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# **Learning objectives**

After this section you will be able to:

- describe the components of a healthy diet and their functions in the body
- compare the nutritional content of different foods or diets
- describe the effects of deficiencies or excesses of different nutrients on a person's health.



If you eat a lot of beetroots your urine turns pink. Eating a lot of asparagus turns your urine bright yellow!



Carbohydrate-rich foods.



Fat-rich foods.

We all know that sweets should only be eaten as a treat and you have probably heard many times that you should eat a balanced diet. But what does this mean, and why is it important?

**Nutrients** are important substances that your body needs to survive and stay healthy. There are different types of nutrients. We get most of them from food. The types of nutrient are:

- 1 carbohydrates, which provide energy
- 2 lipids (fats and oils), which provide energy
- 3 proteins, which are used for growth and repair
- 4 vitamins, which keep you healthy
- 5 minerals, which keep you healthy
- 6 water, which is needed in all cells and body fluids
- 7 **dietary fibre**, which provides bulk to food to keep it moving through the gut. Fibre is not a nutrient but it is important for a healthy diet.

To remain healthy you must eat a **balanced diet**. This means eating food containing the right nutrients in the correct amounts.

**A** State what is meant by a nutrient.

# Carbohydrates

There are two types of carbohydrate:

- simple carbohydrates (sugars): these are found in foods such as sugar and fruit. They provide a quick source of energy.
- complex carbohydrates (starch): these are found in foods such as pasta and bread. They have to be broken down by the body, so the energy is released more slowly.
- **B** State the function of carbohydrates.

# Lipids

Lipids include fats and oils. They have three important jobs. They:

- provide you with a store of energy
- keep you warm, by providing a layer of insulation under your skin
- protect organs like your kidneys and heart from damage.

## **Proteins**

Proteins are needed to repair body tissues and to make new cells for growth. Your muscles, organs, and immune system are mostly made of proteins.

#### **C** State two functions of proteins.

### Vitamins and minerals

Vitamins and minerals are essential substances for keeping you healthy but you only need tiny amounts. Vitamins are needed for you to grow, develop, and function normally. For example, vitamin A is needed for good eyesight. Vitamin D is needed with the mineral calcium to maintain healthy teeth and bones. Iron is a mineral which is important for making red blood cells.

Fruits and vegetables are a good source of vitamins and minerals.

#### **D** State why the body needs calcium and iron.

#### Water

Your cells are made up of about 70% water. To keep them healthy you need to constantly replace the water your body loses in sweat, tears, urine, faeces, and exhaling. You should drink over a litre of water every day. This can come from drinking water but tea, fruit juice, and squash all count.

# **Dietary fibre**

Fibre is the parts of plants that the body cannot break down. It is an important part of your diet as it adds bulk to your food. This means it keeps food moving through the gut, and waste is pushed out of the body more easily, helping to prevent constipation.





# **Healthy eating**

Design and film a healthy-eating TV advert on behalf of the government. The advert should aim to encourage young people to eat a balanced diet.



#### A Protein-rich foods.

Link

1

You can learn more about balanced diets in 8.4.3 Unhealthy diet.

# Key Words

nutrient, carbohydrate, lipid, protein, vitamin, mineral, dietary fibre, balanced diet

# **Summary Questions**

Match the nutrient to its role in the body. (6 marks	
growth and repair	
needed in small amounts to keep you healthy	
provide energy	
provide bulk to food	
energy store and insulation	
needed in cells and bodily fluids	

- 2 A Describe the role of lipids in the body. (3 marks)
- **3** Suggest and explain the advice a doctor might give to a patient who has constipation. *(3 marks)*
- 4 A A Explain in detail what is meant by a balanced diet. Provide examples of what a balanced diet should contain. (6 marks)

• Topic 8.4 Digestion



# **Learning objectives**

After this section you will be able to:

- describe how to test foods for starch, lipids, sugar, and protein
- describe the positive result for each food test.



▲ This food solution contains starch.

# Key Words

food test, hypothesis

**Hypothesis** 



Scientists observe the world and come up with a **hypothesis** to explain what they observe. A hypothesis is an idea about things that always happen. A hypothesis can be tested in an investigation. You can use hypotheses to make a prediction. You may be able to guess by looking at some foods which nutrients they contain. For example, you may know that oily foods contain lipids. Scientists use food tests to find out which nutrients are in a food product.

