Where this unit fits in
This unit builds on:
- ideas about food and nutrition developed in KS2 programme of study.
- unit 5A Keeping healthy and unit 7A Cells.

The concepts in this unit are:
- balanced diet, digestion, absorption and uses of food.

This unit leads onto:
- other units that focus on life processes in humans: unit 8B Respiration and unit 9B Fit and healthy, which revisits the concept of a healthy diet.

To make good progress, students starting this unit need to understand:
- food is needed for activity and growth
- an adequate varied diet is needed to maintain health
- matter, including food, consists of particles, e.g. molecules that can differ in size
- that food provides energy for the body.

Framework yearly teaching objectives - Cells
- Describe the role of the main nutrients in the body; explain why all cells need them and the importance of a balanced diet.
- Explain why some nutrients have to be broken down before the body can use them, and use models and analogies to describe how enzymes break down large molecules during digestion.
- Describe the digestive system using knowledge of enzymes to explain how it works, and the role of the circulation system in transporting the products of digestion to cells.

Framework yearly teaching objectives - Particles
- Use the simple particle model to explain movement of substances through cell membranes by assuming particles are of different sizes.

Expectations from the QCA Scheme of Work
At the end of this unit...
- ... most pupils will...
- ... some pupils will not have made so much progress and will ...
- ... some pupils will have progressed further and will ...

- use secondary sources of information to generate graphs or displays relevant to questions asked
- identify and control relevant variables when investigating the action of an enzyme
- choose secondary sources to provide the information needed about food and diet
- explain why interpretation of evidence about questions of health and diet may be difficult

- name nutrients, fibre and water as part of a balanced diet, identifying examples of foods in which they are found, and describe the role of the main nutrients in the body
- use a model to describe how large molecules are broken down during digestion and describe the role of blood in transporting products of digestion around the body
- name some groups of nutrients and identify some examples of foods in which they are found
- describe a balanced diet
- recognise that blood transports products of digestion around the body
- explain why some nutrients have to be broken down before they can be used by the body and why some foods cannot be digested by humans.

Suggested lesson allocation (see individual lesson planning guides)

**Direct route**

<table>
<thead>
<tr>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
<th>A5</th>
<th>A6</th>
</tr>
</thead>
<tbody>
<tr>
<td>What's in food?</td>
<td>Balanced diet</td>
<td>Healthy or not?</td>
<td>Total breakdown</td>
<td>Taking it in</td>
<td>Chewing it over – Think about lines of best fit</td>
</tr>
</tbody>
</table>

**Extra lessons (not in pupil book)**

<table>
<thead>
<tr>
<th>A1</th>
<th>A2</th>
<th>A3</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is in food? Extra lesson for Activity A1a</td>
<td>Balanced diet Extra lesson for Activity A2b</td>
<td>Healthy or not? Extra lesson for Activity A3b</td>
</tr>
</tbody>
</table>

**Review and assess progress (distributed appropriately)**

**Misconceptions**
- Pupils might think that the more we eat the more faeces we produce.
- Pupils might think that vegetarian diets/diets from other cultures are less nutritious than their own.
- Pupils might think that enzymes break down food not speed up the breakdown.

**Additional information**
- Teachers will need to be aware of the need to treat issues about diet sensitively. They should be aware of diet in other countries and cultures. In multicultural schools ask pupils to bring in food samples for food tests. This will provide stimulus for discussing different diets.
- Specific risk assessments should be made when pupils carry out chemical food tests and investigate the action of amylase and in particular if they use their own saliva. Remind them how to heat test tubes.

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A1 What’s in food?

Learning objectives
i. Food contains useful substances called nutrients.
ii. The main types of nutrients in food are carbohydrates, fats, proteins, vitamins, and minerals.
iii. Fibre and water are also needed for a healthy diet.

Scientific enquiry
iv. Use chemical tests to identify food types.
v. Draw conclusions from data. (Framework YTO Sc1 B)

Learning outcomes
Share learning objectives
Find out that food contains useful substances called nutrients.
Find out the main types of nutrients.
Be able to use chemical tests to identify different types of food. (Sc1)

Brainstorming
Pupils hold up flashcards to show why foods are useful in a person’s diet.

Problem solving
Pupils guess the food from a description of it and by asking yes/no questions.

Capture interest
Show pictures of people with vitamin deficiencies.

Suggested alternative main activities
Activity
Textbook A1
Activity A1a Practical
Activity A1b Paper
Activity A1c Catalyst Interactive Presentations 2

Description
Teacher-led explanation and questioning OR pupils work individually, in pairs or in small groups through the in-text questions and then onto the end-of-spread questions if time allows.
Investigating foods Pupils carry out different food tests to investigate which nutrients are present in different foods.
Which food is the best? Pupils analyse data on food composition to ensure that a dietician recommends the correct diets for their patients.
Which food is the best? Support version of Activity A1b. Pupils analyse data on food composition to ensure that a dietician recommends the correct diets for their patients.

Approx. timing
20 min
45 min
10 min
9 min

Target group
C
H
E
S

Suggested alternative starter activities (5–10 minutes)
Introduce the unit
Unit map for Food and digestion.

Share learning objectives
• Find out that food contains useful substances called nutrients.
• Find out the main types of nutrients.
• Be able to use chemical tests to identify different types of food. (Sc1)

Brainstorming
Pupils hold up flashcards to show why foods are useful in a person’s diet.

Problem solving
Pupils guess the food from a description of it and by asking yes/no questions.

Capture interest
Show pictures of people with vitamin deficiencies.
Catalyst Interactive Presentations 2

Suggested alternative plenary activities (5–10 minutes)
Review learning
Wordsearch to find names of nutrients.

Sharing responses
Pupils share results of the food tests in Activity A1a.

Group feedback
In groups, pupils share results from Activity A1b.

Word game
Pupils play Snap!, matching the nutrients with their functions in the body.

Looking ahead
Pupils identify the carbohydrates, fats and proteins on a variety of restaurant menus.

Learning outcomes
Most pupils will …
• name nutrients, fibre and water as part of a balanced diet and explain their functions
• describe the roles of some vitamins and minerals in the diet and problems that occur if they are missing
• identify examples of foods in which they are found by testing a range of foods.

Some pupils, making less progress will …
• name nutrients, fibre and water as part of a balanced diet and match their names to their functions
• describe the roles of one vitamin and mineral in the diet and problems that occur if they are missing
• identify examples of foods in which they are found by testing a few foods.

Some pupils, making more progress will …
• design a quiz sheet about the different nutrients in the human diet
• analyse data on food composition to ensure that a dietician recommends the correct diets for their patients
• construct and interpret a Venn diagram showing the combinations of nutrients in each food sample tested.

Key words
nutrients, carbohydrates, fats, proteins, vitamin, constipated, calcium, vitamin C, minerals, fibre, water, scurvy, rickets, red only: deficient, iron, iodine, vitamin D, roughage, goitre

Out-of-lesson learning
Homework A1
Textbook A1 end-of-spread questions
Visit a supermarket to collect information leaflets

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**Lesson planning guide**

**Balanced diet**

**Learning objectives**
1. A diet that has the right amount of each nutrient is called a balanced diet.
2. It is important to balance the energy in your food with the energy your body uses.

**Scientific enquiry**
3. Use ICT to collect, store and present information in a variety of ways including the generation of graphs. (Framework YTO Sc 1 8d)

**Suggested alternative starter activities (5–10 minutes)**

Recap last lesson
- Pupils complete a true/false quiz about nutrients and food.

Share learning objectives
- Find out what a balanced diet is.
- Be able to present results from other people's experiments and use them to make conclusions.
- Be able to use computers to store and present your results and conclusions by drawing graphs and charts. (Sc1)

**Problem solving**
- Pupils play ‘Who am I?’

**Science learning**
- Describe the diet of particular people, and pupils have to guess who you are describing.

**Brainstorming**
- Pupils list five things that may affect what people eat every day.

**Capture interest**
- Show photographs of meals from different cultures and ask pupils to say if they think they are healthy or not.

**Catalyst Interactive Presentations 2**

**Suggested alternative main activities**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Learning objective see above</th>
<th>Description</th>
<th>Approx. timing</th>
<th>Target group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textbook A2</td>
<td>I and II</td>
<td>Teacher-led explanation and questioning OR pupils work individually, in pairs or in small groups through the in-text questions and then onto the end-of-spread questions if time allows.</td>
<td>20 min</td>
<td>C H E S R/G G R S</td>
</tr>
<tr>
<td>Activity A2a Paper</td>
<td>I and II</td>
<td>Balanced diet: Pupils imagine themselves in the sixteenth century and write a letter to a sea captain advising him on what foods to take on a long voyage.</td>
<td>20 min</td>
<td>✔ ✔</td>
</tr>
<tr>
<td>Activity A2b ICT</td>
<td>I, II and III</td>
<td>Finding out about diet: Pupils frame and investigate a question by searching software with nutritional information about different aspects of diet. An extra lesson might be used for this.</td>
<td>45 min</td>
<td>✔ ✔</td>
</tr>
</tbody>
</table>

**Suggested alternative plenary activities (5–10 minutes)**

Review learning
- In pairs, pupils prepare four quick questions about the key points in the last lesson.

Sharing responses
- Pupils show their presentations from Activity A2b to the rest of the class.

Group feedback
- Pupils read out the letters from Activity A2a, and combine the ideas to produce a ‘group letter’.

Word game
- Pupils play a ‘word splat’ to recap the key words from A1 and A2.

Looking ahead
- Pupils list five things that they consider ‘bad’ for them in their diet.

**Learning outcomes**

Most pupils will ...
- Explain in letter form that a healthy diet contains a balance of six groups of chemicals and why
- Reflect upon multicultural diets and the unhealthy aspects of the ‘Western diet’
- Explain how it is important to balance energy intake from food with the energy the body uses.

Some pupils, making less progress will ...
- Explain in letter form that a healthy diet contains a balance of six groups of chemicals and why with the help of a writing frame
- Begin to reflect upon diets and the unhealthy aspects of the ‘Western diet’
- Describe obesity and anorexia nervosa as examples of what happens when energy intake from food and the energy the body uses do not balance.

Some pupils, making more progress will ...
- Explain special dietary needs.

Key words
- balanced diet, obese, anorexia nervosa, red only: vegetarian, recommended daily allowances (RDA)

Out-of-lesson learning
- Homework A2
- Textbook A2 end-of-spread questions
- Visit a supermarket to look at food labels
- Find information from: The British Nutrition Foundation website
- Find articles about diet in magazines
- Analyse menus in fast food outlets

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Healthy or not?

**Learning objectives**

i. Processed foods often contain a lot of salt and sugar.

ii. You need to look at foods very carefully to decide whether they are healthy or not.

**Scientific enquiry**

iii. Present information in a variety of ways. (Framework YTO Sc1 8d)

**Suggested alternative starter activities** (5–10 minutes)

<table>
<thead>
<tr>
<th>Recap last lesson</th>
<th>Share learning objectives</th>
<th>Problem solving</th>
<th>Brainstorming</th>
<th>Capture interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pupils work in pairs to devise appropriate questions for a list of answers.</td>
<td>Pupils analyse nutritional labels to determine which foods contain the most sugar or salt.</td>
<td>Pupils complete a card-sorting exercise to separate foods they consider healthy and unhealthy.</td>
<td>In pairs, pupils look through magazine adverts for food. They make a list of five advertising slogans in preparation for Activity A3a.</td>
<td></td>
</tr>
</tbody>
</table>

**Suggested alternative main activities**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Learning objective see above</th>
<th>Description</th>
<th>Approx. timing</th>
<th>Target group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textbook A3</td>
<td>i and ii</td>
<td>Teacher-led explanation and questioning OR pupils work individually, in pairs or in small groups through the in-text questions and then onto the end-of-spread questions if time allows.</td>
<td>20 min</td>
<td>C H E G R S</td>
</tr>
<tr>
<td>Activity A3a Paper</td>
<td>i, ii and iii</td>
<td>Advertising food Pupils design their own advert for a food they have chosen.</td>
<td>10 min</td>
<td>✔</td>
</tr>
<tr>
<td>Activity A3b Discussion</td>
<td>i, ii and iii</td>
<td>The organic food debate Pupils work individually to produce arguments for some of the characters on the activity sheet selecting information from the secondary sources provided (could be done for homework). Pupils take part in a class debate.</td>
<td>60 min</td>
<td>✔</td>
</tr>
<tr>
<td>Activity A3c Paper</td>
<td>i, ii and iii</td>
<td>Healthy eating Write a letter about healthy eating.</td>
<td>20 min</td>
<td>✔ ✔</td>
</tr>
</tbody>
</table>

**Suggested alternative plenary activities** (5–10 minutes)

<table>
<thead>
<tr>
<th>Review learning</th>
<th>Sharing responses</th>
<th>Group feedback</th>
<th>Word game</th>
<th>Looking ahead</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pupils write out a dietician's prescription for a good diet for themselves.</td>
<td>Pupils write a short newspaper report of the debate from Activity A3b discussing the arguments put forward.</td>
<td>Pupils share ideas from the letters prepared in Activity A3c.</td>
<td>Check pupils' progress by playing Taboo using diet and nutrient vocabulary.</td>
<td>Ask pupils to write/draw their ideas about what happens to food once it has been eaten.</td>
</tr>
</tbody>
</table>

**Learning outcomes**

**Most pupils will ...**
- describe the problems associated with too much salt, sugar and fat in the diet
- use food labelling to assess the advertising claim about a cereal bar
- make decisions about healthy diet options

**Some pupils, making less progress will ...**
- state some of the problems associated with too much salt, sugar and fat in the diet
- find information from food labelling

**Some pupils, making more progress will ...**
- consider whether salt is harmful in the diet
- gaining an awareness that interpretation of the available evidence is difficult

**Key words**

red only: organic

**Out-of-lesson learning**

Homework A3
- Textbook A3 end-of-spread questions
- Activity A3a, b, or c
- Visit a supermarket to look at food labels. Find articles about diet in magazines. Find out about world food shortages
Learning objectives

i. Digestion takes place in the digestive system.
ii. Digestion is the breakdown of large nutrient molecules into small molecules by enzymes.
iii. This consists of the mouth, oesophagus, stomach, small intestine, large intestine and anus.
iv. Enzymes speed up the breakdown of food.
v. Different enzymes work on different nutrients (red only).

Scientific enquiry

vi. Use a model to explore digestion. (Framework YTO Sc1 8a)

Suggested alternative starter activities (5–10 minutes)

Recap last lesson

Pupils work in pairs to write answers to questions they are given.

Share learning objectives

• Find out what happens during digestion.
• Find out how enzymes help digestion.
• Be able to use a model to explore digestion. (Sc1)

Problem solving

Pupils complete a jigsaw to put together a complete digestive system.

Capture interest (1)

Pupils play Snap! in pairs.

Capture interest (2)

Pupils watch video clips to show the action of swallowing and peristalsis. Catalyst Interactive Presentations 2

Suggested alternative main activities

Activity

Textbook A4

Activity A4a Practical

Activity A4b Practical

Activity A4c Paper

Activity A4a Catalyst Interactive Presentations 2

Activity A4e Catalyst Interactive Presentations 2

Learning objective

i, ii, iii, iv and v

i, ii, iii, iv and vi

iv and v

i, ii, iii

i, ii, iii, iv and v

Description

Teacher-led explanation and questioning OR pupils work individually, in pairs or in small groups through the in-text questions and then onto the end-of-spread questions if time allows.

The digestive system 1 Pupils observe the teacher model some of the different processes that take place in digestion.

Enzymes at work Pupils investigate the effect of the enzyme amylase on the time taken to break down starch.

Dr Beaumont Pupils pretend to be the Dr from the book, and write a letter describing Alexis and the results/conclusions he made.

Interactive support animation of enzymes at work.

Interactive support animation of digestion.

Approx. timing

20 min

20 min

40 min

25 min

15 min

10 min

Target group

CHE S

R/ G G R S

✔ ✔ ✔

✔ ✔ ✔

✔

✔

✔

✔

Suggested alternative plenary activities (5–10 minutes)

Review learning

Pupils put the structures in the digestive system in the correct order.

Group feedback

Pupils collate results and conclusions from Activity A4b.

Pupils discuss how good each model is from the demonstrations.

Word game

Webseek on parts of the digestive system.

Looking ahead

As a class, classify statements on the cards into 'before digestion' and 'after digestion.' Use these as a springboard for the next lesson.

Learning outcomes

Most pupils will ...

• explain why food needs to be digested
• make links between models to describe the processes that take place in the digestive system
• label a diagram of the digestive system with descriptions of what takes place at each part
• explain the process of digestion
• describe one example of how an enzyme speeds up the breakdown of food
• conclude that amylase speeds up the break down of starch.

Some pupils, making less progress will ...

• state that food needs to be broken down into smaller molecules to be digested
• make links between models to describe the processes that take place in the digestive system
• label a diagram of the digestive system with descriptions of what takes place at each part with help
• describe the process of digestion
• conclude that amylase speeds up the break down of starch.

Some pupils, making more progress will ...

• interpret observations made by Dr William Beaumont about digestion
• make links between a series of models to describe the processes that take place in the digestive system
• explain how enzymes speed up the breakdown of food
• interpret experimental results to determine the optimum temperature for amylase.

Key words

digestion, digestive system, molecule, enzymes, gut, large intestine, anus, red only: digestive juices, biological washing powders, gullet, oesophagus, stomach, amylase, small intestine, chemical process

Out-of-lesson learning

Homework A4

Textbook A4 end-of-spread questions

Activity A4c

Make a flicker book animation to illustrate the process of digestion.
## Lesson planning guide

### Learning objectives
- **i** Small molecules of digested food are absorbed into the blood.
- **ii** The digested food is absorbed into the blood stream through the lining of the small intestine - villi increase the surface area for this.
- **iii** Fibre is not digested and is passed out of the body as faeces.

### Scientific enquiry
- **iv** Draw conclusions using scientific knowledge. (Framework YTO Sc1 8f)
- **v** Consider whether an enquiry could have been improved to yield stronger evidence; explain any anomalous results. (Framework YTO Sc1 8f)

### Suggested alternative starter activities (5–10 minutes)
- **Recap last lesson**
- **Pupils think of a mnemonic to help them remember the order of the organs in the digestive system.**

### Suggested alternative main activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Learning objective see above</th>
<th>Description</th>
<th>Approx. timing</th>
<th>Target group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textbook A5</td>
<td>i, ii and iii</td>
<td>Teacher-led explanation and questioning OR pupils work individually, in pairs or in small groups through the in-text questions and then onto the end-of-spread questions if time allows.</td>
<td>20 min</td>
<td>C H E S R/G G R S</td>
</tr>
<tr>
<td>Activity A5a Practical</td>
<td>i, ii, iii and v</td>
<td>The digestive system 2: Pupils observe the teacher model some of the different processes that take place in digestion.</td>
<td>20 min</td>
<td>✔ ✔ ✔</td>
</tr>
<tr>
<td>Activity A5b Paper</td>
<td>ii, iv and v</td>
<td>Surface area - Pupils learn about the importance of surface area in the digestive system.</td>
<td>25 min</td>
<td>✔</td>
</tr>
</tbody>
</table>

### Suggested alternative plenary activities (5–10 minutes)

<table>
<thead>
<tr>
<th>Review learning</th>
<th>Sharing responses</th>
<th>Group feedback</th>
<th>Word game</th>
<th>Looking back</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pupils write their own questions about the key ideas.</td>
<td>As a class, discuss the results and conclusions from the demonstrations about absorption in Activity A5a.</td>
<td>In groups, pupils discuss their responses from Activity A5b.</td>
<td>Check pupils' progress on digestion by playing bingo.</td>
<td>Pupils revise and consolidate knowledge from the unit.</td>
</tr>
</tbody>
</table>

### Learning outcomes

- **Most pupils will ...**
  - use a fishing net model to explain absorption.
- **Some pupils, making less progress will ...**
  - make links between a fishing net model to explain absorption.
- **Some pupils, making more progress will ...**
  - explain how the villi increase the surface area for absorption.

