-organisms from growing, in this way preserving the food. Onions and gherkins are popular pickled foods.

**Preserving with sugar or salt**

Micro-organisms cannot survive in high amounts of sugar or salt. When making biltong the meat is dried, but also salted. People often preserve fruit by making jam or storing it in syrup. When making jam the fruit is boiled and a lot of sugar is added. The sugar and heat during boiling prevent the growth of micro-organisms. Vegetables in cans and bottles are often preserved in salty water called **brine**.

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**Word bank**

- **brine**: salty water used to preserve foods
- **compact**: fits into a smaller space
Fermenting
Fermenting is a method of preserving food. Fermenting can increase the nutrient value of a food. Fermenting is a process where ‘good’ micro-organisms are added to food. These micro-organisms change the food and their growth prevents harmful micro-organisms from growing. Examples of fermented food include yoghurt, bread and alcoholic drinks such as beer and wine.

Classroom activity 2

Research
Find out how one indigenous culture from any South African community preserves food or preserved food in the past. Write a report and do a presentation.

Your report should include:
• relevant pictures
• the name of the indigenous group of people
• where you find this group of people
• what food they preserve
• how they preserve it.

Read the information about the Nguni people of South Africa and how they preserved their grain in grain pits. You can use this information for your research.
The Nguni grain pit used for preserving grain

The Nguni people of South Africa had a good solution to the problem of storing and preserving grain. The Nguni’s sorghum or maize harvest would be threatened by rats, insects, fungi and mould if not stored or preserved well.

The mealies were left in the field to dry. The grain was stripped from the cobs and stored in a very deep grain pit. The pit was usually dug in the cattle kraal. The pit was lined with a mixture of cow dung and clay. The base of the pit was covered with small stones and clay. When the clay in the grain pit was dry it was filled with grain and covered with a lid of roots and sticks and sealed with cattle dung or clay. A heavy stone was placed to seal the lid onto the pit. The pit was left undisturbed until the grain was needed.

The grain that touched the edges of the pit against the damp clay fermented and gave off carbon dioxide. The carbon dioxide suffocated any pests such as insects or rats that could eat the grain. The grain in the pit was therefore protected.

When the grain was needed, the grain pit was opened and left open for some hours to let the carbon dioxide escape. Traditionally a child was let down into the pit to collect the grain. The grain was in almost perfect condition, except for the kernels that were touching the clay on the sides of the pit.

The Nguni tradition of storing grain in clay-lined grain pits is remarkably effective. Other African people used similar pits for grain storage.
Today we use grain silos where carbon dioxide gas is also used to preserve the contents. This is a good way to preserve grain as it does not need chemicals or other additives.

Figure 4.9 The Nguni stored their grain in a grain pit.

Other cultures and their preservation methods that you could research:
- Afrikaner: rusks, waatlemoenkonfyt or biltong
- Cape Malay: atchar
- South African Indian: curried chutney
- Zulu or Xhosa: amasi, umdoko (sour mealie meal pap)
- Sotho: dipadi

Classroom activity 3

1. Give an example of a food that is processed by chopping and combining.
2. List six food processing methods that preserve food. Give an example of a food that is processed in each way.

3. Why do containers for preserving food have to be sterilised and airtight?

**Challenge**
Deba has a bag of fresh vegetables that he wants to process so that he can eat them for supper over the next few days. Think of a meal he could make that would ensure he preserves the nutrients in the food without the risk of the vegetables rotting.

**Unit 2 Technology project: Design and make a healthy breakfast snack bar**

**What you know already**
Food is processed to make it edible and last longer and to improve the nutrient value.

1. List one way that food can be processed to make it edible.
2. List the four ways that food can be processed to make it last longer.
3. List two ways to improve the nutrient value of food.

In this unit you will complete a Technology project. For more information on how to do a Technology project see page ix-xiii.

Use the Technology process to help you solve the problem set out in the following case study. Along the way there will be
several help tasks to work through. Help tasks help you gain additional knowledge and skills that will be needed to complete the technology project.