# How can you test foods?

A different chemical test exists for each type of nutrient. For most **food tests**, you will need a solution of the food. To prepare a food solution:

- 1 crush the food using a pestle and mortar
- 2 add a few drops of water, and mix well.

You should use a special type of water called distilled water – this is pure water that contains no other chemical substances.

# How do you test for starch?

To test for starch you use iodine solution. lodine solution is an orange-yellow liquid.

- 1 Add a few drops of iodine solution to the food solution.
- 2 If the solution turns a dark blue-black colour, the food contains starch.
- A State the colour change in iodine if a food contains starch.

# How do you test for lipids?

To test for lipids in a solid piece of food you use a piece of filter paper.

- 1 Rub some of the food onto a piece of filter paper.
- 2 Hold the paper up to the light. If the paper has gone translucent, the food contains lipids.
- **B** State how you would test a solid piece of food for lipids.

To test for lipids in a food solution you use ethanol. Ethanol is a colourless liquid.

- 1 Add a few drops of ethanol to the food solution.
- 2 Shake the test tube and leave for one minute.
- **3** Pour the ethanol into a test tube of water.
- 4 If the solution turns cloudy, the food contains lipids.

## How do you test for sugar?

To test for simple sugars such as glucose you use Benedict's solution. Benedict's solution is a blue liquid.

- 1 Add a few drops of Benedict's solution to the food solution.
- 2 Heat the test tube in a water bath.
- 3 If the solution turns orange-red, the food contains sugar.
- **C** State the colour change in Benedict's solution if a food contains sugar.

# How do you test for protein?

To test for protein you use copper sulfate solution and sodium hydroxide solution. Copper sulfate solution is a pale-blue liquid. Sodium hydroxide solution is a colourless liquid.

- 1 Add a few drops of copper sulfate solution to your food solution.
- 2 Add a few drops of sodium hydroxide solution.
- 3 If the solution turns purple, the food contains protein.

**D** State the colour change in a solution of copper sulfate and sodium hydroxide if a food contains protein.



 This food solution contains protein.



 This food solution contains lipids.



This food solution contains sugar.

# **Summary Questions**

**1** A Complete the table using the words below.

turns blue-black

turns orange-red

makes paper translucent

turns purple

Nutrient	Colour change if nutrient present
starch	
lipids	
sugar	
protein	

(4 marks)

2 Describe how to prepare a food solution of a breakfast cereal. (3 marks)

**S A A** Explain in detail how you would test a gingerbread-biscuit solution for the presence of starch, sugar, and protein.

(6 marks)

# 8.4.3 Unhealthy diet

# **Learning objectives**

After this section you will be able to:

- recall how you get and use energy
- describe some health issues caused by an unbalanced diet
- calculate the energy requirements of different people.



This food pyramid shows a healthy balanced diet. The largest part of your diet should be carbohydrate based. Lipids, oils, and sweets should only be eaten in very small quantities.

# Link

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You can learn more about energy in food in Book 1, 3.1.1 Food and fuels.

# Key Words

malnourishment, starvation, obese, deficiency

You may have seen pictures of people who are either extremely overweight or underweight. Both of these conditions are caused by **malnourishment**. This means the people have eaten the wrong amount or the wrong types of food.

# Where does your energy come from?

You need energy for everything you do, even to sleep. This energy comes from your food. The energy in food is measured in joules (J) or kilojoules (kJ) – 1 kilojoule is the same as 1000 joules.

If you look on a food label it will tell you how much energy is stored in that food.

### A State the unit that energy in food is measured in.

# Why is it unhealthy to be underweight?

Some people do not eat enough food. In extreme cases this is known as **starvation**. If the energy in the food you eat is less than the energy you use, you will lose body mass. This leads to you being underweight. Underweight people:

- often suffer from health problems, such as a poor immune system
- lack energy to do things, and are often tired
- are likely to suffer from a lack of vitamins or minerals.

**B** State three problems caused by being underweight.

# Why is it unhealthy to be overweight?

Some people eat too much, or eat too many fatty foods. If the energy content in the food you eat is more than the energy you use, you gain body mass. This is stored as fat under the skin. If a person becomes extremely overweight, they are said to be

#### obese.

Overweight people have an increased risk of:

- heart disease
- stroke
- diabetes
- some cancers.