### Key words
- absorbed/absorption, villi (singular villus), faeces, anus, egestion, large intestine, red only: cellulose, constipated, diarrhoea, cellulase

### Out-of-lesson learning
- **Homework A5**
- **Textbook A5 end-of-spread questions**
### Lesson planning guide

**Chewing it over - Think about lines of best fit**

#### Learning objectives

1. Review the concept of line graphs.
2. Draw lines of best fit with a view to analysing patterns and trends in results.

#### Scientific enquiry

3. Draw conclusions from data and describe how conclusions are consistent with the evidence obtained, using scientific knowledge and understanding to understand them. (Framework YTO Sc1 8f)

#### Suggested alternative starter activities (5–10 minutes)

<table>
<thead>
<tr>
<th>Bridging to the unit</th>
<th>Setting the context</th>
<th>Concrete preparation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discuss with pupils how best to present data (as line graph or bar chart).</td>
<td>Ask pupils to make conclusions using the tables of data on the pupil sheet. Explain that presenting data as a graph makes it easier to draw a conclusion.</td>
<td>Pupils match each of the conclusions on the pupil sheet with the correct type of graph.</td>
</tr>
</tbody>
</table>

#### Main activity

<table>
<thead>
<tr>
<th>Activity</th>
<th>Learning objective</th>
<th>Description</th>
<th>Approx. timing</th>
<th>Target group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textbook A6</td>
<td>i, ii and iii</td>
<td>Teacher-led explanation and questioning OR pupils work individually, in pairs or in small groups through the in-text questions and then onto the end-of-spread questions if time allows.</td>
<td>30 min</td>
<td>C: N, G, S, K, E</td>
</tr>
</tbody>
</table>

#### Suggested alternative plenary activities (5–10 minutes)

<table>
<thead>
<tr>
<th>Group feedback</th>
<th>Bridging to other topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ask pupils to write a set of guidelines for other pupils on how to interpret different types of graphs.</td>
<td>Ask pupils to think of five other investigation scenarios where they may use a line graph to help make a conclusion.</td>
</tr>
</tbody>
</table>

#### Learning outcomes

<table>
<thead>
<tr>
<th>Most pupils will ...</th>
<th>Some pupils, making less progress will ...</th>
<th>Some pupils, making more progress will ...</th>
</tr>
</thead>
</table>
| • consolidate their understanding of the use of line graphs to analyse patterns and trends in data  
  • they will have the opportunity to resolve any cognitive conflict arising from thinking about why some of the results do not fit the pattern. | • develop their understanding of the use of line graphs to analyse patterns and trends in data  
  • they will have the opportunity to resolve any cognitive conflict arising from thinking about why some of the results do not fit the pattern. | • extend their understanding to think about curved lines of best fit. |

#### Key words

- line of best fit.

#### Out-of-lesson learning

- Textbook A6 end-of-spread questions
Food and digestion

Absorption  Nutrients

Food

Digestion  Balanced diet

Healthy food

Copy the unit map and use these words to help you complete it. You may add words of your own too.

amino acids R  gut
amylase  large intestine
anorexia nervosa  minerals
anus  molecules
biological washing powder  obese
carbohydrates  oesophagus
deficient R  organic food R
diarrhoea R  proteins
digestive juices R  recommended daily allowance (RDA) R
digestive system  rickets R
egestion  salt
enzyme  scurvy R
faeces  small intestine
fat  stomach
fatty acids R  sugar
fibre (roughage)  vegan R
glucose R  vegetarian R
glycerol R  villi R
goitre R  vitamins
gullet  water

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### Introduce the unit

- **Either** draw the outline of the unit map on the board then ask pupils to give you words to add, saying where to add them. Suggest some words yourself when necessary to keep pupils on the right track.

- **Or** give out the unit map and ask pupils to work in groups deciding how to add the listed words to the diagram. Then go through it on the board as each group gives suggestions.

### Share learning objectives

- Ask pupils to write a list of FAQs they would put on a website telling people about what is in food. Collect suggestions as a whole-class activity, steering pupils towards those related to the objectives. Conclude by highlighting the questions you want them to be able to answer at the end of the lesson.

### Brainstorming

- Make flashcards for each pupil containing the words: growth and energy. (You could use a different colour card for each word.)

- Read out the names of the foods listed opposite.

- Ask pupils to hold up either the growth card or the energy card to show the main reason why that food is useful in a person’s diet.

- Extend the activity to any other foods you think appropriate.

### Problem solving

- Describe each food, using the descriptions on the teacher sheet.

- Pupils guess what you are talking about; if necessary by asking yes/no questions after the description.

### Capture interest

- Show pupils pictures of people with vitamin deficiencies.

#### Suggested alternative starter activities (5-10 minutes)

<table>
<thead>
<tr>
<th>Introduce the unit</th>
<th>Share learning objectives</th>
<th>Brainstorming</th>
<th>Problem solving</th>
<th>Capture interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduce the unit with a unit map</td>
<td>• Find out that food contains useful substances called nutrients.</td>
<td>Pupils hold up flashcards to show why foods are useful in a person’s diet.</td>
<td>Pupils guess the food from a description of it and by asking yes/no questions.</td>
<td>Show pictures of people with vitamin deficiencies. Catalyst Interactive Presentations 2</td>
</tr>
</tbody>
</table>
A1  What's in food?

Problem solving

Teacher sheet

Read these descriptions to the pupils:

This food is something that gives you energy and is sweet. [Cake]

This food is quite chewy, but helps you grow. [Steak]

You get this sometimes in stir-fry dishes. It helps you to grow and comes from a bird. [Chicken]

This is not very good for your teeth. It gives you a quick burst of energy and tastes really nice. [Chocolate bar]
Recap last lesson
- Use the true/false quiz on the pupil sheet about nutrients and food. It could be displayed as an OHT.

Share learning objectives
- Ask pupils to write a list of FAQs they would put on a website telling people about balanced diets. Collect suggestions as a whole-class activity, steering pupils towards those related to the objectives. Conclude by highlighting the questions you want them to be able to answer at the end of the lesson.

Problem solving
- Put the names of the different occupations listed opposite on the board.
- Describe a typical diet for each person, and ask pupils to guess who you are describing.

Brainstorming
- Pupils list five things that may affect what people eat every day.
- Examples
  - The amount of physical exercise taken
  - The type of job someone has
  - Whether someone is pregnant
  - Whether someone needs a special diet because they are ill, or how culture affects diet.

Capture interest
- Show photographs of meals from different cultures and ask pupils to say if they think they are healthy or not.

<table>
<thead>
<tr>
<th>Recap last lesson</th>
<th>Share learning objectives</th>
<th>Problem solving</th>
<th>Brainstorming</th>
<th>Capture interest</th>
</tr>
</thead>
</table>
| Pupils complete a true/false quiz about nutrients and food. | • Find out what a balanced diet is. • Be able to present results from other people’s experiments and use them to make conclusions. • Be able to use computers to store and present your results and conclusions by drawing graphs and charts. (Sc1) | Pupils play ‘Who am I?’ Describe the diet of particular people, and pupils have to guess who you are describing. | Pupils list five things that may affect what people eat every day. | Show photographs of meals from different cultures and ask pupils to say if they think they are healthy or not. Catalyst Interactive Presentations 2
A2 **Balanced diet**

**Recap last lesson**

Decide if the following statements are true or false. Cross out the wrong word.

1. Nutrients are the useful substances found in food. [True/False]
2. Animals make their food from light and water. [True/False]
3. Proteins help your body to grow and repair itself. [True/False]
4. Fats give you energy. [True/False]
5. Vitamins and minerals help to keep you healthy. [True/False]
6. You would die in a few days without fibre. [True/False]
7. All the chemical reactions in your body take place in water. [True/False]
### Healthy or not?

#### Recap last lesson
- Give pupils the list of answers. Ask them to work in pairs to devise a question which would result in each of these answers.

#### Share learning objectives
- Ask pupils to write a list of FAQs they would put on a website telling people about which foods are healthy and which are not. Collect suggestions as a whole-class activity, steering pupils towards those related to the objectives. Conclude by highlighting the questions you want them to be able to answer at the end of the lesson.

#### Problem solving
- Bring in a selection of nutritional labels from foods for pupils to look at in groups.
- Ask pupils to write a list of answers. Ask them to work in pairs to devise a question which would result in each of these answers.

#### Brainstorming
- Make flashcards from the words opposite, showing the names of different foods.
- Hand out each flashcard to a different pupil. Ask each pupil to hold up their cards. Then, as a class, decide whether the food is healthy or unhealthy.

#### Capture interest
- Bring in a selection of magazines for pupils to look through.
- Ask pupils to make a list of five advertising slogans from these adverts in preparation for Activity A3a.

#### Answers
1. balanced diet
2. recommended daily allowance (RDA)
3. obese
4. women
5. extra calcium

---

**Suggested alternative starter activities (3–10 minutes)**

<table>
<thead>
<tr>
<th>Recap last lesson</th>
<th>Share learning objectives</th>
<th>Problem solving</th>
<th>Brainstorming</th>
<th>Capture interest</th>
</tr>
</thead>
</table>
| Pupils work in pairs to devise appropriate questions for a list of answers. | - Find out why processed foods can be bad for your health.  
- Find out what information you can discover from food labels.  
- Present and interpret information from secondary sources. (Sc1). | Pupils analyse nutritional labels to determine which foods contain the most sugar or salt. | Pupils complete a card sorting exercise to separate foods they consider healthy and unhealthy. | In pairs, pupils look through magazine adverts for food. They make a list of five advertising slogans in preparation for Activity A3a. |

---

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This worksheet may have been altered from the original on the CD-ROM.
Recap last lesson

- Give pupils the list of answers. Ask them to work in pairs to devise a question which would result in each of these answers.

Share learning objectives

- Ask pupils to write a list of FAQs they would put on a website telling people about the digestive system. Collect suggestions as a whole-class activity, steering pupils towards those related to the objectives. Conclude by highlighting the questions you want them to be able to answer at the end of the lesson.

Problem solving

- Pupils complete the jigsaw to put together a complete digestive system.

Capture interest (1)

- Ask pupils to play Snap! in pairs, using the cards on the pupil sheet.

Capture interest (2)

- Pupils watch video clips to show the action of swallowing and peristalsis.

Answers

1. High blood pressure and heart disease
2. Tooth decay
3. Heart disease
4. A stroke
5. Organic food
Problem solving

Rearrange the jigsaw pieces to make a picture of the human digestive system.
## Total breakdown

### Capture interest (1)

<table>
<thead>
<tr>
<th>Small intestine</th>
<th>Mouth and Gullet</th>
<th>Anus</th>
<th>Stomach</th>
<th>Large intestine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large intestine</td>
<td>Stomach</td>
<td>Anus</td>
<td>Small intestine</td>
<td>Mouth and Gullet</td>
</tr>
<tr>
<td>Stomach</td>
<td>Anus</td>
<td></td>
<td>Small intestine</td>
<td>Anus</td>
</tr>
<tr>
<td>Anus</td>
<td>Stomach</td>
<td>Large intestine</td>
<td>Large intestine</td>
<td>Mouth and Gullet</td>
</tr>
<tr>
<td>Mouth and Gullet</td>
<td>Small intestine</td>
<td>Stomach</td>
<td>Anus</td>
<td>Large intestine</td>
</tr>
<tr>
<td>Anus</td>
<td>Stomach</td>
<td>Large intestine</td>
<td>Small intestine</td>
<td>Mouth and Gullet</td>
</tr>
<tr>
<td>Stomach</td>
<td>Anus</td>
<td>Large intestine</td>
<td>Small intestine</td>
<td>Mouth and Gullet</td>
</tr>
</tbody>
</table>

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This worksheet may have been altered from the original on the CD-ROM.
Recap last lesson
- Pupils should think of a mnemonic to help them remember the order of the organs in the digestive system.
- Ask pupils to share their mnemonics with the class.

Share learning objectives
- Ask pupils to write a list of FAQs they would put on a website telling people about absorption. Collect suggestions as a whole-class activity, steering pupils towards those related to the objectives. Conclude by highlighting the questions you want them to be able to answer at the end of the lesson.

Problem solving (1)
- Give each group of pupils an equal number of Lego bricks or ‘stick-a-bricks’.
- Under ‘race’ conditions:
  - ask pupils to build a cube (like a house)
  - ask them to demolish the house and build a tower instead
  - ask them to demolish the tower and build a car park (with all bricks lying next to each other) instead.
- Discuss the idea of demolishing the buildings into bricks before rebuilding the structures.
- Use this to introduce the idea of digestion and why it is needed.

Problem solving (2)
- Set up the apparatus shown in the diagram on the technician sheet.
- Invert the tubes into the Petri dishes of iodine.
- Take guesses on which will go black first because of absorption of iodine.
- After 4 minutes, remove the tubes and agree on the winner.
- Discuss the results by pointing out the difference in size in the opening of the tubes.
- Use this as an introduction to the ideas of absorption and surface area.

Capture interest
- Show pupils an animation of digestion and absorption across the villi.
Problem solving (2)

Technician sheet

Prepare equipment for the teacher to demonstrate the apparatus shown in the diagram.

- Ignition tube
- Test tube
- Boiling tube
- Visking tubing attached with an elastic band
- Large Petri dish containing iodine solution
- Standard volume of starch solution
**Suggested alternative starter activities (3-10 minutes)**

<table>
<thead>
<tr>
<th>Bridging to the unit</th>
<th>Setting the context</th>
<th>Concrete preparation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discuss with pupils how best to present data (as a line graph or bar chart).</td>
<td>Ask pupils to make conclusions using the tables of data on the pupil sheet. Explain that presenting data as a graph makes it easier to draw a conclusion.</td>
<td>Pupils match each of the conclusions on the pupil sheet with the correct type of graph.</td>
</tr>
</tbody>
</table>

**Bridging to the unit**

- Display data on the teacher sheet (taken from the pupil book) on the board and explain that it is to do with the digestion of starch.
- Discuss with pupils how best to present it (as a line graph or bar chart). Lead the discussion around to why it should be plotted as a line graph. Include a discussion of plotting input and output variables on the correct axes, labelling axes, including units, plotting points clearly, and giving the graph a title.
- Note that it is not intended that this activity actually involves the plotting of the graph, as this is part of the activity of the pupil book spread.

**Setting the context**

- Ask pupils to look first at the table and make conclusions from the data on the pupil sheet.
- Then ask them to look at the graph and decide what conclusion they can draw.
- Ask them to compare how easy it was to make a conclusion from a table and a graph. Explain that drawing a graph usually makes it easier to draw a conclusion.
- Explain that drawing a graph can also help you to make a prediction about the output variable using the input variable. Ask pupils to use the graph to predict how long it will take to digest all the protein with a protein concentration of 3.5.

**Concrete preparation**

- Pupils match each of the conclusions on the pupil sheet with the correct type of graph.
### Chewing it over

#### Bridging to the unit

**Teacher sheet**

<table>
<thead>
<tr>
<th>Amount of enzyme</th>
<th>Time taken to digest all the protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>300</td>
</tr>
<tr>
<td>4</td>
<td>260</td>
</tr>
<tr>
<td>6</td>
<td>220</td>
</tr>
<tr>
<td>8</td>
<td>180</td>
</tr>
<tr>
<td>10</td>
<td>130</td>
</tr>
<tr>
<td>12</td>
<td>90</td>
</tr>
<tr>
<td>14</td>
<td>45</td>
</tr>
</tbody>
</table>
**Setting the context**

Look at the table and the graph. They both show the results of Jayshree's experiment. She mixed different amounts of protein with the same amount of enzyme, and tried to measure how long it took to digest all of the protein.

Compare how easy it is to draw conclusions from the table and from the graph.

<table>
<thead>
<tr>
<th>Amount (concentration) of protein</th>
<th>Time taken to digest all protein (seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60</td>
</tr>
<tr>
<td>2</td>
<td>80</td>
</tr>
<tr>
<td>3</td>
<td>110</td>
</tr>
<tr>
<td>4</td>
<td>140</td>
</tr>
<tr>
<td>5</td>
<td>190</td>
</tr>
<tr>
<td>6</td>
<td>240</td>
</tr>
<tr>
<td>7</td>
<td>280</td>
</tr>
</tbody>
</table>

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Concrete preparation

The graphs and the conclusions below come from four different investigations. Unfortunately, they've been mixed up, and whoever drew the graphs forgot to label the axes. Decide which graph matches which conclusion by drawing lines to match them up.

In my class, the number of blue-eyed boys is greater than the number of green-eyed boys.

As the temperature increased, the speed of the reaction increased.

As the amount of enzyme increased, it took less time for the reaction to happen.

Girls with red hair are taller than girls with brown hair who are taller than girls with black hair.
Investigating foods

Running the activity

The activity needs good organisation by the pupils in order to complete all the tests and questions in one lesson. Suggested foods for testing are: potatoes (starch), powdered milk made up to a liquid (protein), lemonade (glucose), cheese (fat), celery (none). Other foods may also be tested, and you could ask pupils to bring in particular foods for testing.

Core: Pupils work in pairs or small groups. They draw up their own results table to summarise their results and use the knowledge they have gained from the experiments to answer the questions.

Help: Pupils do the tests shown on the Core sheet, but use the Help sheet to record their results and answer questions.

Extension: Pupils do the tests and questions shown on the Core sheet. They use Venn diagrams to present their results.

Other relevant material

A1a Resource sheet

Expected outcomes

Pupils either produce (Core and Extension) or complete (Help) a results table to summarise their findings, and then complete the questions to show they understand the food tests.

Pitfalls

Some of the tests do not work as quickly as they should. They are very dependent on the types of food sampled, so a range of standard samples is useful to show positive results to pupils.

Safety notes

Eye protection should be worn for the Biuret and Benedict's tests. Remind pupils not to eat the food samples. Pupils should take care with corrosive chemicals and hot water. If scalded, hold the affected part under cold running water. Remind pupils to wash their hands afterwards. Benedict's solution is preferred to Fehling's solution which is more hazardous.