**Lesson 1**

**Identify the design: A breakfast snack bar**

Read the case study. Identify what it is that needs to be designed and made.

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**Case study: Breakfast snack bars for your class**

Imagine that your school principal is concerned about the number of children who come to school without having had any breakfast. The children are hungry and unable to concentrate in class. The school board has decided to spend some money every term to make sure all the children are well fed before school begins each day. They have decided that each teacher should have food in their classroom for the children to eat before class starts each day.

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*Figure 4.10 Making a healthy breakfast snack bar*
This food would have to:
- be something already processed and prepared
- be easy to eat without utensils
- be able to last at least three weeks in a classroom without a fridge
- be tasty
- offer a balanced meal with maximum nutrient value.

**Identifying**

To understand the problem, identify the need set out in the case study and work out exactly what you need to design and make, it helps to ask these questions:
- What do I have to design and make?
- What is it for?
- Who will be using it?
- How will I process it?
- What safety precautions do I need to consider?
- What ingredients will I use?
- How will I preserve it?
- How will I make it tasty?
- Is there anything specific that needs to be included?

As you answer these questions you will be able to make a list of specifications and constraints. You can then use this list of specifications to develop a design brief as shown in Help task 1.

**Help task 1**

Developing a design brief

1. Make a list of all the specifications for the breakfast snack.
2. Make a list of any constraints placed on the design.
3. Write a design brief for the breakfast snack. Below is an example of a possible phrase to begin your design brief with. Rewrite the phrase and complete it by filling in the gaps.

‘Design and make a __________ that is ______________
____________________________________________________
____________________________________________________
____________________________________________________
____________________________________________________
____________________________________________________.’

Before you begin making your breakfast snack, work though the following help tasks. These tasks will give you the important skills needed to process food.

Lesson 2
Investigate a basic oats bar
You can consider different recipes for making a basic oats bar.

Investigating how to make a basic oats bar
A recipe is a written instruction that describes how to make a food dish using a list of specific ingredients. Various recipes on how to make a basic oats bar can be found in recipe books and on the internet. Recipes may differ slightly from each other. Complete Help tasks 2 and 3 to practise the skills you need to make an oats bar.

Help task 2
How to make a basic oats bar

Equipment you will need:
• a frying pan
• a pot
- a wooden spoon
- a flat dish
- wax wrap (optional)
- a dish towel
- pot holders
- measuring cups
- a sharp knife
- a chopping board
- plastic wrap (optional)
- something to cook on, such as a gas cooker, an electric two-plate stove, an electric frying pan or even a fire

**Ingredients you will need:**
- 3½ cups oats
- 2/3 cups brown sugar
- ½ cup honey
- 4 tablespoons butter
- 2 teaspoons vanilla essence
- ½ teaspoon salt

![Safety warning]

**Safety warning**
Cookers can be dangerous. Do not touch any part of the cooker or you could get burnt. Be extra careful with gas cookers: make sure they are turned off properly after use. A fire can be dangerous. Do not attempt to make a fire for cooking without the guidance and help of your teacher. Knives can also be dangerous; work safely.

**Method**
1. Dry roast the oats by placing them in a frying pan on a cooker at a low heat.
2. Keep stirring the oats until they brown slightly. Don’t burn them! Take them off the cooker and leave them somewhere safe.

3. In a separate pot, melt the butter, honey, vanilla essence and salt together and stir them until they are completely melted together.

4. Pour the roasted oats into a big mixing bowl and pour the melted honey mixture on top. Be careful: this mixture is hot! Mix well, until all the oats are sticky. Use a wooden spoon to mix the oats mixture.

5. Prepare the flat dish by lining it with wax paper rubbed with butter. (If you do not have wax paper, rub the inside of the dish with butter.)

6. Pour the sticky oats mixture into the flat dish on top of the wax paper. Using the back of the wooden spoon, smooth the mixture until it fills the dish from corner to corner.

7. Fold the extra wax wrap over the sticky oats mixture and place a dish towel on top. Use your hands and press down hard on the mixture all over.

8. Leave it to cool for 2–3 hours.