**c** State three diseases that obese people are more likely to suffer from.

# What are vitamin and mineral deficiencies?

If a person does not have enough of a certain vitamin or mineral they are said to have a **deficiency**. This can damage a person's health. For example, a vitamin A deficiency can lead to 'night blindness'. This makes it difficult for you to see clearly in dim light. A vitamin D deficiency can lead to a condition called rickets, where your bones become weak.

#### **D** Name the condition caused by a vitamin A deficiency.

### How much energy do you need?

Your body needs energy to function properly. The amount of energy you need depends on your age (as this affects your growth rate), your body size, and how active you are. The more exercise you do, the more energy your body requires.

#### **Energy requirements**

Use the graph below to estimate the energy that a female computer programmer needs each day. How did you arrive at your answer?



▲ Daily energy requirements for different types of people.



▲ This person is suffering from rickets.

# **Summary Questions**

- Copy and complete the sentences below.
  You gain the \_\_\_\_\_ you need to survive from food. Energy is measured in \_\_\_\_\_.
  If you take in more energy than you use you \_\_\_\_\_ body mass. If you become \_\_\_\_\_ your risk of \_\_\_\_\_\_ disease increases. An underweight person is often \_\_\_\_\_.
- 2 A Use the graph on this page to answer the following questions.
  - a Calculate the extra energy a female office worker would need each day if she became pregnant. (2 marks)
  - **b** A male office worker starts a new job as a construction worker. Calculate the percentage increase in his daily energy needs. (4 marks)
- 3 🗟 🗟 🗟 Compare the health problems of being underweight with the health problems of being overweight.

(6 marks)

# **8.4.4 Digestive system**

# **Learning objectives**

After this section you will be able to:

- state what happens during digestion
- describe the structure of the main parts of the digestive system
- describe how components of the digestive system are adapted to their function.

You may sometimes notice your stomach rumbling. This is a hint that you need to eat. You know that the food contains nutrients. But how does your body get nutrients out of food?

# What is the digestive system?

The **digestive system** is a group of organs that work together to break down food. The nutrients in most of the food you eat are large molecules, like lipids and proteins. During **digestion** these large molecules are broken down into small molecules of nutrients. These nutrients can then pass into the blood where they are used by the body.



A State what happens during digestion.

Structures in the digestive system

 During digestion large molecules are broken down into small molecules and pass into the bloodstream.

# Link

You can learn more about molecules in 5.3.3 Compounds.

# **Fantastic fact**

If you unravelled your small intestine it would be roughly four times taller than you - it is not very small!





**B** Name the structure that food passes along to reach the stomach.

The diagram opposite shows the main structures in your digestive system. It is often referred to as your gut.

Mouth	Food is chewed and mixed with saliva. Teeth help to break the food into smaller chunks.
Gullet	Food passes down this tube.
Stomach	Food is mixed with digestive juices and acids.
Small intestine	Digestive juices from the liver and pancreas are added and digestion is completed. Small molecules of nutrients pass through the intestine wall into the bloodstream.
Large intestine	Only food that cannot be digested gets this far. Water passes back into the body, leaving a solid waste of undigested food called faeces.
Rectum	Faeces are stored here until they leave the body.
Anus	This is a muscular ring through which faeces pass out of the body.

# Moving through the digestive system

Fibre in your food isn't digested but adds bulk to the food. Muscles push against this, forcing food along the gut. Eating lots of fibre-rich foods such as vegetables and wholemeal bread helps prevent constipation.



Muscles in the wall of the gut squeeze food along – a bit like squeezing a tube of toothpaste.

# Key Words

digestive system, digestion, gullet, stomach, small intestine, large intestine, rectum, anus, villi

#### Wordbank

Make a wordbank by listing all the scientific terms about digestion. You can refer to your wordbank as you progress through this topic.

#### **C** Describe how food moves along the gut.

# Passing into the blood

The small molecules of nutrients produced during digestion pass into the bloodstream through the wall of the small intestine. They are then transported around the body.