ICT opportunities

Pupils could make presentations of their results using software such as Microsoft® PowerPoint.

Answers

Help:

2 glucose, starch
Investigating foods

**Type** | **Purpose** | **Differentiation**
--- | --- | ---
Practical | Pupils test a variety of foods to establish which nutrients they contain. | Core, Help, Extension

**Other relevant material**
A1a Resource sheet

**Equipment**
For each group:
- food samples
- iodine solution
- Benedict’s solution
- Biuret solution
- plain paper
- hot water bath
- test tubes
- test tube rack

**For your information**

**Running the activity**
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Investigating foods

Food scientists use food tests to find out which nutrients are present in different foods. You are going to carry out some of the tests they do.

**Equipment**

- food samples
- iodine solution
- Benedict’s solution
- Biuret solutions A and B
- plain paper
- hot water bath
- test tubes
- test tube rack

**Obtaining evidence**

1. Look at the food tests described on the resource sheet.
2. Test each of the foods provided using each of the food tests to find out what nutrients they contain.

**Presenting the results**

3. Make a table like the one below to summarise your results. The first entry has been completed for you.

<table>
<thead>
<tr>
<th>Food</th>
<th>Observation</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potatoes</td>
<td>turned iodine blue-black</td>
<td>contain starch</td>
</tr>
</tbody>
</table>

**Considering the evidence**

1. Which of the foods tested contain starch?
2. Which of the foods tested contain fat?
3. Which of the foods tested contain carbohydrates?
4. Which of the foods tested would be best for the body for energy?
5. Which of the foods tested would be best for the body for growth and repair?
Use the table below to record your results for Activity A1a.

<table>
<thead>
<tr>
<th>Food</th>
<th>Food test</th>
<th>Observation</th>
<th>Nutrient present/not present</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>protein</td>
<td></td>
<td></td>
</tr>
<tr>
<td>protein</td>
<td>glucose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>glucose</td>
<td>starch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>starch</td>
<td>fat</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>protein</td>
<td></td>
<td></td>
</tr>
<tr>
<td>protein</td>
<td>glucose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>glucose</td>
<td>starch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>starch</td>
<td>fat</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>protein</td>
<td></td>
<td></td>
</tr>
<tr>
<td>protein</td>
<td>glucose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>glucose</td>
<td>starch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>starch</td>
<td>fat</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>protein</td>
<td></td>
<td></td>
</tr>
<tr>
<td>protein</td>
<td>glucose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>glucose</td>
<td>starch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>starch</td>
<td>fat</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>protein</td>
<td></td>
<td></td>
</tr>
<tr>
<td>protein</td>
<td>glucose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>glucose</td>
<td>starch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>starch</td>
<td>fat</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>protein</td>
<td></td>
<td></td>
</tr>
<tr>
<td>protein</td>
<td>glucose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>glucose</td>
<td>starch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>starch</td>
<td>fat</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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A1a  Investigating foods (continued)

Considering the evidence

1. Which of the foods tested contain:
   a. protein
   b. glucose
   c. starch
   d. fat?

2. Circle the two food types which together make up carbohydrates.
   
   protein  glucose  starch  fat

3. Suggest which of the foods tested would be best for the body for:
   a. growth and repair
   b. energy.
A1a  Investigating foods

Use this sheet to help you display your results for Activity A1a.

Presenting the results

Look at the diagram. It is called a **Venn diagram**. It is made up of three overlapping rings. Venn diagrams can be used to show which nutrients particular types of food contain.

- Beans contain all three nutrients, and so are shown in the central part of the diagram, where the protein, fat, and carbohydrate rings overlap.
- Rice contains only carbohydrate, and so would go in the part of the carbohydrate ring that does not overlap with anything else.
- Milk contains protein and fat, and so would go in the overlapping section between the protein ring and the fat ring.

1. Copy the diagram and use it to present your results from the food test by writing the name of each food in the appropriate part of the diagram.
Here are the tests for protein, fat, glucose and starch. Glucose and starch are both carbohydrates.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Food test</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>protein</td>
<td>Add 5–10 drops of Biuret A solution to a test tube containing your food mixed with 0.5 cm depth water. Then add 5–10 drops of Biuret B solution.</td>
<td>A colour change from light blue to lilac indicates the presence of protein.</td>
</tr>
<tr>
<td>fat</td>
<td>Rub or add some of the food to a piece of paper. Hold the paper to the light.</td>
<td>The paper appearing translucent when held up to the light indicates the presence of fat.</td>
</tr>
<tr>
<td>glucose</td>
<td>Add 5–10 drops of Benedict’s solution to a test tube containing your food shaken with 0.5 cm depth of water. Put the test tube into a hot water bath.</td>
<td>A colour change from blue to either green, yellow, orange or brick-red indicates the presence of a sugar such as glucose.</td>
</tr>
<tr>
<td>starch</td>
<td>Add 2–5 drops of iodine solution to your food, or to a test tube containing your food mixed with 0.5 cm depth water.</td>
<td>A colour change from orange to blue-black indicates the presence of starch.</td>
</tr>
</tbody>
</table>
Which food is the best?

Running the activity
Pupils work individually or in pairs to answer questions on the sheet.

ICT opportunities
Pupils can make further analysis of the foods by preparing graphs of food and nutrients for direct graphical comparisons using the spreadsheet in Activity A1c.

Answers
1. Porridge oats.
2. Porridge oats and cheddar cheese.
3. Cheese, because it contains most calcium.
4. Yes, it has a higher protein content (26g per 100g of food, while fish is 19.6g).
5. Because it contains less fat.
6. Yes, because little of the energy comes from fat, most of it is in the form of carbohydrate.
7. Orange, because it contains a large amount of vitamin C.
8. Cheddar cheese, because it contains the most fat of all the foods per 100g.
Dieticians need to know exactly the amount of nutrients that are in particular foods. This information helps them to recommend the correct food for their patients. Look at the table and answer the questions below.

<table>
<thead>
<tr>
<th>Food</th>
<th>Energy (kJ)</th>
<th>Protein (g)</th>
<th>Fat (g)</th>
<th>Carbohydrate (g)</th>
<th>Vitamin C (mg)</th>
<th>Calcium (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>milk (whole)</td>
<td>272</td>
<td>3.2</td>
<td>3.9</td>
<td>4.6</td>
<td>0.0</td>
<td>103</td>
</tr>
<tr>
<td>milk (skimmed)</td>
<td>137</td>
<td>3.4</td>
<td>0.1</td>
<td>4.7</td>
<td>0.0</td>
<td>108</td>
</tr>
<tr>
<td>cheddar cheese</td>
<td>1682</td>
<td>26.0</td>
<td>33.5</td>
<td>0.0</td>
<td>0.0</td>
<td>800</td>
</tr>
<tr>
<td>orange</td>
<td>147</td>
<td>1.0</td>
<td>0.0</td>
<td>9.0</td>
<td>2.5</td>
<td>11</td>
</tr>
<tr>
<td>porridge oats</td>
<td>1582</td>
<td>10.9</td>
<td>9.2</td>
<td>66.0</td>
<td>0.1</td>
<td>52</td>
</tr>
<tr>
<td>fish (cod)</td>
<td>982</td>
<td>19.6</td>
<td>14.3</td>
<td>7.5</td>
<td>0.1</td>
<td>80</td>
</tr>
</tbody>
</table>

1. Which food is the best source of carbohydrate?
2. Which two foods contain the greatest amount of energy per 100 g?
3. Which food is best for your teeth and bones? Why?
4. Is cheese a better source of protein than fish?
5. Why do some people think that skimmed milk is healthier than whole milk?
6. Should a dietician recommend porridge oats rather than cheese as a good source of energy? Why?
7. Which food should a dietician give to a person who has bleeding gums?
8. Which food should he not give to a person on a low-fat diet? Why?
Balanced diet

Running the activity
This activity reinforces pupils’ learning on nutrients and balanced diets and aims to improve their presentation and literacy skills.

Core: Pupils read the information on the sheet and write a detailed letter, imagining themselves back in the 16th Century. They will need to look through the book for extra information for this work.

Help: Pupils read the information on the Core sheet then write their letter using the writing frame on the Help sheet.

Other relevant material
Government leaflets and books such as The Manual of Nutrition (MAFF)
Leaflets from supermarkets

ICT opportunities
The letter could be produced using a word processing package or DTP.
Pupils could search the Internet for more information about what types of food were commonly carried on long voyages in the 16th Century.
It is important that all of us have a balanced and healthy diet. If we do not, then our bodies cannot work properly and we can become ill.

Hundreds of years ago, British sailors used to spend several months at sea on each voyage. They would often go for a long time without any fresh fruit or vegetables.

Many of these sailors got a disease called scurvy. This caused their gums to bleed and their teeth to become loose and sometimes fall out. They also felt quite weak and often died from this disease.

In 1795, a Scottish doctor called James Lind said that every ship should carry lots of limes which could be given to the sailors while they were at sea. Vitamin C in the limes stopped the sailors from getting scurvy. The British sailors were given the nickname 'limeys', and this is still sometimes used to describe the British today! Vitamin C is also found in lemons, oranges and other citrus fruits.

British sailors also suffered because they did not drink any milk (it was very difficult to keep cows on board ship). Some of the sailors got very soft teeth and bones, so that some of their bones actually began to bend. If they had realised that drinking milk was important, they may have been nicknamed ‘milkies’!

Imagine it is the 16th Century. You are advising the captain of a sailing ship who is preparing for a long sea journey. Write a letter to the captain explaining what food he should take on the voyage and why.

(Hint: Look back through your work to remind yourself what foods make up a balanced diet.)
Dear Captain

I have looked into the question of what foods you should take on your voyage, and I am pleased to offer you the following advice.

It is very important for sailors to have a balanced diet because

The sailors should eat the following seven types of food: carbohydrates, fats

They need carbohydrates and fats because and they can find them in foods such as for carbohydrates, and for fats.

To stop sailors getting scurvy they need which is found in foods such as

To stop sailors getting soft bones and teeth they need to drink

I wish you good fortune and a safe return.

Yours sincerely
Finding out about diet

Running the activity
Pupils will need access to computers which are connected to the Internet and have presentation software such as Microsoft® PowerPoint installed.

Core: In groups, pupils read the instructions on the sheet and use the Internet to research their chosen aspect of diet from obesity, vegetarianism, balanced diet, and slimming. They produce a leaflet or PowerPoint presentation about their topic.

Help: Pupils follow the instructions on the Core sheet, but use the sub-heading suggestions on the Help sheet to help organise their research and the information in their leaflets or presentations.

Other relevant material
Skill sheet 4: Web searches
Government leaflets and books such as The Manual of Nutrition (MAFF)
Leaflets from supermarkets
Websites such as The British Nutrition Foundation: Diet and health section

ICT opportunities
Pupils could search the Internet for information about diet using the website mentioned above, and by using a search engine such as Google to find other relevant sites.
Finding out about diet

In this activity you will choose an aspect of diet to do some research on.

1. First you need to frame your question for the research. You can choose from the following topics:

   **Obesity**  **Vegetarianism**  **Balanced diet**  **Slimming**

   Decide what aspect of your chosen topic you will investigate and write it down as a question. You can choose one of the questions below, or make up your own:

   - Why do people become obese?
   - Why are people vegetarian?
   - How can vegetarian people get a balanced diet?
   - How does lifestyle affect a person's balanced diet?
   - Do people who are slimming get a balanced diet?
   - What happens if you slim too much?

2. Decide where you are going to do your research. Think about which search engines and websites you are going to use. Go to the library, and find out which books would be good sources of information.

3. You are going to present your information to the class as a PowerPoint presentation or as a health education leaflet. Begin your research by finding out some general information about your chosen topic, explaining, for example 'What is obesity?'. Use this information to write the introduction.

4. For the main part of your leaflet or presentation, you then need to include the information required to answer your original question.
Finding out about diet

Use the sub-headings below to help with your leaflet or presentation.

Choose which topic you are going to research and use the questions to help you research and organise the information.

**Obesity**
- What is it?
- Why is it a problem?
- What causes it?
- How can you avoid it?

**Slimming**
- What is it and why do people do it?
- How can you do it safely and successfully?
- Why can it be dangerous?

**Balanced diet**
- What is it?
- Why is it important?
- What must you eat to get a balanced diet?
- Why is it easy not to eat a balanced diet?

**Vegetarianism**
- What is it?
- Why are people vegetarian?
- How can vegetarians eat a balanced diet?
Running the activity
You will need to remind pupils to bring in magazines for this week’s lesson. It would be wise to bring in your own magazines for those that forget! Provide pupils with scissors and glue to stick their adverts onto sheets of A3 paper. Having looked at adverts from magazines, pupils should design their own advert for a particular food of their choice. Their aim should be to identify an unhealthy food, and then to advertise it as a healthy choice.

ICT opportunities
Pupils could design their adverts using word processing or desktop publishing software.
You know that you need to eat a healthy, balanced diet. But it is really hard to know what to eat when advertisements try to make out that everything is healthy.

1. Look through a variety of magazines to find some food adverts. Cut them out and stick them onto a sheet of paper.

2. Underneath each advert, write down what you think are the good points and bad points about each food. Do the adverts mention the bad points you have identified?

3. Design your own advert:
   a. Choose a food that you think is unhealthy. It is your job to convince whoever sees your advert that the food is healthy.
   b. You’re not allowed to lie in the advert or you could be taken to court by the Food Standards Agency. But you do not have to point out any of your food’s bad points.
   c. Look at the adverts from the magazines to give you some design ideas.
   d. Design your advert on a full page, as if it were to feature in a magazine.
The organic food debate

Running the activity

This activity reinforces the advantages and disadvantages of organic food and helps to develop pupils’ debating skills. Pupils also have an opportunity to improve literacy skills.

Pupils work in small groups of two or three to produce arguments for some of the characters on the activity sheet and then debate their ideas as a class. The debate is then written up as a newspaper article to emphasise their ideas and to allow all pupils to record their views and findings.

Pupils can use material from the Pupil book and the two resource sheets, or research their ideas further using the Internet.

Tell pupils to prepare a one-minute ‘speech’ outlining their ideas at the start of the debate. They should then think about all the questions they could be asked by anyone with an opposite point of view to them, and prepare the answers. Ask each group to nominate a speaker, and tell the other pupils in the group that they will be supporters.

Other relevant material

Skill sheet 4: Web searches
A3b Resource 1 and 2
Information leaflets from the Soil Association, Bristol House, 40–56 Victoria Street, Bristol BS1 6BY
Leaflets from supermarkets

Pitfalls

You will need to set strict expectations at the start of the debate in terms of behaviour and politeness. Ensure that each group has a mix of abilities, as preparing for a debate would be quite difficult for lower ability pupils. Putting a time limit on the debate will keep the discussion focused.

ICT opportunities

Pupils can search the Internet for information on organic food. They can use a search engine such as Google to find appropriate websites, or they could try the following:

Soil Association website
Organic food in the UK
Organic food fact site
The organic food debate

People have many different opinions about organic food and organic farming. You are going to debate the arguments for and against organic food and write an article for a local newspaper.

1. Discuss with your group whether you think these people are in favour of organic food or against it.
2. Take the role of one of the people above. Research the topic to prepare information to support your arguments.
3. Prepare a one minute speech to outline your ideas at the start of the debate.
4. Think about all the questions you could be asked by someone who is against your ideas. Prepare your answers to cover as many questions as possible.
5. Conduct a class debate about whether organic or non-organic food is better.
6. Write a report for a local newspaper on the debate and the arguments put forward.
The organic food debate

Read about the reasons why some people think organic food is good.

Organic food is produced without using:

- fertilisers (which keep the soil fertile)
- pesticides (which kill insects and other pests)
- hormones (which make animals grow bigger or fruit get ripe more quickly).

Many people want to eat organic food because they think there are good things about it. They think:

- it is better for the environment because
  - no pesticides are used
  - no pests are killed and so birds (who eat the pests) have more food for survival
- it is healthier because
  - organic food contains no man-made chemicals
  - organic farm workers do not need to use strong chemicals (such as pesticides) that may harm them
- it keeps soil more fertile because
  - natural fertilisers like manure are used, rather than man-made fertilisers
  - soils are left to rest, or crops are changed every year on particular fields, giving the soil time to restore its supply of nutrients
- animals live in better conditions because
  - organically farmed animals live in surroundings more like their natural surroundings
  - they usually have more space to move around in.
The organic food debate

Read about the reasons why some people think organic food is bad.

Many people don’t want to eat organic food because they think that organic food has its own bad points, just like normal food. They think:

- organic food is expensive because
  - without using man-made pesticides and hormones, the amount of crop produced by an organic farm is lower
  - this can make the price of the crop increase

- organic farming cannot feed everyone in the world because it would be impossible to feed everyone unless you used man-made pesticides, fertilisers and hormones

- organic food does not look very good because
  - normal farmers sometimes use wax to coat their fruit to make it look shiny
  - organic farmers do not use anything to make their food look good

- organic food may contain insects that have not been killed by chemicals.
Healthy eating

Running the activity

Pupils will need access to information from the pupil book to complete the activity successfully.

Core: Pupils write a letter about healthy eating.
Help: Pupils use the writing frame to write a letter about healthy eating.

ICT opportunities

Pupils could use word processing or desktop publishing software to produce the letter.
Healthy eating

Your older brother has just left home and moved to a different city. Because he lives away, he will be cooking his own meals. You have just studied balanced diets and healthy eating, so you are going to write a letter to him, telling him about healthy eating.

Your letter should explain the meaning of the term ‘balanced diet’ and should include the following points:

- The foods in which you find a lot of salt.
- The health problems that salt can cause.
- The foods in which you find a lot of sugar.
- The health problems that sugar can cause.
- The foods in which you find a lot of fat.
- The health problems that fat can cause.
Dear [Name],

We've been studying healthy eating this week in science. I thought you may want to know what I've found out. First, watch out for those breakfast bars. Although the adverts say they're healthy...

Secondly, you know dad usually puts salt in the water when he boils vegetables, well...

Finally, you know what you said about baked beans, sausages and chips in the university canteen? I'm sorry, but they're not very healthy either. This is because...

Hope to see you next week if you can come home for the weekend. I'll make sure there's some healthy food waiting for you!

Best wishes,

[Your Name]
Running the activity
This is a series of teacher demonstrations. You may have to give prompts to help the pupils guess which process is being visualised. Run the demonstrations as appropriate to the level of your pupils: Core (C), Help (H) or Extension (E).

**Peristalsis** (C, H, E) – Use a pair of tights with a tennis ball to show the movement of food down the gut by peristalsis.

**The role of fibre** (C, H, E) – Demonstrate the difference between bran fibre with and without water to show why fibre is important.

**Lock and key mechanism** (E) – Use interlocking beads to show how enzymes link with substrate molecules and break them down.

Not all the activities have to be used in the same lesson, but can be used when suitable.

Other relevant material
It is sometimes difficult for pupils to see demonstrations clearly. If available, use a video camera (e.g. Flexicam) and a large screen.