The small intestine needs to absorb the nutrients quickly, before the undigested food passes out of the body. The small intestine is specially adapted to this function. The wall of the small intestine is thin. It is also covered with tiny structures called **villi**. These stick out of the wall and give it a big surface area. They also contain blood capillaries to carry away the absorbed food molecules.



Villi in the small intestine increase the surface area so more nutrients can be absorbed.

# **Summary Questions**

**1** A Match each organ below to its role in digestion.

stomach	food is chewed and mixed with saliva
small intestine	water is absorbed back into the body
large intestine	food is mixed with acid and digestive juices
rectum	faeces are stored here until they pass out of the body
mouth	small molecules of nutrients are absorbed into the bloodstream
	(Emarka

(5 marks)

**2** A Describe the adaptations of the small intestine to its function.

(3 marks)

3 🗟 🖄 Explain why it is important to eat a fibre-rich diet.

(3 marks)

4 Describe in detail the passage of food through the digestive system.

(6 marks)

# 8.4.5 Bacteria and enzymes in digestion

# **Learning objectives**

After this section you will be able to:

- describe the role of enzymes in digestion
- describe the role of bacteria in digestion
- describe all the events that take place in turning a meal into simple food molecules.



A Probiotic foods.

Have you seen the TV adverts that say that yoghurts and yoghurt drinks are good for your digestive system? They contain bacteria, which is important for digestion.

# **Bacteria in digestion**

Your large intestine contains bacteria. These microorganisms live on the fibre in your diet. They make important vitamins such as vitamin K. These vitamins are then absorbed into your body and help to keep you healthy. The **gut bacteria** also help to break food down.

Some foods, called probiotic foods, like live yoghurt, contain these useful bacteria.

# A State why bacteria are important in your digestive system.

# What's in digestive juices?

Your teeth begin digestion by breaking down food into smaller pieces. The digestive juices in your gut contain **enzymes**. These are special proteins that can break large molecules of nutrients into small molecules.

Large molecules in your food like starch, a type of carbohydrate, are made of lots of smaller molecules joined together. Enzymes chop these large molecules into the smaller molecules they are made from.

enzymes cut molecule here



Enzymes are known as biological **catalysts** – they speed up digestion without being used up.

# What's in a name?

The enzymes carbohydrase, protease, and lipase are named after the type of nutrient they break down.



# **Different types of enzyme**

Different types of enzyme break down different nutrients. There are three main types of enzymes involved in digestion – **carbohydrase**, **protease**, and **lipase**.

### Carbohydrase

Carbohydrase is an enzyme that breaks down carbohydrates into sugar molecules.



▲ Starch is broken down into sugar molecules.

Carbohydrates are digested in the mouth, stomach, and small intestine. Carbohydrase present in your saliva breaks down the starch in bread into sugar.

#### Protease

Protease is an enzyme that breaks down proteins into amino acids.



Protein is broken down into amino acids.

Proteins are digested in the stomach and small intestine. Acid in the stomach helps digestion and kills harmful microorganisms in food.

#### Lipase

Lipase is an enzyme that breaks down lipids into fatty acids and glycerol.

Digestion of lipids takes place in the small intestine. It is helped by **bile**, a substance made in the liver. Bile breaks the lipids into small droplets that are easier for the lipase enzymes to work on.



#### **C** State the function of bile.

## What happens to the bread you eat?



Describe the journey bread takes through your body and how it is digested. Present its journey as a flow diagram. Hint – bread contains a lot of starch.

# Key Words

gut bacteria, enzyme, catalyst, carbohydrase, protease, lipase, bile

# **Summary Questions**

**1** Copy the sentences below, choosing the correct bold word.

Carbohydrates/proteins are broken down into sugar by the enzyme lipase/carbohydrase. Proteins are broken down into amino acids/lipase by the enzyme carbohydrase/protease. Lipids are broken down into lipase/ fatty acids and glycerol by the enzyme lipase/carbohydrase.