Expected outcomes
Pupils should be able to say which process is being demonstrated.

Pitfalls
Peristalsis: If you have never done this before, practise it before the lesson so you know how to make it work.

ICT opportunities
Pupils could make or watch an animation to visualise how the lock and key mechanism for enzymes works, using Microsoft® PowerPoint or Macromedia Flash. There is a good range of animations available on the Internet.
The digestive system 1

Other relevant material
It is sometimes difficult for pupils to see demonstrations clearly. If available, use a video camera (e.g. Flexicam) and a large screen.

Equipment
For peristalsis:
- tennis ball
- pair of tights
For the role of fibre:
- bran fibre
- water
- two beakers
For lock and key mechanism:
- beads that lock together

For your information
Running the activity
This is a series of teacher demonstrations. You may have to give prompts to help the pupils guess which process is being visualised. Run the demonstrations as appropriate to the level of your pupils: Core (C), Help (H) or Extension (E).

Peristalsis (C, H, E) – Use a pair of tights with a tennis ball to show the movement of food down the gut by peristalsis.
The role of fibre (C, H, E) – Demonstrate the difference between bran fibre with and without water to show why fibre is important.
Lock and key mechanism (E) – Use interlocking beads to show how enzymes link with substrate molecules and break them down.

Not all the activities have to be used in the same lesson, but can be used when suitable.

Expected outcomes
Pupils should be able to say which process is being demonstrated.

Pitfalls
Peristalsis: If you have never done this before, practise it before the lesson so you know how to make it work.
Enzymes at work

Running the activity

Pupils work through the experiment in groups of two or three. They produce a table for their results and then conclude and evaluate their experiments. As an extension, some pupils can go on to investigate the effects of temperature on amylase action.

Core: Pupils work through the instructions on the Core sheet.
Help: Pupils work through the instructions on the Core sheet, but complete the table on the Help sheet with their results.
Extension: Pupils test the effect of temperature on amylase.

Other relevant material

Skill sheet 5: Drawing charts and graphs (for Extension)

Expected outcomes

Core: Pupils carry out the investigation and find out how quickly amylase breaks down starch.
Help: Pupils use the Help sheet to help them record their results.
Extension: Pupils find out how the action of amylase is affected by temperature.

Pitfalls

The enzyme will work best at 37°C but can work at room temperature. The pupils must be sure of their end point. This is when no black colour is observed. They must also be very quick in taking their first sample at the start of the experiment.
Pupils should clean their pipettes quickly between each sample, to avoid contamination by solution from the previous sample.

Safety notes

Eye protection should be worn. Advise pupils to wash their hands after handling the chemicals and minimise skin contact. Treat amylase, and all enzymes, as a potential allergen.

ICT opportunities

A similar experiment can be carried out using light sensors and datalogging equipment to look at the breakdown of starch. (ICT PoS 2b: Datalogging)

Answers

Core:
1. When there is no black colour.
2. Individual answers.
3. Possible improvements could include taking repeat readings and averaging their results, using clean pipettes for each sample, taking samples more often, e.g. every 30 seconds instead of every minute.

Extension:
1. This should be about 40°C, although unusual results can be quite common.
2. It is similar to that found in biological situations (humans).
3. The pattern reflects the activity of the enzyme amylase – low at 5°C, high at 35°C and inactive at 65°C. The enzyme becomes inactive because it changes shape.
4. Possible improvements could include taking repeat readings and averaging their results, using clean pipettes for each sample, taking samples more often, e.g. every 30 seconds instead of every minute.
**Type** | **Purpose** | **Differentiation**
--- | --- | ---
Practical | Pupils investigate the effect of the enzyme amylase on the time taken to break down starch. | Core, Help, Extension

**Other relevant material**

Skill sheet 5: Drawing charts and graphs (for Extension)

**Equipment**

For each group (Core):
- spotting tile (at least six wells)
- marker pen
- two dropping pipettes
- iodine solution
- 1% starch solution
- 1% amylase solution (at least 30 cm³)
- two measuring cylinders (10 cm³)
- digital stopclock
- test tube

In addition for each group (Extension):
- water baths at 35°C, 50°C and 65°C
- beaker of water at 20°C
- beaker of ice and water at 5°C

**For your information**

**Running the activity**

Pupils work through the experiment in groups of two or three. They produce a table for their results and then conclude and evaluate their experiments. As an extension, some pupils can go on to investigate the effects of temperature on amylase action.

Core: Pupils work through the instructions on the Core sheet.
Help: Pupils work through the instructions on the Core sheet, but complete the table on the Help sheet with their results.
Extension: Pupils test the effect of temperature on amylase.

**Expected outcomes**

Core: Pupils carry out the investigation and find out how quickly amylase breaks down starch.
Help: Pupils use the Help sheet to help them record their results.
Extension: Pupils find out how the action of amylase is affected by temperature.

**Pitfalls**

The enzyme will work best at 37°C but can work at room temperature. The pupils must be sure of their end point. This is when no black colour is observed. They must also be very quick in taking their first sample at the start of the experiment.
Pupils should clean their pipettes quickly between each sample, to avoid contamination by solution from the previous sample.

**Safety notes**

Eye protection should be worn. Advise pupils to wash their hands after handling the chemicals and minimise skin contact. Treat amylase, and all enzymes, as a potential allergen.
Enzymes at work

Enzymes are used in digestion to speed up the time taken to break down food. In the mouth, saliva contains an enzyme called salivary amylase. This helps break down starch into sugar.

You are going to use iodine to find out how quickly the enzyme amylase breaks down starch.

**Equipment**
- spotting tile
- iodine solution
- test tube
- stopclock
- 1% amylase solution
- pen
- two dropping pipettes
- two small measuring cylinders
- 1% starch solution

**Obtaining evidence**

1. Label the wells of a spotting tile 0, 1, 2, 3, etc. until you reach 11 min.
2. Put one drop of iodine into each of the wells.
3. Add 1 cm³ of amylase solution to 5 cm³ of starch solution in a test tube and mix. Immediately take a drop from the test tube and add it to the well marked ‘0’. Start the stopclock.
4. Take a drop of the solution every minute and add it to the iodine in the appropriate well of the tile. For example, after 2 minutes add it to the well marked ‘2’.

**Presenting the results**

5. Record the results in a table.

**Considering the evidence**

① How do you know that starch has been broken down?
② How long did it take for all the starch to be digested?

**Evaluating**

③ How could you improve the accuracy of your experiment?
# Enzymes at work

Use this table to help record your results from Activity A4b.

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>Colour</th>
<th>Has all the starch been digested?</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
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<tr>
<td>3</td>
<td></td>
<td></td>
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<td>4</td>
<td></td>
<td></td>
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<tr>
<td>5</td>
<td></td>
<td></td>
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<tr>
<td>6</td>
<td></td>
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<td>7</td>
<td></td>
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<td>8</td>
<td></td>
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<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Enzymes are used in digestion to speed up the time taken to break down food. In the mouth, saliva contains an enzyme called salivary amylase. This helps break down starch into sugar.

Enzymes are affected by factors such as pH and temperature. You are going to investigate the effect of temperature on the digestive enzyme amylase.

Amylase in saliva breaks down starch into sugar. You will use iodine to follow the breakdown of starch by amylase over a range of temperatures. Iodine turns blue-black when starch is present, but will stay orange if there is no starch. Therefore if starch has been completely broken down then there will be no colour change.

**Equipment**
- spotting tile
- iodine solution
- test tubes
- 1% starch solution
- measuring cylinders
- water baths at 35°C, 50°C and 65°C
- beaker of ice and water at 5°C
- pens
- dropping pipettes
- stopclocks
- 1% amylase solution
- thermometers
- beaker of water at 20°C

**Obtaining evidence**

1. Put one drop of iodine into six of the wells of a tile. Label them 0, 2, 4, 6, 8, and 10 minutes.
2. The temperatures you are going to use are 5, 20, 35, 50, and 65°C. Add 1 cm³ of 1% amylase solution to 5 cm³ of 1% starch solution in a test tube. Place the test tube into the 5°C beaker of water and ice.
3. Immediately remove one drop from the test tube, and add it to the well marked 0 minutes. Record whether the iodine turns black or remains orange.
4. Take one drop of the solution every 2 minutes (i.e. at 2, 4, 6, 8 and 10 minutes) and add it to the iodine in the appropriate well of the tile.
5. Repeat steps 2–4 for each different temperature.
**Activity Extension**

**Enzymes at work** (continued)

**Presenting the results**

6. Record in a table whether the iodine turns black each time.

**Considering the evidence**

7. Graph your results using a line graph. The input variable should be temperature, and the outcome variable should be the time needed before the iodine stops turning black.

1. Which temperature is best for enzyme action?
2. Why do you think this temperature is best for enzymes to work?
3. Suggest why you get the pattern of results seen.

**Evaluating**

4. How would you improve the accuracy of your experiment?
### Running the activity

Give pupils access to the pupil book. You may need to remind them about how to write a formal letter, and suggest that they plan the letter beforehand, and make it appear on a manuscript paper background in their books.

### Other relevant material

**Skill sheet 4: Web searches**

Pupils will need access to the pupil book, Page 9.

### ICT opportunities

Pupils could write the letters using a word processor.

Pupils could search the Internet for more information on the doctor and his patient. See the following website:

History Highlights of Nutrition

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<table>
<thead>
<tr>
<th>Type</th>
<th>Purpose</th>
<th>Differentiation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper</td>
<td>Pupils imagine they are Dr William Beaumont as described in the pupil book. They write a letter to a friend, describing their patient, Alexis St Martin, and their findings about digestion.</td>
<td>Extension</td>
</tr>
</tbody>
</table>

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This worksheet may have been altered from the original on the CD-ROM.

Sheet 1 of 1
You are going to imagine that you are Dr Beaumont and write a letter about one of your patients.

1. Read about Dr Beaumont on page 9 of the textbook.
2. Do some research on the Internet about Dr Beaumont’s experiment.
3. Imagine you are Dr Beaumont writing a letter to a friend about Alexis St Martin, your patient. Make sure you cover the following points in your letter:
   - Explain what makes Alexis so special.
   - Describe what happened to the meat after you had put it into Alexis’ stomach.
   - Explain what the meat and vegetables looked like after they had been in Alexis’ stomach for several hours.
   - Explain why they had changed appearance in this way.
The digestive system 2

Running the activity

This is a series of teacher demonstrations. You may have to give prompts to help the pupils guess which process is being visualised. Run the demonstrations as appropriate to the level of your students: Core (C), Help (H) or Extension (E).

Absorption through the gut (C, H, E) – Set up Visking tubing containing a starch and glucose solution (meal) in a beaker or boiling tube of water. Use an elastic band to fix the tubing to the top of the boiling tube or beaker. The water can be tested for the presence of starch and sugar to show the movement of particles through the Visking tubing.

Particle differences (C, H) – Use a sieve with peas (large molecules) and sand (small molecules) to compare the movement of small molecules and large molecules through the intestine wall.

Not all the activities have to be used in the same lesson, but can be used when suitable.

Other relevant material

It is sometimes difficult for pupils to see demonstrations clearly. If available, use a video camera (e.g. Flexicam) and a large screen.

Expected outcomes

Pupils should be able to say which process is being demonstrated.

Pitfalls

Absorption through the gut: It is sometimes tricky to get this right. Set up the experiment and leave for a while before the lesson (test before if necessary).

ICT opportunities

Pupils could make or watch an animation to visualise how the food moves through the Visking tubing, using Microsoft® PowerPoint or Macromedia Flash. There is a good range of animations available on the Internet.
The digestive system 2

Assistant notes

Other relevant material
It is sometimes difficult for pupils to see demonstrations clearly. If available, use a video camera (e.g. Flexicam) and a large screen.

Equipment
For absorption through the gut:
- starch solution
- glucose solution
- Visking tubing
- elastic band
- beaker or boiling tube
- water

For particle differences:
- sand
- dried peas
- sieve
- container to collect sand

For your information

Running the activity
This is a series of teacher demonstrations. You may have to give prompts to help the pupils guess which process is being visualised. Run the demonstrations as appropriate to the level of your students: Core (C), Help (H) or Extension (E).

Absorption through the gut (C, H, E) – Set up Visking tubing containing a starch and glucose solution (meal) in a beaker or boiling tube of water. Use an elastic band to fix the tubing to the top of the boiling tube or beaker. The water can be tested for the presence of starch and glucose to show the movement of particles through the Visking tubing.

Particle differences (C, H) – Use a sieve with peas (large molecules) and sand (small molecules) to show the movement of small molecules between large molecules through the intestine wall.

Not all the activities have to be used in the same lesson, but can be used when suitable.

Expected outcomes
Pupils should be able to say which process is being demonstrated.

Pitfalls
Absorption through the gut: It is sometimes tricky to get this right. Set up the experiment and leave for a while before the lesson (test before if necessary).
Running the activity

Pupils carry out the activity to gain understanding of the importance of surface area to volume ratio in living organisms. They use maths cubes to visualise the different blocks. A resource sheet showing the different blocks is provided, so the activity could be completed just with the resource sheet. Some pupils may be able to complete the table without these aids.

Other relevant material

A5b Resource sheet
64 maths cubes per group or pupil

Safety notes

Warn pupils inclined to misbehave about inappropriate behaviour with the maths cubes.

ICT opportunities

Pupils could visualise the cubes using a design package such as Design View or Corel Draw.

Answers

<table>
<thead>
<tr>
<th>Dimensions of block(s)</th>
<th>Number of blocks made</th>
<th>Total number of surfaces</th>
<th>Total volume of all blocks</th>
<th>Total surface area</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 x 4 x 4</td>
<td>1</td>
<td>6</td>
<td>64</td>
<td>96</td>
</tr>
<tr>
<td>2 x 4 x 4</td>
<td>2</td>
<td>12</td>
<td>64</td>
<td>128</td>
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<td>2 x 2 x 4</td>
<td>4</td>
<td>24</td>
<td>64</td>
<td>160</td>
</tr>
<tr>
<td>2 x 2 x 2</td>
<td>8</td>
<td>48</td>
<td>64</td>
<td>192</td>
</tr>
<tr>
<td>2 x 2 x 1</td>
<td>16</td>
<td>64</td>
<td>64</td>
<td>256</td>
</tr>
<tr>
<td>2 x 1 x 1</td>
<td>32</td>
<td>128</td>
<td>64</td>
<td>320</td>
</tr>
<tr>
<td>1 x 1 x 1</td>
<td>64</td>
<td>256</td>
<td>64</td>
<td>384</td>
</tr>
</tbody>
</table>

1. It stays the same.
2. The ratio increases.
3. It is highly folded into very small villi, thus giving a large surface area but in a small volume.
4. To help absorption of food.
5. Small structures (alveoli) that increase the total surface area.
Digested food will mostly be absorbed through the small intestine. The surface lining the inside of the small intestine is made up of millions of villi. You are going to examine how villi help the small intestine absorb digested food.

1 Build a large block four cubes wide, four cubes high and four cubes deep. You are going to ‘cut’ your block in half over and over again, until you have 64 cubes that are $1 \times 1 \times 1$. Look at the resource sheet if you’re not sure what to do.

2 Copy and complete this table as you divide your block. The first line has been completed for you.

<table>
<thead>
<tr>
<th>Dimensions of block(s) in cubes</th>
<th>Number of blocks made</th>
<th>Total number of surfaces you can see (surface area)</th>
<th>Total volume of all the blocks</th>
<th>Surface area : volume ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>$4 \times 4 \times 4$</td>
<td>1</td>
<td>96</td>
<td>64</td>
<td></td>
</tr>
<tr>
<td>$2 \times 4 \times 4$</td>
<td>2</td>
<td>128</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$2 \times 2 \times 4$</td>
<td>4</td>
<td>160</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$2 \times 2 \times 2$</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$2 \times 2 \times 1$</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$2 \times 1 \times 1$</td>
<td>32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$1 \times 1 \times 1$</td>
<td>64</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 What happens to the total volume of all the blocks as they are divided?
Food needs to be absorbed quickly into a large volume of blood, by passing through the surface of the small intestine. We can get a good idea of how well the small intestine is suited to quick absorption by comparing the surface area to volume ratio of the small blocks and the large blocks.

2 What happens to the surface area to volume ratio as you divide the blocks up more?

3 Although the small intestine fits into the volume of your abdomen, its total surface area is equivalent to the surface area of a tennis court. Explain how this is possible by talking about villi.

4 Why does the intestine wall need a large surface area : volume ratio?

5 The lungs also need to have a large surface area to volume ratio to allow oxygen to be absorbed as quickly as possible. What feature would you expect to find in the lungs to help with this?
Surface area

Start with 1 block like this
2 blocks like this

4 blocks like this
8 blocks like this

16 blocks like this
32 blocks like this

64 blocks like this
A1 What's in food?

**Suggested alternative plenary activities (5–10 minutes)**

<table>
<thead>
<tr>
<th>Review learning</th>
<th>Sharing responses</th>
<th>Group feedback</th>
<th>Word game</th>
<th>Looking ahead</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wordsearch to find names of nutrients.</td>
<td>Pupils share results of the food tests in Activity A1a.</td>
<td>In groups, pupils share results from Activity A1b.</td>
<td>Pupils play Snap!, matching the nutrients with their functions in the body.</td>
<td>Pupils identify the carbohydrates, fats and proteins on a variety of restaurant menus.</td>
</tr>
</tbody>
</table>

**Review learning**
- Ask pupils to complete the wordsearch on the pupil sheet.
- Ring the words on a copy of the pupil sheet and show it as an OHT for them to check their answers. Use the words on it to introduce the lesson.

**Sharing responses**
- Pupils share their results of food tests in Activity A1a.
- Extension activity gives pupils an opportunity to construct Venn diagrams to summarise the results. You could introduce this method of presentation to other pupils on the board, using the diagrams to show what nutrients each type of food contained.

**Group feedback**
- In groups, pupils share and compare their answers from Activity A1b.
- Take feedback from each group, leading to a class discussion.

**Word game**
- Ask pupils to play Snap! in pairs, using the cards on the pupil sheet, matching the nutrients with their functions in the body.

**Looking ahead**
- Bring in a selection of menus from restaurants serving food of different ethnic origins.
- Ask pupils to identify the carbohydrates, fats and proteins on each menu.

**Equipment**
- A selection of restaurant menus
What's in food?

Review learning

The names of the nutrients are hidden in the wordsearch. See how many you can find.

- vitamin
- carbohydrate
- protein
- fat
- mineral

L R E A C D E A E G J E V
D F N V H G D I F A T M G
E N O I T E N I M A T I V
Z J V U F B E S R D G W X
C V D S C I E D S R T N V
D S B E E O Y L N T J D I
B D E J R H A A G F K L
O G M C O R F R S L Y W X
J A A B D E N E P P S B D
M P R O T E I N S A A E C
E A I P E Y E I X Z B I J
C K M N O S U M T R V P P

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### What's in food?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>fat</td>
<td>protein</td>
</tr>
<tr>
<td>fat</td>
<td>protein</td>
</tr>
<tr>
<td>water</td>
<td>carbohydrate</td>
</tr>
<tr>
<td>water</td>
<td>carbohydrate</td>
</tr>
<tr>
<td>vitamin</td>
<td>energy</td>
</tr>
<tr>
<td>vitamin</td>
<td>energy</td>
</tr>
<tr>
<td>energy</td>
<td>growth and repair</td>
</tr>
<tr>
<td>energy</td>
<td>growth and repair</td>
</tr>
<tr>
<td>where chemical reactions happen</td>
<td>needed in small amounts</td>
</tr>
<tr>
<td>where chemical reactions happen</td>
<td>needed in small amounts</td>
</tr>
</tbody>
</table>
Balanced diet

Suggested alternative plenary activities (5–10 minutes)

<table>
<thead>
<tr>
<th>Review learning</th>
<th>Sharing responses</th>
<th>Group feedback</th>
<th>Word game</th>
<th>Looking ahead</th>
</tr>
</thead>
<tbody>
<tr>
<td>In pairs, pupils prepare four quick questions about the key points in the last lesson.</td>
<td>Pupils show their presentations from Activity A2b to the rest of the class.</td>
<td>Pupils read out the letters from Activity A2a, and combine the ideas to produce a ‘group letter’.</td>
<td>Pupils play a ‘word splat’ to recap the key words from A1 and A2.</td>
<td>Pupils list five things that they consider ‘bad’ for them in their diet.</td>
</tr>
</tbody>
</table>

Review learning

- In pairs, pupils prepare four quick questions about the key points in the last lesson.
- Each pair should exchange questions with another pair, and try to answer their questions.

Sharing responses

- Pupils show their presentations from Activity A2b to the rest of the class.

Group feedback

- Pupils read out their letters from Activity A2a.
- In their groups, they could combine their ideas to produce a ‘group letter’.

Word game

- Initiate a ‘word splat’ by asking pupils to devise questions that can be answered by pointing to the key words for the lesson. The key words should be written on the board/OHT.
- Divide the class into two groups. A pupil from each group should be invited to stand close to the board/OHT.
- Choose a pupil to ask a question. The pupils by the board/OHT must each say the word and try to point to it first. The loser chooses another member of his or her group to stand at the board/OHT.

Looking ahead

- Pupils list five things that they consider ‘bad’ for them in their diet.
- Take suggestions from the class and compile an agreed list on the board.

Words
- nutrients, carbohydrates, fats, proteins, vitamins, minerals, fibre, rickets, goitre, balanced diet, recommended daily allowance (RDA), obese, anorexia nervosa, vegetarian, vegan
A3 Healthy or not?

**Suggested alternative plenary activities (5–10 minutes)**

<table>
<thead>
<tr>
<th>Review learning</th>
<th>Sharing responses</th>
<th>Group feedback</th>
<th>Word game</th>
<th>Looking ahead</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pupils write out a dietician's prescription for a good diet for themselves.</td>
<td>Pupils write a short newspaper report of the debate from Activity A3b discussing the arguments put forward.</td>
<td>Pupils share ideas from the letters prepared in Activity A3c.</td>
<td>Check pupils’ progress by playing Taboo using diet and nutrient vocabulary.</td>
<td>Ask pupils to write/draw their ideas about what happens to food once it has been eaten.</td>
</tr>
</tbody>
</table>

**Review learning**
- Each pupil writes out a dietician’s prescription for a good diet for himself or herself.

**Sharing responses**
- Pupils read out their newspaper report of the debate from Activity A3b.
- Discuss any differences in the reports of the arguments put forward.

**Group feedback**
- In groups, pupils share ideas from the letters prepared in Activity A3c.
- In groups, ask pupils to design a balanced meal for their brother, taking into account the ideas they included in their letters.

**Word game**
- Pupils play Taboo, using cards cut out from the pupil sheet.
- Give one pupil a card with a mystery word on it. The pupil offers clues to the class to allow them to identify the mystery word, but is not allowed to use the given ‘taboo’ words in their clues.
- You can adjust the level of challenge by banning the use of just the first, or first and second words in the taboo list, and then increase the number later.

**Looking ahead**
- Ask pupils to write/draw their ideas about what happens to food once it has been eaten.
- Collect ideas from the class and summarise them on the board.
Healthy or not?

Word game

**Balanced diet**
- fat
- food
- nutrient

**Recommended daily allowance**
- amount
- food label
- balanced diet

**Nutrient**
- substance
- food
- food label

**Protein**
- repair
- grow
- nutrient

**Heart disease**
- fat
- blockage
- blood vessels

---

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**A4 Total breakdown**

**Suggested alternative plenary activities (5–10 minutes)**

<table>
<thead>
<tr>
<th>Review learning</th>
<th>Sharing responses</th>
<th>Group feedback</th>
<th>Word game</th>
<th>Looking ahead</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pupils put the structures in the digestive system in the correct order.</td>
<td>Pupils collate results and conclusions from Activity A4b.</td>
<td>In groups, pupils discuss how good each model is from the demonstrations.</td>
<td>Wordsearch on parts of the digestive system.</td>
<td>As a class, classify statements on the cards into ‘before enzymes added’ and ‘after enzymes added’. Use these as a springboard for the next lesson.</td>
</tr>
</tbody>
</table>

**Review learning**

- Give out the pupil sheets with diagrams of the organs of the digestive system. Each is labelled with a code number.
- Pupils arrange them into what they think is the correct order and find out the code made up by the numbers.

**Sharing responses**

- Pupils collate results and conclusions from Activity A4b.
- Discuss ways in which their conclusions can be made more accurate, including taking samples more often, and other ways of assessing when starch has been completely digested.

**Group feedback**

- In groups, pupils summarise what each model shows from Activity A4a.
- Ask pupils to write down how each model is similar, and how each model is different to what actually happens in the digestive system.

**Word game**

- Ask pupils to complete the wordsearch on the pupil sheet.
- Ring the words on a copy of the pupil sheet and show it as an OHT for them to check their answers.

**Looking ahead**

- Make flashcards from the words opposite, showing the parts of the digestive system that food goes through before and after enzymes are added.
- Hand out each flashcard to different pupils. Ask these pupils to hold up their cards then, as a class, decide which group (before enzymes added or after enzymes added) each person carrying a card should go into.
Review learning

- Cut out the organs of the digestive system below and arrange them in the correct order.
- Write down the numbers to find out the code.
Word game

All of these words are connected with digestion and the digestive system. See how many you can find in the grid below.

mouth  small intestine  gullet  oesophagus

stomach  large intestine  anus  enzyme

![Grid with letters and words related to digestion](image-url)
Taking it in

Suggested alternative plenary activities (5–10 minutes)

<table>
<thead>
<tr>
<th>Review learning</th>
<th>Sharing responses</th>
<th>Group feedback</th>
<th>Word game</th>
<th>Looking back</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pupils write their own questions about the key ideas.</td>
<td>As a class, discuss the results and conclusions from the demonstrations about absorption in Activity A5a.</td>
<td>In groups, pupils discuss their responses from Activity A5b.</td>
<td>Check pupils' progress on digestion by playing Bingo.</td>
<td>Pupils revise and consolidate knowledge from the unit.</td>
</tr>
</tbody>
</table>

**Review learning**
- In pairs, pupils prepare four quick questions about the key ideas in the lesson.
- Each pair should exchange questions with another pair, and try to answer their questions.

**Sharing responses**
- Discuss the results and conclusions from the demonstrations about absorption in Activity A5a.

**Group feedback**
- In groups, pupils discuss responses to the questions from Activity A5b to check their ideas about surface area.

**Word game**
- Pupils select nine words from the list to write into their bingo grid.
- Read out definitions from the teacher sheet in any order. Pupils match these to their chosen words. The game is over when a pupil can strike out a line.
- The 'winning' pupil has to recall the definitions of the words as they read each one in the winning line to the class.

**Looking back**
- Pupils revise and consolidate knowledge from the unit.
- They can use the Unit map, Pupil checklist, or the Test yourself questions.
Word game

Choose nine words from the list below and write them in the empty grid.

Cross out each word when you hear the teacher read out its definition.

Shout BINGO! when you have crossed out a line of three words on the card.

The line can be across, down or diagonal.

<table>
<thead>
<tr>
<th>nutrient</th>
<th>digestion</th>
<th>glucose</th>
<th>mouth</th>
</tr>
</thead>
<tbody>
<tr>
<td>enzymes</td>
<td>villi</td>
<td>egestion</td>
<td>anus</td>
</tr>
<tr>
<td>constipation</td>
<td>large intestine</td>
<td>fatty acids</td>
<td></td>
</tr>
</tbody>
</table>

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Word game

Read out the definitions below in any order.

1. A useful substance in food [nutrient]
2. Large food molecules being broken down into smaller ones [digestion]
3. When you digest starch, you produce this [glucose]
4. When you digest fat, you produce this [fatty acids]
5. These increase the surface area of the intestines [villi]
6. When undigested material leaves the body [egestion]
7. Chemicals which digest large molecules [enzymes]
8. Where food enters the body [mouth]
9. Food that has passed through the small intestine wall into the blood [absorbed]
10. Where faeces leave the body [anus]
11. You have this when you find it difficult to push faeces out of your body [constipation]
12. The part of the intestine where water is absorbed into the blood [large intestine]
Chewing it over - Think about

**Suggested alternative plenary activities (5–10 minutes)**

<table>
<thead>
<tr>
<th>Group feedback</th>
<th>Bridging to other topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ask pupils to write a set of guidelines for other pupils on how to interpret different types of graphs.</td>
<td>Ask pupils to think of five other investigation scenarios where they may use a line graph to help make a conclusion.</td>
</tr>
</tbody>
</table>

**Group feedback**

- Ask pupils to write a set of guidelines for other pupils on how to interpret different types of graphs.

**Bridging to other topics**

- Ask pupils to think of five other investigation scenarios where they may use a line graph to help make a conclusion.
A1  What's in food?

1 Draw lines to match the nutrients to what your body needs them for.

- carbohydrates
  - Needed for my body to grow and repair itself.
- vitamins and minerals
  - Needed to keep food moving through my system.
- proteins
  - Needed to give my body energy.
- fats
  - Needed to give my body energy and keep the body warm.
- fibre
  - Needed in tiny amounts to keep my body healthy.

2 Look at this list of foods.

<table>
<thead>
<tr>
<th>bread</th>
<th>fish</th>
<th>carrots</th>
<th>egg</th>
<th>beans</th>
</tr>
</thead>
<tbody>
<tr>
<td>meat</td>
<td>potatoes</td>
<td>strawberries</td>
<td>apples</td>
<td>tomatoes</td>
</tr>
<tr>
<td>cake</td>
<td>peas</td>
<td>cheese</td>
<td>milk</td>
<td>butter</td>
</tr>
</tbody>
</table>

- a Some have a lot of fat in them. Colour these foods in yellow.
- b Some have a lot of protein in them. Colour these foods in red.
- c Some have a lot of carbohydrate in them. Colour these foods in blue.
1. Use some of these words to fill the gaps.

- A balanced diet is one that has the right amounts of nutrients, fibre and balanced to keep me fit and healthy.

- A balanced diet is balanced for different people.

- How much energy your body needs depends on whether you are the same, how active you are and the size of your body.

- If you take in more energy than your body needs you may become obese. People who are very overweight for their height are called obese.

- Anorexia is an eating disorder where someone eats hardly anything and becomes very underweight. They can die.
2 Look at these pieces of advice about diet.

- A high fat diet is healthy.
- A low salt diet is good for you.
- A high salt diet is good for you.
- A low fat diet is healthy.
- Eat five portions of fruit and vegetables a day.
- Eat just one portion of fruit and vegetables a day.

a Find the good pieces of advice. Colour them green.
b Find the bad pieces of advice. Colour them red.

3 Look at these pairs of people. For each pair, draw a circle around the person who has the higher energy needs.
Healthy or not?

1 Look at this information from a Cerius bar.

<table>
<thead>
<tr>
<th>NUTRITIONAL INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 g provides:</td>
</tr>
<tr>
<td>Energy 1900 kJ/450 kcal.</td>
</tr>
<tr>
<td>Protein 9 g.</td>
</tr>
<tr>
<td>Carbohydrates 67 g (of which are sugars 37 g, starch 30 g).</td>
</tr>
<tr>
<td>Fat 16 g (of which saturates 14 g).</td>
</tr>
<tr>
<td>Fibre 1.6 g.</td>
</tr>
<tr>
<td>Salt 2 g.</td>
</tr>
<tr>
<td>Thiamine (B₁) 0.9 mg (65%).</td>
</tr>
<tr>
<td>Riboflavin (B₂) 1.0 mg (65%).</td>
</tr>
<tr>
<td>Niacin 11.3 mg (65%).</td>
</tr>
<tr>
<td>Vitamin B₆ 1.3 mg (65%).</td>
</tr>
<tr>
<td>Folic acid 125 µg (65%).</td>
</tr>
<tr>
<td>Calcium 720 mg (90%).</td>
</tr>
<tr>
<td>Iron 8.8 mg (65%). (%) = % Recommended Daily Allowance.</td>
</tr>
</tbody>
</table>

One Cerius bar weighs 25 g.

a What is the most salt you should have in your diet each day? Circle the correct answer.
6 grams / 9 grams / 12 grams

b How much salt does 100 grams of Cerius bars contain? ........................................ grams.

c Circle the correct answer.
One Cerius bar, weighing 25 grams, would contain 0.5 / 2 / 4 grams of salt.

d Circle the correct answer.
Scientists say that we should eat very few foods that contain more than 10 / 14 / 18 / 22 grams of fat out every 100 grams of food.

e 100 grams of Cerius bars contain ......................... grams of fat.

f Circle the correct answer.
A Cerius bar is a high / low fat food.

g 100 grams of Cerius bars contain ......................... grams of sugars.
A3 Healthy or not? (continued)

2 Underline the right words. Cross out the wrong words.

a Cerius bars are a high / low fat food.
b Cerius bars contain lots of / some fibre.
c Cerius bars do / do not contain many vitamins and minerals.
d Cerius bars contain lots of / little salt.
e Cerius bars contain lots of / not a lot of sugar.
f Cerius bars are / are not a healthy choice for breakfast.

3 Draw lines to match the ingredients to their health risks.

- Salt: Too much of this increases the risk of a heart attack.
- Sugar: Too much of this can cause high blood pressure. This increases the risk of heart disease and strokes.
- Fat: This causes tooth decay.

4 Write true or false for each sentence.

a Processed foods like baked beans often contain little salt and sugar. .................
b Cereal bars are sticky and the sugar sticks to your teeth. .................
c Too much fat in your diet makes your teeth rot. .................
d More than 6 grams of salt a day is healthy for you. .................
1. Use words from this list to fill in the gaps.

- My food is made up of particles called ________________.
- Carbohydrates, ________________ and ________________ are made up of large ________________.
- ________________ and minerals are made up of small molecules.
- My body can only use the big molecules in proteins, ________________ and ________________ once they have been broken down into smaller ones. This process is called ________________.
- Digestion happens in my ________________ system.
- Chemicals called ________________ break the large molecules into small molecules.

2. Write true or false for each sentence.

- My gut is 9 metres long. ________________
- Enzymes slow down digestion. ________________
- Big starch molecules are made up of lots of little glucose molecules. ________________
- Different enzymes break down different nutrients. ________________
3 Look at this diagram of the digestive system.

Use these words to answer all the parts of this question.

- liver
- small intestine
- anus
- mouth
- gall bladder
- stomach
- large intestine

a Complete the labelling of the diagram.

b The journey your food takes through your digestive system starts in your mouth and ends at your anus.

Fill in this list to show the journey your food takes.

- mouth
- ..........................................................
- ..........................................................
- ..........................................................
- ..........................................................
- ..........................................................

- anus

- ..........................................................
- ..........................................................
- ..........................................................
- ..........................................................
- ..........................................................

- ..........................................................
- ..........................................................
- ..........................................................
- ..........................................................
- ..........................................................


c Enzymes are added to your food in three places. List these three places.

- ..........................................................
- ..........................................................
- ..........................................................
Taking it in

1. Draw lines to match the words to their descriptions.
   - small intestine
   - absorption
   - villi
   - large intestine
   - anus
   - egestion

   Getting rid of waste through the anus.
   Here, water from the waste food goes into the blood.
   This is when the small food molecules go into the blood.
   Tiny 'fingers' that cover the inside wall of the small intestine.
   Where waste food passes out of the body.
   Where small food molecules go into the blood.

2. Tick the boxes to show the right answers.

   a. Only tiny food molecules can get through the wall of the small intestine. This is because ...
      ..the wall of the small intestine has big holes in it
      ..the wall of the small intestine has tiny holes in it
      ..the wall of the small intestine has no holes in it

   b. The villi in the small intestine ...
      ..give a very big surface
      ..give a very small surface
      ..give a bumpy surface

   c. A very large surface ...
      ... helps food absorption happen quickly
      ... helps food absorption happen slowly
      ... doesn’t help food absorption.
Chewing it over

1. Wendy did an experiment about starch and enzymes. She tried to find out if the amount of enzyme added to starch changed how long it took for all the starch to be digested.

   a. Here are the steps Wendy did in the experiment, but they’re all jumbled up! Write numbers in the boxes to put them in order.

<table>
<thead>
<tr>
<th>Step</th>
<th>Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop the timer when the blue-black colour changes back to brown. Write down the time in the table.</td>
<td>Add brown iodine to the starch. It turns blue-black.</td>
</tr>
<tr>
<td><img src="image1" alt="Enzyme" /> <img src="image2" alt="Starch" /> <img src="image3" alt="Iodine" /></td>
<td><img src="image4" alt="Iodine" /></td>
</tr>
<tr>
<td>Add the enzyme and start the timer.</td>
<td>Put the starch on to the spotting tile.</td>
</tr>
<tr>
<td><img src="image5" alt="Enzyme" /> <img src="image6" alt="Starch" /></td>
<td><img src="image7" alt="Starch" /></td>
</tr>
</tbody>
</table>

b. What colour is iodine?

c. What colour is iodine when it is added to starch?
Chewing it over (continued)

Here are Wendy's results.

<table>
<thead>
<tr>
<th>Amount of enzyme (%)</th>
<th>Time to digest the starch (seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>260</td>
</tr>
<tr>
<td>2</td>
<td>210</td>
</tr>
<tr>
<td>3</td>
<td>160</td>
</tr>
<tr>
<td>4</td>
<td>110</td>
</tr>
<tr>
<td>5</td>
<td>60</td>
</tr>
</tbody>
</table>

a Look at the graph paper. Fill in the missing numbers on each axis.

b Plot Wendy's results on the graph paper.

c Use your ruler to join the points up with a straight line.

d What has Wendy found out by doing this experiment?

The higher the amount of enzyme ...
... the slower the starch is digested. [ ]
... the faster the starch is digested.  [ ]
... there is no effect on how quickly the starch is digested. [ ]

e If Wendy had used 2.5% of enzyme, how long would it have taken for the starch to be digested?