#### (6 marks)

2 A Explain why live yoghurt should be part of your diet.

#### (3 marks)

3 A A Make a visual summary of the ideas on this page to compare the roles of enzymes and bacteria in digestion.

(6 marks)

# **8 Organisms: Summary**

# **Key Points**

#### Breathing

- Gas exchange takes place inside the lungs oxygen is taken in and carbon dioxide is given out.
- Oxygen enters the body through the mouth and nose. It then travels down the windpipe, through a bronchus, then a bronchiole, into an alveolus, and diffuses into the blood.
- Exhaled air is warmer and contains more carbon dioxide and water vapour than inhaled air, but less oxygen.
- When you inhale, muscles between your ribs and the diaphragm contract. This increases the volume inside your chest. The pressure decreases and air is drawn into the lungs.
- When you exhale, muscles between your ribs and the diaphragm relax. This decreases the volume inside your chest. The pressure increases and air is forced out of your lungs.

#### Digestion

- Nutrients are essential substances that your body needs to survive. They are carbohydrates, lipids, proteins, vitamins, mineral, water, and fibre.
- To remain healthy you must eat a balanced diet. This means eating food containing the right nutrients in the correct amounts.
- Underweight people often lack energy. They may also suffer from a vitamin or mineral deficiency, which can cause problems like a poor immune system.
- Overweight people have an increased risk of heart disease, diabetes, and some cancers.
- During digestion large molecules like lipids and proteins are broken down into small molecules. They can then pass into the blood where they are used by the body.
- Enzymes are proteins that can break large molecules into small molecules. They are biological catalysts - they speed up digestion without being used up.

# BIG Write

#### Say no to drugs

You work for the NHS as a communications officer. You have been asked to produce an antidrugs leaflet. It will be given to all teenagers as part of an antidrugs campaign.

#### Task

Write the text that will appear in the leaflet. It should contain information on smoking, alcohol, and illegal recreational drugs.

# Tips

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- Make sure your points are clear, concise, and convincing back up your arguments with scientific facts.
- Keep your audience in mind your leaflet needs to appeal to teenagers and all scientific concepts must be explained clearly.

# Key Words

gas exchange, lungs, ribs, respiratory system, trachea, bronchus, bronchiole, alveolus, breathing, inhale, respiration, exhale, condense, contract, diaphragm, lung volume, asthma, drug, medicinal drug, recreational drug, addiction, withdrawal symptoms, ethanol, depressant, alcoholic, unit of alcohol, passive smoking, stimulant, nutrient, carbohydrate, lipid, protein, vitamin, mineral, dietary fibre, balanced diet, food test, hypothesis, malnourishment, starvation, obese, deficiency, digestive system, digestion, gullet, stomach, small intestine, large intestine, rectum, anus, villi, gut bacteria, enzyme, catalyst, carbohydrase, protease, lipase, bile

# **End-of-Big Idea questions**

1 To remain healthy you must eat a balanced diet. Draw a line to match the nutrient to its function in the body.

carbohydrates	used for growth and
	repair
lipids	needed in small amounts
	to keep you healthy
proteins	provide energy
vitamins and	provide a store of energy
minerals	and are used to insulate
	the body

#### (4 marks)



- Y V V
- a Name structure X. (1 mark)
- **b** State what happens in structure Y. (1 mark)
- **c** Which letter represents the structure that stores faeces until they leaves the body? *(1 mark)*
- **d** Describe the role of the stomach in digestion. (2 marks)

(5 marks)

- **3** A student wants to do a food test to find out which nutrients are in crisps. She starts by making a solution of the crisps.
  - a Name the piece of equipment she should use to break the crisps into small pieces.

(1 mark)

b Suggest two safety precautions the student should take before beginning the test. (2 marks)

**c** Describe how the student should test the food solution for protein. *(3 marks)* 

(6 marks)

4 🗟 🗟 This diagram shows the main structures in the respiratory system.



**a** Name the bones that protect the lungs.

(1 mark)

- Name the process that occurs in the alveolus. (1 mark)
- **c** State what the diaphragm is made of.

(1 mark)

**d** Describe what happens in the lungs when you exhale. (3 marks)

#### (6 marks)

- **5 A A** Enzymes are special proteins that play a crucial rule in digestion.
  - **a** Describe the role of enzymes in digestion. (1 mark)
  - **b** Explain why enzymes are called catalysts. *(2 marks)*
  - c Compare how and where carbohydrates and proteins are digested. (4 marks)
  - **d** Explain how lipids are broken down and digested. (3 marks)

(**10** marks)

6 A A Compare the main differences in the composition of inhaled and exhaled air.

(6 marks)