[ ] seconds
Food and digestion

A1 What's in food?
1 carbohydrates – Needed to give my body energy.
   vitamins and minerals – Needed in tiny amounts to keep my body healthy.
   proteins – Needed for my body to grow and repair itself.
   fats – Needed to give my body energy and keep my body warm.
   fibre – Needed to keep food moving through my system.
2 a Coloured yellow – egg, meat, cake, cheese, milk, butter
   b Coloured red – fish, egg, meat, cheese, milk
   c Coloured blue – bread, beans, potatoes, cake, peas

A2 Balanced diet
1 a balanced, nutrients, water
   b different
   c energy, growing, size (or weight)
   d fat, obese
   e Anorexia nervosa.
2 a Coloured green – Eat five portions of fruit and vegetables a day. A low salt diet is good for you. A low fat diet is healthy.
   b Coloured red – A high fat diet is healthy. Eat just one portion of fruit and vegetables a day. A high salt diet is good for you.
3 Clockwise from top left, circled – boy, construction worker, male office worker, pregnant woman.

A3 Healthy or not?
1 a 6 grams  e 16 grams
   b 2 grams  f high
   c 0.5 grams  g 37 grams
   d 14 grams
2 a high
   b some
   c do
   d a little
   e lots of
   f are not
3 salt – Too much of this can cause high blood pressure. This increases the risk of heart disease and strokes.
   sugar – This causes tooth decay.
   fat – Too much of this increases the risk of a heart attack.
4 a false
   b true
A4 Total breakdown
1 a molecules
   b proteins, fats, molecules
   c vitamins
   d fats, carbohydrates, digestion
   e digestive
   f enzymes
2 a true
   b false
   c true
   d true
3 a Anticlockwise from top – mouth, liver, gall bladder, large intestine, anus, small intestine, stomach
   b mouth, stomach, small intestine, large intestine, anus
   c mouth, stomach, small intestine

A5 Taking it in
1 small intestine – Where small food molecules go into the blood.
   absorption – This is when the small food molecules go into the blood.
   villi – Tiny ‘fingers’ that cover the inside wall of the small intestine.
   large intestine – Here, water from the waste food goes into the blood.
   anus – Where waste food passes out of the body.
   egestion – Getting rid of waste through the anus.
2 a The wall of the small intestine has tiny holes in it.
   b Give a very big surface.
   c Helps food absorption happen quickly.

A6 Chewing it over
1 a step 4, step 2, step 3, step 1
   b brown
   c blue-black
2 a, b, c

Enzyme (%)
Time to digest starch (seconds)

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This worksheet may have been altered from the original on the CD-ROM.
What's in food?

Look at the breakfast cereal labels below.

Which breakfast cereal contains:

a. Which breakfast cereal contains:
   i. the most carbohydrate?  
   ii. the least sugar?  
   iii. the most fibre?  
   iv. the least fat?  
   v. the most fat?  
   vi. the least Vitamin C?

b. Name another nutrient needed by the body not contained in cereals.

c. Which cereal is best for healthy teeth and bones?

d. Copy and complete the sentence below:
The healthiest of the breakfast cereals is __________ because _________________.

Copy and complete the table below:

<table>
<thead>
<tr>
<th>Nutrient Function</th>
<th>Where found</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrate</td>
<td>Growth and repair, Meat</td>
</tr>
<tr>
<td>Fibre</td>
<td></td>
</tr>
<tr>
<td>Vitamin C</td>
<td>Healthy teeth and bones</td>
</tr>
<tr>
<td>Fat</td>
<td>Butter</td>
</tr>
</tbody>
</table>

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This worksheet may have been altered from the original on the CD-ROM.
3 Explain why animals must eat, but plants do not eat.

4 Explain why marathon runners must drink as they run.

EXTENSION

5 Diets have improved enormously over the last century. This is partly because people can afford more and better food and partly because we understand the importance of a balanced diet now.

Diets often used to be deficient in certain components, such as Vitamin D, iron and iodine. This is not now a problem in developed countries. However, in some countries diets have changed very little. Diseases that we no longer see in the West are still common. The World Health Organisation and international aid charities, such as Oxfam, are committed to working to improve the diets of people in these countries.

a Write a sentence to explain the meaning of the word ‘deficient’.

b Write a paragraph to explain the importance of each of the nutrients underlined in the text.

c Why are the diets of people in developing countries still poor?

d How might aid charities improve these diets?

6 Vasco da Gama, a Portuguese explorer, sailed round Africa to India in 1498. By the time he reached Mombasa, in East Africa, his crew was ill. Their hands and feet were swollen and their gums were growing over their teeth, so they could not eat the hard biscuit and salted meat carried on the ship.

They reached Mombasa on 6th April, where local traders sold them oranges that the crew could just about manage to eat. By 12th April they had recovered.

a Explain why Vasco da Gama’s crew had become ill.

b Why did the oranges improve things so quickly?

c Da Gama said the cure was due to the ‘fine air’ of Mombasa. Suggest why he could have come to such a wrong conclusion.

d Citrus fruit was often prepared for a voyage by boiling it down in copper vats. Sailors still became ill, even after eating cooked citrus fruit. What does this information suggest to you about the effect of cooking citrus fruit?
A2 Balanced diet

HELP

1

a Which of these jobs uses the most energy per hour?
b Which job uses the least energy per hour?
c Explain why the teacher uses more energy than the computer operator.
d i Which person is taking in more energy than they are using, every day?
   ii Explain how you could tell.

2 a Which two nutrients are often too high in a 'Western diet'?
b Which one of these can cause heart attacks?
c The office worker is suffering from anorexia nervosa. Explain what this is.
A2 Balanced diet (continued)

3 Child and teenage obesity is now thought to be a major problem in the UK.
   a What is child and teenage obesity?
   b How might diet be a cause of obesity?
   c What else might be a reason for recent increases in child and teenage obesity?
   d Why would eating plenty of fruit and vegetables help to keep us healthy?

4 The diagram shows some items on Joe's school lunch menu.

<table>
<thead>
<tr>
<th>Course</th>
<th>Item</th>
<th>Amount of fat (g)</th>
<th>Amount of fibre (g)</th>
<th>Amount of protein (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main</td>
<td>Beefburger</td>
<td>19</td>
<td>1.0</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Cheeseburger</td>
<td>22</td>
<td>1.1</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Chicken pie</td>
<td>24</td>
<td>0.9</td>
<td>19</td>
</tr>
<tr>
<td>Potato</td>
<td>Baked</td>
<td>0</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Mashed</td>
<td>3</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Chips</td>
<td>17</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Drink</td>
<td>Water</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Orange juice</td>
<td>0</td>
<td>0</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>Milkshake</td>
<td>7</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

   a Choose one item from each course to give Joe:
      i the meal containing the most fat.
      ii the meal containing the least fat.
      iii the meal containing the most protein.
      iv the meal containing the least fibre.

   b Suggest one item that the school could add to the menu to increase the amount of fibre Joe eats.

   c Which drink would help Joe to grow healthy teeth?
The graphs show body mass data for adult men and women.

The table gives some information about five people.

<table>
<thead>
<tr>
<th>Name</th>
<th>Height (m)</th>
<th>Body mass (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>John</td>
<td>1.90</td>
<td>85</td>
</tr>
<tr>
<td>Jane</td>
<td>1.65</td>
<td>52</td>
</tr>
<tr>
<td>Edward</td>
<td>1.75</td>
<td>86</td>
</tr>
<tr>
<td>Sophie</td>
<td>1.80</td>
<td>61</td>
</tr>
<tr>
<td>Suzy</td>
<td>1.50</td>
<td>35</td>
</tr>
</tbody>
</table>

Jane is a successful runner. She keeps her body mass down to the lower limit for her height.

Discus throwers keep their body mass close to the upper limit for their height.

a  i  Who is probably a discus thrower?

b  i  Who else, apart from Jane, is probably a runner?
   ii  Explain your choice.

c  Who is very overweight?

d  Why might a javelin thrower need to be at the upper limit for his or her height?

e  Why is it an advantage for runners to be at the lower limit?

f  Suzy has a disease. It is caused by her diet. Suggest what the disease might be and what caused it.

g  What advice would you give to Edward?
HELP

1. The label shown below is from a packet of fruit cereal. One serving is about one third of the amounts per 100g shown on the label.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Amount per 100g</th>
<th>RDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>1554kJ</td>
<td></td>
</tr>
<tr>
<td>Protein</td>
<td>14g</td>
<td></td>
</tr>
<tr>
<td>Carbohydrates</td>
<td></td>
<td></td>
</tr>
<tr>
<td>of which:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sugars</td>
<td>24g</td>
<td></td>
</tr>
<tr>
<td>starch</td>
<td>51g</td>
<td></td>
</tr>
<tr>
<td>Fat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>of which saturates</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1g</td>
<td>0.3g</td>
<td></td>
</tr>
<tr>
<td>Fibre</td>
<td>4g</td>
<td></td>
</tr>
<tr>
<td>Sodium</td>
<td>0.7g</td>
<td></td>
</tr>
<tr>
<td>Vitamins:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>7.5µg</td>
<td>5µg</td>
</tr>
<tr>
<td>C</td>
<td>90mg</td>
<td>60mg</td>
</tr>
<tr>
<td>B₁</td>
<td>2.1mg</td>
<td>1.4mg</td>
</tr>
<tr>
<td>B₂</td>
<td>2.4mg</td>
<td>1.6mg</td>
</tr>
<tr>
<td>B₆</td>
<td>6mg</td>
<td>2mg</td>
</tr>
<tr>
<td>B₁₂</td>
<td>1.5µg</td>
<td>1.0µg</td>
</tr>
<tr>
<td>Niacin</td>
<td>27mg</td>
<td>18mg</td>
</tr>
<tr>
<td>Folic acid</td>
<td>300µg</td>
<td>200µg</td>
</tr>
<tr>
<td>Minerals:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron</td>
<td>21mg</td>
<td>14mg</td>
</tr>
</tbody>
</table>

a. Which type of ingredient is providing most of the energy?

b. i. How much vitamin C will there be in one serving?
   ii. Is this amount enough?

c. How much energy would there be in one serving?

d. The sodium is in salt that is added to the cereal. Why might salt be added?
Healthy or not? (continued)

2 Copy and complete the sentences below:
   a. Too much salt is bad for me because
   b. My old granddad should not eat so much food containing a lot of fat because
   c. I should clean my teeth after eating sugary foods because

CORE

Look again at the cereal label in question 1.

3 One serving is one third of the quantities shown in the table. There are 500g of cereal in each packet.
   a. Calculate the amounts per serving (to one decimal place) for:
      i. protein  ii. starch  iii. fat  iv. fibre.
   b. Calculate the amounts per packet for:
      i. iron  ii. niacin  iii. Vitamin C  iv. sugars.
   c. Write a paragraph explaining why this fruit cereal might be considered to be a healthy breakfast choice.

EXTENSION

Look again at the cereal label in question 1.

4 Only one of the ingredients provides the recommended daily amount per serving. Which one is it?

5 Why would it be a bad idea to recommend that a friend should eat only this fruit cereal with milk each day?

6 None of the ingredients in the fruit cereal came from an organic source. Explain why a customer might be prepared to pay more to buy an organic fruit cereal.
1. The main parts of the digestive system, shown below, are in the wrong order. Write them in the correct order, starting at the mouth.

- mouth
- anus
- small intestine
- stomach
- large intestine
- gullet

2. Read the information below.

Ben has tea at 6.00 p.m. on Tuesday. He has fish and chips, an apple and a cup of tea. He chews the food well before he swallows it. He finishes his tea at 6.30 p.m.

At 7.00 p.m. the food has been mixed with enzymes in Ben’s stomach, which churns it around for several hours. By midnight, all of Ben’s meal has reached his small intestine. More enzymes are added to finish off the digestion. Nutrients are absorbed into Ben’s bloodstream for the next six hours.

Ben wakes up at 7.00 a.m. He needs to go to the toilet because his bladder is full. Since about 5.00 a.m. it has been full with water absorbed from his food.

Ben goes to school. When he gets home again, about 5.00 p.m., he needs to go to the toilet. All the solid waste from last night’s tea is ready to be removed.

a. Copy and complete the table, to show the order in which things happen inside Ben.

<table>
<thead>
<tr>
<th>Day</th>
<th>Time of day</th>
<th>What was happening to Ben</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuesday</td>
<td>6.00 p.m.</td>
<td>Finishes tea</td>
</tr>
<tr>
<td></td>
<td>7.00 p.m.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Midnight</td>
<td></td>
</tr>
<tr>
<td>Wednesday</td>
<td>7.00 p.m.</td>
<td>Water starts to be absorbed in large intestine</td>
</tr>
<tr>
<td></td>
<td>7.00 a.m.</td>
<td>Ben goes to toilet to remove solid waste</td>
</tr>
</tbody>
</table>

b. Through which part of Ben’s digestive system is the solid waste removed?

c. Where is Ben’s waste water stored?
A4  Total breakdown (continued)

CORE

3 The diagram shows part of a starch molecule.

   glucose       glucose       glucose       glucose       etc.

   etc.

   a Draw a diagram showing what the starch molecule might look like after it has been digested.

   b A chemical called amylase breaks down starch. To what family of chemicals does amylase belong?

4 Here is some information about enzymes:

   name                     function
   amylase                  converts starch into glucose.
   trypsin                  converts proteins into amino acids.
   protease                 converts proteins into amino acids.
   carbohydrase            converts starch into glucose.
   lipase                  converts fats into fatty acids and glycerol.
   pepsin                   converts proteins into amino acids.

Amylase is found in saliva in the mouth.
Pepsin and protease are found in the stomach.
Carbohydrase, trypsin and lipase are found in the small intestine.

   a In which part of the digestive system are the following digested by enzymes:
      i proteins?  ii starches?  iii fats?

   b The stomach contents are very acidic and break down many enzymes.
      Why might the amylase in saliva need replacing with carbohydrase, in the small intestine?

   c A piece of meat, chewed for several minutes in the mouth, still contains the same proteins as when it was first bitten off. Explain why.

   d The human gut does not contain a cellulose digesting enzyme.
      Plants are mostly made of cellulose.
      i Where, in a plant cell, is the cellulose (think back to Year 7 work on cells)?
      ii Why can cows digest grass when humans cannot?
EXTENSION

5 a Plot the following data, about pepsin, onto graph paper.

<table>
<thead>
<tr>
<th>pH</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to digest 1g of protein (minutes)</td>
<td>45</td>
<td>5</td>
<td>5</td>
<td>10</td>
<td>35</td>
<td>50</td>
</tr>
</tbody>
</table>

b At what pH is pepsin most effective?

c Why is pepsin suited to digestion in the stomach?

d In the small intestine, bile neutralises the stomach contents. Explain why pepsin is replaced by trypsin in the small intestine.

6 a At what temperature are most enzymes most effective?

b In terms of energy saving, explain the advantage of using biological washing powders over non-biological washing powders. (Hint: What wash temperature should you use with biological powders?)
The diagram shows a laboratory model of the digestive system.

**a** Use words from the list below to label the parts from A–F, shown above.

- anus
- gullet
- stomach
- mouth
- large intestine
- small intestine

**b** i What substance, which is represented by label X and contains amylase, is made in the mouth?

ii What substance is represented by label Y?

**c** What is produced, in a person, from the part labelled F on the model?

**d** Copy and complete the following sentence:

The pair of tights is a good model for this part of the digestive system because ...........................................
CORE

Look again at the model shown for question 1.

2  a  What is not represented, around the outside of parts D and E, that is important for getting absorbed nutrients round the body?
   
   b  i  What is not represented, on the inside of parts D and E, that is important for absorption?
      ii  Explain how this structure helps absorption to happen efficiently.
   
   c  i  Which substance is absorbed in part D?
      ii  Which substance is absorbed in part E?
   
   d  i  What is the main component of the material at point F?
      ii  Why is this substance not absorbed?
   
   e  i  Name one type of nutrient that does not have to be digested before it is absorbed.
      ii  Why does the nutrient you have named not need to be digested?

EXTENSION

Look again at the model shown for question 1.

3  a  What is the function of the enzymes that are injected, in the model, at point Z?
   
   b  Structure C, in real life, churns and squashes its contents for a few hours before moving them on to part D. Suggest why this is important.
   
   c  Gupta's saliva does not contain amylase. His small intestine does not make carbohydrase either.
      i  Why should Gupta avoid eating too many starchy foods?
      ii  What sort of food should Gupta eat, to make sure his body gets the energy it needs?
      iii  How might Gupta feel, if he does not eat the right sort of food?

4  a  Which molecule is the main component of the material produced by humans at point F?
   
   b  Why are humans not able to digest this molecule?
   
   c  Some animals can digest this molecule. How do they do it?
   
   d  On the model, the clip at point W represents a ring of muscle called a sphincter. A sphincter squeezes a tube to close it tightly shut.
      Anne is a gymnast. Suggest why it is very important, for Anne, that her sphincter is working properly.
### HELP

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 a i</td>
<td>Crystal Crunch</td>
<td>1</td>
</tr>
<tr>
<td>1 ii</td>
<td>Organoflakes</td>
<td>1</td>
</tr>
<tr>
<td>1 iii</td>
<td>Organoflakes</td>
<td>1</td>
</tr>
<tr>
<td>1 iv</td>
<td>Organoflakes</td>
<td>1</td>
</tr>
<tr>
<td>1 v</td>
<td>Snackipops</td>
<td>1</td>
</tr>
<tr>
<td>1 vi</td>
<td>Crystal Crunch</td>
<td>1</td>
</tr>
<tr>
<td>2 b</td>
<td>Water</td>
<td>1</td>
</tr>
<tr>
<td>2 c</td>
<td>Organoflakes</td>
<td>1</td>
</tr>
<tr>
<td>2 d</td>
<td>The healthiest of the breakfast cereals is Organoflakes because they contain the least fat but the most fibre and Vitamin C. Underscore shows pupil response.</td>
<td>2</td>
</tr>
</tbody>
</table>

Total for Help 10

### CORE

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 a</td>
<td><strong>Nutrient</strong>&lt;br&gt;Protein for energy e.g. bread</td>
<td>2 1</td>
</tr>
<tr>
<td>2 a</td>
<td><strong>Nutrient</strong>&lt;br&gt;Calcium for energy e.g. milk/cheese</td>
<td>2 1</td>
</tr>
<tr>
<td>2 a</td>
<td><strong>Function</strong>&lt;br&gt;Protein to keep food moving through the gut e.g. vegetables</td>
<td>2</td>
</tr>
<tr>
<td>2 a</td>
<td><strong>Function</strong>&lt;br&gt;Calcium prevents scurvy e.g. citrus fruit</td>
<td>2</td>
</tr>
<tr>
<td>2 a</td>
<td><strong>Function</strong>&lt;br&gt;Calcium keeps gums healthy e.g. milk/cheese</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Animals cannot make their own food/cannot do photosynthesis. Plants make their own food/can do photosynthesis.</td>
<td>1 1</td>
</tr>
<tr>
<td>4</td>
<td>Sweat a lot during the race; so needs to replace the water lost; because chemical reactions in the body take place in solution.</td>
<td>3</td>
</tr>
</tbody>
</table>

Total for Core 15

### EXTENSION

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 a</td>
<td>A shortage/absence of a nutrient in the diet.</td>
<td>1</td>
</tr>
<tr>
<td>5 b</td>
<td>Vitamin D – for strong bones and teeth; Iron – to make blood; Iodine – to produce growth hormone.</td>
<td>3</td>
</tr>
<tr>
<td>5 c</td>
<td>Not enough money to buy good food/lack of knowledge about diet/poor growing conditions. Accept equivalent answers.</td>
<td>1</td>
</tr>
<tr>
<td>5 d</td>
<td>Provide emergency food/education/improved farming methods.</td>
<td>1</td>
</tr>
<tr>
<td>6 a</td>
<td>No Vitamin C in diet; caused scurvy.</td>
<td>2</td>
</tr>
<tr>
<td>6 b</td>
<td>Contain lots of Vitamin C.</td>
<td>1</td>
</tr>
<tr>
<td>6 c</td>
<td>Importance of correct nutrients not understood.</td>
<td>1</td>
</tr>
<tr>
<td>6 d</td>
<td>Cooking destroys Vitamin C.</td>
<td>1</td>
</tr>
</tbody>
</table>

Total for Extension 11
### A2 - Balanced Diet

**HELP**

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 a</td>
<td>Labourer</td>
<td>1</td>
</tr>
<tr>
<td>1 b</td>
<td>Office worker</td>
<td>1</td>
</tr>
<tr>
<td>1 c</td>
<td>Standing/moving around.</td>
<td>1</td>
</tr>
<tr>
<td>1 d i</td>
<td>The lorry driver.</td>
<td>1</td>
</tr>
<tr>
<td>1 d ii</td>
<td>He is very fat.</td>
<td>1</td>
</tr>
<tr>
<td>2 a</td>
<td>Fat</td>
<td>1</td>
</tr>
<tr>
<td>2 b</td>
<td>Salt</td>
<td>1</td>
</tr>
<tr>
<td>2 c</td>
<td>Fat</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Loss of weight due to not eating.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Accept equivalent answers</td>
<td>1</td>
</tr>
</tbody>
</table>

**CORE**

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 a</td>
<td>Being very overweight (when you are young).</td>
<td>1</td>
</tr>
<tr>
<td>3 b</td>
<td>Too much fat/eating more than is needed.</td>
<td>1</td>
</tr>
<tr>
<td>3 c</td>
<td>Not enough exercise/too much TV or computer games etc.</td>
<td>1</td>
</tr>
<tr>
<td>3 d</td>
<td>Contain fibre and minerals/vitamins.</td>
<td>1</td>
</tr>
<tr>
<td>4 a i</td>
<td>Chicken pie + chips + milkshake.</td>
<td>1</td>
</tr>
<tr>
<td>4 a ii</td>
<td>Beefburger + baked potato + water or orange juice.</td>
<td>1</td>
</tr>
<tr>
<td>4 a iii</td>
<td>Cheeseburger + baked potato + milkshake.</td>
<td>1</td>
</tr>
<tr>
<td>4 a iv</td>
<td>Chicken pie + chips + any drink.</td>
<td>1</td>
</tr>
<tr>
<td>4 b</td>
<td>Any item of fruit or vegetable.</td>
<td>1</td>
</tr>
<tr>
<td>4 c</td>
<td>Milkshake</td>
<td>1</td>
</tr>
</tbody>
</table>

**EXTENSION**

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 a i</td>
<td>John</td>
<td>1</td>
</tr>
<tr>
<td>5 b i</td>
<td>Sophie</td>
<td>1</td>
</tr>
<tr>
<td>5 b ii</td>
<td>Has a body mass near the lower limit.</td>
<td>1</td>
</tr>
<tr>
<td>5 c</td>
<td>Edward</td>
<td>1</td>
</tr>
<tr>
<td>5 d</td>
<td>Needs a lot of muscle.</td>
<td>1</td>
</tr>
<tr>
<td>5 e</td>
<td>Less to carry round the track; so uses less energy/can run faster.</td>
<td>2</td>
</tr>
<tr>
<td>5 f</td>
<td>Anorexia nervosa.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Not eating enough to provide the energy she needs.</td>
<td>1</td>
</tr>
<tr>
<td>5 g</td>
<td>Two from: eat foods containing less fat/less carbohydrate/do more exercise.</td>
<td>2</td>
</tr>
</tbody>
</table>
### HELP

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Carbohydrate</td>
<td>1</td>
</tr>
<tr>
<td>b i</td>
<td>30mg. One mark for number and one for unit.</td>
<td>2</td>
</tr>
<tr>
<td>b ii</td>
<td>No</td>
<td>1</td>
</tr>
<tr>
<td>c</td>
<td>518kJ. One mark for number and one for unit.</td>
<td>2</td>
</tr>
<tr>
<td>d</td>
<td>For taste/to make sure we get the sodium we need.</td>
<td>1</td>
</tr>
<tr>
<td>2 a</td>
<td>Too much salt is bad for me because it can cause heart disease/stroke/high blood pressure.</td>
<td>1</td>
</tr>
<tr>
<td>b</td>
<td>My old granddad should not eat so much food containing a lot of fat because it increases the risk of heart disease/heart attack.</td>
<td>1</td>
</tr>
<tr>
<td>c</td>
<td>I should clean my teeth after eating sugary foods because the sugar feeds the microbes that cause tooth decay. Underlined text is pupil's answer.</td>
<td>1</td>
</tr>
</tbody>
</table>

**Total for Help 10**

### CORE

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 a i</td>
<td>4.7g</td>
<td>1</td>
</tr>
<tr>
<td>b i</td>
<td>17g</td>
<td>1</td>
</tr>
<tr>
<td>b ii</td>
<td>0.3g</td>
<td>1</td>
</tr>
<tr>
<td>b iv</td>
<td>1.3g</td>
<td>1</td>
</tr>
<tr>
<td>c</td>
<td>Two from: low in fat/low in sodium/ rich in vitamin/contains iron.</td>
<td>2</td>
</tr>
</tbody>
</table>

**Total for Core 11**

### EXTENSION

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Vitamin B6</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Does not contain enough of many of the ingredients.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Contains few minerals</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Would overload some of the vitamins etc.</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Organic contains no chemical residues which could damage health.</td>
<td>1</td>
</tr>
</tbody>
</table>

**Total for Extension 6**
### HELP

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mouth before gullet. Gullet before stomach. Stomach before small intestine. Small intestine before large intestine. Large intestine before anus.</td>
<td>5</td>
</tr>
<tr>
<td>2a</td>
<td>The completed table is shown below. Unshaded boxes are pupil answers.</td>
<td></td>
</tr>
<tr>
<td><strong>Day</strong></td>
<td><strong>Time</strong></td>
<td><strong>What was happening</strong></td>
</tr>
<tr>
<td>Tuesday</td>
<td>6.00 p.m.</td>
<td>Starts tea</td>
</tr>
<tr>
<td></td>
<td>6.30 p.m.</td>
<td>Finishes tea</td>
</tr>
<tr>
<td></td>
<td>7.00 p.m.</td>
<td>Food mixed with enzymes in stomach</td>
</tr>
<tr>
<td></td>
<td>Midnight</td>
<td>Food in small intestine</td>
</tr>
<tr>
<td>Wednesday</td>
<td>5.00 a.m.</td>
<td>Water starts to be absorbed in large intestine</td>
</tr>
<tr>
<td></td>
<td>7.00 a.m.</td>
<td>Toilet to remove water in bladder</td>
</tr>
<tr>
<td></td>
<td>5.00 p.m.</td>
<td>Toilet to remove solid waste</td>
</tr>
<tr>
<td>b</td>
<td>The anus.</td>
<td>1</td>
</tr>
<tr>
<td>c</td>
<td>His bladder.</td>
<td>1</td>
</tr>
</tbody>
</table>

**Total for Help**: 14

### CORE

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>3a</td>
<td>A diagram showing individual glucose units. Glucose hexagon must be intact and not joined to another one.</td>
<td>1</td>
</tr>
<tr>
<td>b</td>
<td>Enzymes</td>
<td>1</td>
</tr>
<tr>
<td>4a i</td>
<td>Stomach and small intestine.</td>
<td>2</td>
</tr>
<tr>
<td>ii</td>
<td>Mouth and small intestine.</td>
<td>2</td>
</tr>
<tr>
<td>iii</td>
<td>Small intestine.</td>
<td>1</td>
</tr>
<tr>
<td>b</td>
<td>Amylase is destroyed by acid in the stomach.</td>
<td>1</td>
</tr>
<tr>
<td>c</td>
<td>There are no protein digesting enzymes in the mouth/saliva.</td>
<td>1</td>
</tr>
<tr>
<td>d i</td>
<td>Cell wall.</td>
<td>1</td>
</tr>
<tr>
<td>ii</td>
<td>Must contain cellulose-digesting enzymes/cellulase.</td>
<td>1</td>
</tr>
</tbody>
</table>

**Total for Core**: 11

### EXTENSION

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>5a</td>
<td>Accurate plots; axes labelled; smooth curve drawn; minimum between pH1 and pH2. One mark for each answer.</td>
<td>4</td>
</tr>
<tr>
<td>b</td>
<td>pH1/pH2/between pH1 and pH2.</td>
<td>1</td>
</tr>
<tr>
<td>c</td>
<td>It is resistant to acid.</td>
<td>1</td>
</tr>
<tr>
<td>d</td>
<td>Pepsin works best in acid. Bile neutralises contents reducing the action of the pepsin so another enzyme is necessary that works better at neutral/alkaline pH.</td>
<td>1</td>
</tr>
<tr>
<td>6a</td>
<td>37°C/body temperature.</td>
<td>1</td>
</tr>
<tr>
<td>b</td>
<td>Can use cooler wash temperature; so less energy needed to heat the water.</td>
<td>2</td>
</tr>
</tbody>
</table>

**Total for Extension**: 12
HELP

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>A - mouth/teeth; B - gullet; C - stomach; D - small intestine; E - large intestine; F - anus.</td>
<td>6</td>
</tr>
<tr>
<td>b i</td>
<td>Saliva</td>
<td>1</td>
</tr>
<tr>
<td>ii</td>
<td>Food</td>
<td>1</td>
</tr>
<tr>
<td>c</td>
<td>Faeces</td>
<td>1</td>
</tr>
<tr>
<td>d</td>
<td>small molecules can pass through them but larger ones cannot. Accept any suitable answer.</td>
<td>1</td>
</tr>
</tbody>
</table>

Total for Help 10

CORE

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>2a</td>
<td>A good blood supply.</td>
<td>1</td>
</tr>
<tr>
<td>b i</td>
<td>Villi</td>
<td>1</td>
</tr>
<tr>
<td>ii</td>
<td>Increase the surface area so digested food is absorbed quickly.</td>
<td>1</td>
</tr>
<tr>
<td>c i</td>
<td>Digested nutrients/molecules of digested food.</td>
<td>1</td>
</tr>
<tr>
<td>ii</td>
<td>Water</td>
<td>1</td>
</tr>
<tr>
<td>d i</td>
<td>Fibre</td>
<td>1</td>
</tr>
<tr>
<td>ii</td>
<td>Molecules too large (to pass through walls of villi).</td>
<td>1</td>
</tr>
<tr>
<td>e i</td>
<td>Minerals or vitamins.</td>
<td>1</td>
</tr>
<tr>
<td>ii</td>
<td>Molecules are already small enough to be absorbed.</td>
<td>1</td>
</tr>
</tbody>
</table>

Total for Core 10

EXTENSION

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>3a</td>
<td>Break down large molecules into smaller ones that can be absorbed.</td>
<td>1</td>
</tr>
<tr>
<td>b</td>
<td>Mixes enzymes with food and helps to break up large pieces into smaller pieces.</td>
<td>1</td>
</tr>
<tr>
<td>c i</td>
<td>He cannot digest them/turn them into glucose so they will not be absorbed.</td>
<td>1</td>
</tr>
<tr>
<td>ii</td>
<td>Food containing glucose.</td>
<td>1</td>
</tr>
<tr>
<td>iii</td>
<td>Feels tired/lethargic/short of energy.</td>
<td>1</td>
</tr>
<tr>
<td>4a</td>
<td>Cellulase</td>
<td>1</td>
</tr>
<tr>
<td>b</td>
<td>Do not make cellulase.</td>
<td>1</td>
</tr>
<tr>
<td>c</td>
<td>Have bacteria in their gut that make cellulase.</td>
<td>1</td>
</tr>
<tr>
<td>d</td>
<td>Prevents food from falling back out when she is upside down.</td>
<td>1</td>
</tr>
</tbody>
</table>

Total for Extension 13

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This worksheet may have been altered from the original on the CD-ROM.
**A Food and digestion**

1. Draw lines to match the nutrients to their functions in the body.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>carbohydrates</td>
<td>keep body healthy in many ways</td>
</tr>
<tr>
<td>proteins</td>
<td>for growth and repair of tissues</td>
</tr>
<tr>
<td>fats</td>
<td>an immediate source of energy</td>
</tr>
<tr>
<td>vitamins and minerals</td>
<td>an energy store and vital part of cell membranes</td>
</tr>
</tbody>
</table>

2. Complete this table by adding the main nutrients found in the foods.

<table>
<thead>
<tr>
<th>Food</th>
<th>Main nutrient found in the food</th>
</tr>
</thead>
<tbody>
<tr>
<td>butter, margarine, milk, meat</td>
<td></td>
</tr>
<tr>
<td>fruit, vegetables, cereal, brown rice, brown bread</td>
<td>carbohydrate</td>
</tr>
<tr>
<td>potatoes, bread, rice</td>
<td></td>
</tr>
<tr>
<td>meat, fish, eggs, beans, milk</td>
<td>protein</td>
</tr>
</tbody>
</table>

3. Complete these sentences by choosing from the words below. You may use words once, more than once or not at all.

- **a** Your diet is what you eat. A ......................................... provides all the energy and nutrients that your body needs to stay healthy.
- **b** A healthy diet needs to have a balance of nutrients. This balance is not the same for everybody. A young active person would need more ................................... .
- **c** Weight-lifters need to build large muscles. To do this they need to eat a diet with lots of ...................................................... in it.
- **d** Vegetarians have a different diet. They do not eat meat. Meat contains ...................................................... , so vegetarians need to eat other foods to get this nutrient.

4. Processed foods contain salt, sugar and fat which can be bad for us. Draw lines to match each one to the problem it may cause.

<table>
<thead>
<tr>
<th>Food</th>
<th>Problem it may cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>salt</td>
<td>a risk of tooth decay</td>
</tr>
<tr>
<td>sugar</td>
<td>a risk of heart disease and strokes</td>
</tr>
<tr>
<td>fat</td>
<td>a risk of heart disease</td>
</tr>
</tbody>
</table>
A  **Food and digestion** (continued)

5 Look at the list of parts of the body. Underline the four which are part of the digestive system.

- stomach
- small intestine
- pancreas
- lungs
- mouth
- muscles

6 Complete these sentences by choosing from the words below.

- break down
- mouth
- stomach
- speed up

Enzymes are found in the ______________ , ______________ and small intestine.

They __________________________ digestion. Different enzymes

__________________________ different nutrients into smaller molecules.

7 Complete these sentences by crossing out the wrong words.

a Absorption happens when nutrients are small enough to pass into your blood/intestine.

b Vitamins, minerals and starch/glucose do not need to be digested before they are absorbed because they are already small enough.

8 Fibre and water are needed by the body.

Write true or false for each statement.

a Fibre is digested and absorbed into the blood. ______________

b Water is absorbed into the blood to be used by the body. ______________

c Fibre keeps food moving through your digestive system. ______________

d Fibre is needed for growth and repair. ______________
A  Food and digestion

1. Draw lines to match the nutrients to their functions in the body.

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2. Complete this table by adding the main nutrients found in the foods.

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<tr>
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</tr>
</thead>
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<td>butter, margarine, milk, meat</td>
<td>fat</td>
</tr>
<tr>
<td>fruit, vegetables, cereal, brown rice, brown bread</td>
<td>fibre</td>
</tr>
<tr>
<td>potatoes, bread, rice</td>
<td>carbohydrate</td>
</tr>
<tr>
<td>meat, fish, eggs, beans, milk</td>
<td>protein</td>
</tr>
</tbody>
</table>

3. Complete these sentences by choosing from the words below. You may use words once, more than once or not at all.

a. Your diet is what you eat. A **balanced diet** provides all the energy and nutrients that your body needs to stay healthy.

b. A healthy diet needs to have a balance of nutrients. This balance is not the same for everybody. A young active person would need more **carbohydrates**.

c. Weight-lifters need to build large muscles. To do this they need to eat a diet with lots of **protein** in it.

d. Vegetarians have a different diet. They do not eat meat. Meat contains **protein**, so vegetarians need to eat other foods to get this nutrient.

4. Processed foods contain salt, sugar and fat which can be bad for us. Draw lines to match each one to the problem it may cause.

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<tr>
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</tr>
<tr>
<td>sugar</td>
<td>a risk of heart disease and strokes</td>
</tr>
<tr>
<td>fat</td>
<td>a risk of heart disease</td>
</tr>
</tbody>
</table>
5 Look at the list of parts of the body. Underline the four which are part of the digestive system.

- stomach
- small intestine
- pancreas
- lungs
- mouth
- muscles

6 Complete these sentences by choosing from the words below.

- break down
- mouth
- stomach
- speed up

Enzymes are found in the __________, __________, and small intestine. They __________ digestion. Different enzymes __________ different nutrients into smaller molecules.

7 Complete these sentences by crossing out the wrong words.

a Absorption happens when nutrients are small enough to pass into your blood/ intestine.

b Vitamins, minerals and starch/ glucose do not need to be digested before they are absorbed because they are already small enough.

8 Fibre and water are needed by the body.

Write true or false for each statement.

a Fibre is digested and absorbed into the blood. __________

b Water is absorbed into the blood to be used by the body. __________

c Fibre keeps food moving through your digestive system. __________

d Fibre is needed for growth and repair. __________
A Food and digestion

1 Add two more substances needed for a healthy diet to this list. 2 marks
- carbohydrate
- vitamins
- minerals

2 Look at these foods. What is the main nutrient found in each? 4 marks
a bread  b butter  c fish  d potatoes

3a Look at the list of foods that three sisters have eaten:
- Emma
  - pizza
  - chips
  - cola
- Charlotte
  - salad
  - chicken
  - orange juice
- Holly
  - milkshake
  - chocolate bar
  - cola

Which sister has eaten the most balanced meal? 1 mark

b Explain what is meant by the term ‘balanced diet’. 1 mark

c What functions do these nutrients have in the body? 4 marks
- i carbohydrates
- ii protein
- iii fibre
- iv fats

4 Visking tubing is a kind of plastic. It has tiny gaps just like the wall of the small intestine.

a Paresh set up this experiment, but he forgot to label what the parts of the model show.

What do the following parts in the model represent in your digestive system? Choose from the boxes below. 3 marks
- i Visking tubing
- ii water in the boiling tube
- iii contents of the Visking tubing

Paresh and George set up a model gut. A solution of starch and amylase (enzyme) was put inside the Visking tubing. They tested for the presence of starch outside the tubing.
**A Food and digestion (continued)**

**b** Would they find starch outside the Visking tubing? 1 mark

**c** Why did Paresh add amylase to the starch solution? 1 mark

5 Diane is a marathon runner, and she trains every day before a big race. Her meal the night before the race is rich in starch-based carbohydrates. The digested carbohydrates are broken down into glucose and then transported around her body.

How do they get transported? 1 mark

6a Some of the essential nutrients consist of smaller molecules. What is the name of the smaller molecules that starch is made of? 1 mark

b Enzymes have specific areas of the body where they work best. What substance, containing the enzyme amylase, starts the digestion of starch in the mouth? 1 mark

7 David had some black and white photographic film. Photographic film is made of a layer of gelatine with a clear plastic backing.

Gelatine is a protein. Enzyme A can break down protein. David set up two experiments. This picture shows the results.

**a** 

i David says beaker A contained Enzyme A. What evidence is there for this? 1 mark

ii What does this evidence enable David to do now? Choose one from the following list. 1 mark

**b** 

i Choose two factors from this list that David should keep the same in the two experiments. 2 marks

ii Why is it important that these factors are kept the same? 1 mark
Food and digestion

1. a) Look at the list of foods that three sisters have eaten:

<table>
<thead>
<tr>
<th>Emma</th>
<th>Charlotte</th>
<th>Holly</th>
</tr>
</thead>
<tbody>
<tr>
<td>pizza</td>
<td>salad</td>
<td>milkshake</td>
</tr>
<tr>
<td>chips</td>
<td>chicken</td>
<td>chocolate bar</td>
</tr>
<tr>
<td>cola</td>
<td>orange juice</td>
<td></td>
</tr>
</tbody>
</table>

Which sister has eaten the most balanced meal? 1 mark

b) Explain what is meant by the term ‘balanced diet’. 1 mark

c) What function do these nutrients have in the body? 4 marks
   i) carbohydrates
   ii) protein
   iii) fibre
   iv) fats

2. Visking tubing is a special kind of plastic. It has tiny gaps just like the wall of the small intestine.

a) Paresh set up this experiment, but he forgot to label what the parts of the model show.

What do the following parts in the model represent in your digestive system? Choose from the boxes below. 3 marks
   i) Visking tubing
   ii) water in the boiling tube
   iii) contents of the Visking tubing

Paresh and George set up a model gut. A solution of starch and amylase (enzyme) was put inside the Visking tubing. They tested for starch outside the Visking tubing.

b) Would they find starch outside the Visking tubing? 1 mark

c) Why did Paresh add amylase to the starch solution? 1 mark

3. Diane is a marathon runner, and she trains every day before a big race. Her meal the night before the race is rich in starch-based carbohydrates. The digested carbohydrates are transported around her body.
Food and digestion (continued)

a How do they get transported?  

b If Diane ate a salad the night before a race and had nothing for breakfast, why would she not be able to perform so well?

4 a Some of the essential nutrients, such as starch, protein and fat, have to be broken down before the body can use them. Explain why this is.  
b Enzymes have specific areas of the body where they work best. Copy and complete the sentences below.  

i Protein is broken down by the enzyme ...................................................... . This process takes place in the stomach.

ii The digestion of starch starts in the mouth when ...................................................... is produced. This contains the enzyme amylase. Further digestion of starch occurs in the small intestine.

iii The digestion of fat occurs in the small intestine. The enzyme for this is called ...................................................... .

5 Cows and horses live off grass. Explain why humans cannot extract nutrients from grass.

6 David had some black and white photographic film. Photographic film is made of a layer of gelatine with a clear plastic backing.

Gelatine is a protein. Enzyme A can break down protein. David set up two experiments. This picture shows the results.

ai Choose two factors from this list that David should keep the same in the two experiments.  

ii Why is it important that these factors are kept the same?  
b David knows that there are variables that can speed up or slow down the rate at which the enzyme works. Suggest two variables that might affect the rate at which the enzyme works.
# Food and digestion

## Question Answer Mark Level

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Mark</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Two from: Fats, fibre, protein, water.</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2 a</td>
<td>Carbohydrate (accept starch)</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>b</td>
<td>Fat</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>c</td>
<td>Protein</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>d</td>
<td>Carbohydrate (accept starch)</td>
<td>1</td>
</tr>
<tr>
<td>3 a</td>
<td>Charlotte</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>b</td>
<td>A diet containing a range of the nutrients needed to stay healthy.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>c i</td>
<td>An immediate source of energy.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>c ii</td>
<td>For growth and repair of tissues.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>c iii</td>
<td>To keep waste moving through the digestive system.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>c iv</td>
<td>An energy store and/or a vital part of cell membranes.</td>
<td>1</td>
</tr>
<tr>
<td>4 a i</td>
<td>Wall of the small intestine.</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>ii</td>
<td>Blood</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>iii</td>
<td>Partially digested food.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>b</td>
<td>No</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>c</td>
<td>To break down the starch molecules (into glucose).</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>In the blood.</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>6 a</td>
<td>Glucose (accept sugars)</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>b</td>
<td>Saliva</td>
<td>1</td>
</tr>
<tr>
<td>7 a i</td>
<td>The film has gone clear.</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>ii</td>
<td>Draw a conclusion.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>b i</td>
<td>Two from:</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>amount of liquid</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>size of film</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>To make the experiment reliable.</td>
<td>1</td>
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## Scores in the range of: NC Level

<table>
<thead>
<tr>
<th>Range</th>
<th>NC Level</th>
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<tbody>
<tr>
<td>4-7</td>
<td>3</td>
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<tr>
<td>8-13</td>
<td>4</td>
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<tr>
<td>14-17</td>
<td>5</td>
</tr>
<tr>
<td>18-25</td>
<td>6</td>
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</tbody>
</table>
# Food and digestion

## Red (NC Tier 4-7)

<table>
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<th>Question</th>
<th>Answer</th>
<th>Mark</th>
<th>Level</th>
</tr>
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<tbody>
<tr>
<td>1 a</td>
<td>Charlotte</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>b</td>
<td>A diet containing a range of the nutrients needed to stay healthy.</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>c i</td>
<td>An immediate source of energy.</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>ii</td>
<td>For growth and repair of tissues.</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>iii</td>
<td>To keep waste moving through the digestive system.</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>iv</td>
<td>An energy store and/or a vital part of cell membranes.</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2 a i</td>
<td>Wall of the small intestine.</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>ii</td>
<td>Blood</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>iii</td>
<td>Partially digested food.</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>b</td>
<td>No</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>c</td>
<td>To break down the starch molecules (into glucose).</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>3 a</td>
<td>In the blood.</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>b</td>
<td>She would not have eaten enough carbohydrates, therefore, she would not have enough energy.</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>4 a</td>
<td>The molecules or particles are too large to fit through the intestine wall or be absorbed. If they are not broken down or absorbed the body cannot get any goodness or nutrients from them.</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>b i</td>
<td>Protease or pepsin.</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>ii</td>
<td>Saliva</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>iii</td>
<td>Lipase</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>We do not have the correct enzymes to digest fibre.</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>6 a i</td>
<td>Two from:</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>ii</td>
<td>To make the experiment reliable.</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>b</td>
<td>pH</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Temperature</td>
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<td>6</td>
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### Scores in the range of: NC Level

<table>
<thead>
<tr>
<th>Range</th>
<th>Level</th>
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<tbody>
<tr>
<td>5-9</td>
<td>4</td>
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<tr>
<td>10-14</td>
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<tr>
<td>15-18</td>
<td>6</td>
</tr>
<tr>
<td>19-25</td>
<td>7</td>
</tr>
</tbody>
</table>

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This worksheet may have been altered from the original on the CD-ROM.
# Food and digestion

<table>
<thead>
<tr>
<th>Learning outcomes</th>
<th>I can do this very well</th>
<th>I can do this quite well</th>
<th>I need to do more work on this</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can name the main types of nutrients.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can name any other substances needed for a healthy diet.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can use chemical tests to identify different types of food.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can describe the meaning of the term ‘balanced diet’.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can describe how to decide what to eat.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can identify those foods that have a lot of sugar and salt in them.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can identify those foods that are unhealthy by looking at the nutritional labels.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can describe where digestion happens, and I can name parts of the digestive system.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can describe how digestion happens.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can describe the role of enzymes in digestion.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can use a model to talk about digestion.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can describe how food is absorbed into the blood.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can describe what happens to fibre after it has passed through the digestive system.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can use line graphs to help identify patterns in results.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Word</td>
<td>Definition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>absorbed/absorption</td>
<td>Useful substances present in foods.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>amylase R</td>
<td>Nutrients found in foods such as bread, which give you energy.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>anorexia nervosa</td>
<td>Nutrients found in foods, such as butter, that give you energy and insulate your body.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>anus</td>
<td>Nutrients found in foods such as fish, used in your body for growth and repair.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>balanced diet</td>
<td>A substance, such as vitamin C, that is needed in the diet in very small amounts to keep your body healthy.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>biological washing powder R</td>
<td>A vitamin found in fresh fruit and vegetables.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>calcium</td>
<td>A vitamin found in milk and butter and made in your body in sunlight, which gives you strong bones and teeth.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>carbohydrates</td>
<td>A disease caused by not eating enough vitamin D in the diet, in which the bones are soft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cellulase R</td>
<td>A disease caused by not eating enough vitamin C in the diet, in which the gums bleed and the skin does not heal.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cellulose R</td>
<td>Compounds of calcium, iron, iodine and other elements that are needed in the diet in small amounts to keep your body healthy are also called minerals.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>chemical process R</td>
<td>A mineral found in milk and cheese, which keeps your teeth and bones healthy. The mineral calcium is actually calcium compounds.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>constipated</td>
<td>A mineral found in liver and eggs, which is used in your body to make blood.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>digestion</td>
<td>A mineral found in fish, used by the thyroid gland to make a hormone that helps you grow.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>digestive juices R</td>
<td>A disease caused by not eating enough iodine in the diet, in which the thyroid gland in the neck becomes very large.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>digestive system</td>
<td>Bulky material found in cereals, fruits and vegetables that helps to keep food moving through your gut.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>egestion</td>
<td>Fibre, found in cereals, fruit and vegetables.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>enzymes</td>
<td>Difficulty in emptying the bowels.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>faeces</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fats</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fibre</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>goitre R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>gullet R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>gut</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iodine R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iron R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>large intestine</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
A Food and digestion (continued)

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>line of best fit</td>
<td>A compound of hydrogen and oxygen. Water is the solvent in which all the chemical reactions in your body take place.</td>
</tr>
<tr>
<td>minerals</td>
<td>A diet that has the right amounts of all the nutrients.</td>
</tr>
<tr>
<td>molecule</td>
<td>Levels set by the Government that advise about the amounts of different nutrients eaten each day.</td>
</tr>
<tr>
<td>nutrients</td>
<td>People who are very overweight for their height are obese.</td>
</tr>
<tr>
<td>obese</td>
<td>An eating disorder that causes a person to eat too little.</td>
</tr>
<tr>
<td>oesophagus R</td>
<td>A person who does not eat any meat.</td>
</tr>
<tr>
<td>organic R</td>
<td>Food that has been produced without using manufactured chemicals.</td>
</tr>
<tr>
<td>proteins</td>
<td>A group of two or more atoms joined together.</td>
</tr>
<tr>
<td>recommended daily allowances (RDA) R</td>
<td>Process by which food is broken down into smaller molecules.</td>
</tr>
<tr>
<td>rickets</td>
<td>The long tube in your body down which food passes between the mouth and the anus, and where digestion and absorption take place.</td>
</tr>
<tr>
<td>roughtage R</td>
<td>A change that makes a new substance.</td>
</tr>
<tr>
<td>scurvy</td>
<td>The organ system that breaks down your food into smaller molecules and absorbs them.</td>
</tr>
<tr>
<td>small intestine R</td>
<td>The part of the gut that links the mouth and stomach, also called the oesophagus.</td>
</tr>
<tr>
<td>stomach R</td>
<td>The part of the gut that links the mouth and stomach, also called the gullet.</td>
</tr>
<tr>
<td>trend R</td>
<td>The part of the gut where the food is churned up and mixed with enzymes in acidic conditions.</td>
</tr>
<tr>
<td>vegetarian R</td>
<td>The part of the gut where enzymes and bile are added in alkaline conditions to digest the different substances in food. Absorption also happens here.</td>
</tr>
<tr>
<td>villi (singular villus)</td>
<td>Juices in the digestive system that contain enzymes which help to break down different nutrients.</td>
</tr>
<tr>
<td>vitamin</td>
<td>Washing powder that contains enzymes to break down stains caused by proteins.</td>
</tr>
<tr>
<td>vitamin C</td>
<td></td>
</tr>
<tr>
<td>vitamin D R</td>
<td></td>
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<tr>
<td>water</td>
<td></td>
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</table>
### Glossary

#### Food and digestion (continued)

<table>
<thead>
<tr>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Definition</strong></td>
</tr>
<tr>
<td>Proteins that speed up the breakdown of food in digestion.</td>
</tr>
<tr>
<td>An enzyme in saliva that helps to break down starch. R</td>
</tr>
<tr>
<td>The process by which digested food passes through the lining of the small intestine into the blood.</td>
</tr>
<tr>
<td>Finger-like structures in the small intestine which increase the area for the absorption of digested food.</td>
</tr>
<tr>
<td>The part of the gut where waste food is stored and water is absorbed.</td>
</tr>
<tr>
<td>The undigested food that is egested from the body.</td>
</tr>
<tr>
<td>Molecules in plant cell walls. R</td>
</tr>
<tr>
<td>The enzyme that breaks down cellulose. R</td>
</tr>
<tr>
<td>The opening through which undigested food passes out of the body.</td>
</tr>
<tr>
<td>Passing undigested food out of the body.</td>
</tr>
<tr>
<td>A line drawn on a graph that shows the overall trend or pattern.</td>
</tr>
<tr>
<td>A general pattern. R</td>
</tr>
</tbody>
</table>
### Food and digestion

<table>
<thead>
<tr>
<th>Key words</th>
<th>Key words</th>
</tr>
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<tbody>
<tr>
<td>absorbed/absorption</td>
<td>enzymes</td>
</tr>
<tr>
<td>amylase</td>
<td>faeces</td>
</tr>
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<td>anorexia nervosa</td>
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<tr>
<td>anus</td>
<td>fibre</td>
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<tr>
<td>balanced diet</td>
<td>goitre</td>
</tr>
<tr>
<td>biological washing</td>
<td>gullet</td>
</tr>
<tr>
<td>powders</td>
<td>gut</td>
</tr>
<tr>
<td>calcium</td>
<td>iodine</td>
</tr>
<tr>
<td>carbohydrates</td>
<td>iron</td>
</tr>
<tr>
<td>cellulase</td>
<td>large intestine</td>
</tr>
<tr>
<td>cellulose</td>
<td>line of best fit</td>
</tr>
<tr>
<td>chemical process</td>
<td>minerals</td>
</tr>
<tr>
<td>constipated</td>
<td>molecule</td>
</tr>
<tr>
<td>digestion</td>
<td>nutrients</td>
</tr>
<tr>
<td>digestive juices</td>
<td>obese</td>
</tr>
<tr>
<td>digestive system</td>
<td>oesophagus</td>
</tr>
<tr>
<td>egestion</td>
<td>organic</td>
</tr>
<tr>
<td></td>
<td>proteins</td>
</tr>
<tr>
<td></td>
<td>recommended daily</td>
</tr>
<tr>
<td></td>
<td>allowances (RDA)</td>
</tr>
<tr>
<td></td>
<td>rickets</td>
</tr>
<tr>
<td></td>
<td>roughage</td>
</tr>
<tr>
<td></td>
<td>scurvy</td>
</tr>
<tr>
<td></td>
<td>small intestine</td>
</tr>
<tr>
<td></td>
<td>stomach</td>
</tr>
<tr>
<td></td>
<td>trend</td>
</tr>
<tr>
<td></td>
<td>vegetarian</td>
</tr>
<tr>
<td></td>
<td>villi (singular villus)</td>
</tr>
<tr>
<td></td>
<td>vitamin</td>
</tr>
<tr>
<td></td>
<td>vitamin C</td>
</tr>
<tr>
<td></td>
<td>vitamin D</td>
</tr>
<tr>
<td></td>
<td>water</td>
</tr>
</tbody>
</table>
A1 What’s in food?

Green

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Content (per 100g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>protein</td>
<td>7.3g</td>
</tr>
<tr>
<td>carbohydrate</td>
<td>82.7g</td>
</tr>
<tr>
<td>fat</td>
<td>0.8g</td>
</tr>
</tbody>
</table>

b Any two from: bread, potatoes, cake, sweets, pasta, rice

c Any two from: butter, margarine, milk, meat, oil

d Proteins are used for growth and repair of the body.

e Scurvy is caused by a lack of vitamin C. Citrus fruits contain vitamin C. Eating citrus fruits kept the sailors from getting scurvy.

f Calcium is needed for healthy teeth and bones. Milk contains lots of calcium.

1 fat – Provides energy and helps prevent the body losing heat.

2a Fibre helps food to keep moving through your body. It prevents constipation.

b Cereals, fruit and vegetables.

2b Carbohydrates are found in bread, potatoes, pasta, rice, cakes and sweets. Fats are found in butter, margarine, milk and oil.

2c Foods which contain proteins will help to repair the body, so meat, fish, eggs, peas, beans and milk would be recommended.

3a The cell walls.

A2 Balanced diet

Green

a The amount of energy you need in your food depends on how much energy your body uses up every day.

b Some people take in more energy than they use up. They risk becoming fat. Some people do not eat enough food to give them energy for their body’s needs and they become thin.

c Individual answers which contain carbohydrate foods only.

d Individual answers.

1a Any acceptable conclusion, such as to keep you fit and healthy.

b Nutrients, fibre and water.

c How much energy your body uses up every day.

2 A woman working in an office uses less energy than a man who works on a building site.

3 These people are likely to increase in weight because the “Western diet” contains much more fat than the diet which people in developing countries are used to.

Red

ai The RDAs of energy for males are higher than for females.

ii The RDAs of energy for an adult male are greater than for a male child, but the RDAs for an adult female are less than for a female child.

bi The RDA for an adult female is much higher than for a male.

ii Pregnant women need more iron for making the fetus’s blood.

3a True. An office worker is not as active as a builder.

b False. Vegetarians eat a lot of roughage in their cereals and vegetables.

c True. Sports people use a lot of energy and glucose supplies energy very quickly.
A3 Healthy or not?

**Green**

a. They contain lots of nutrients and are easy to eat on the move.
b. 16g
   i. 16g
   ii. more
   iii. 0.4g
c. Individual answers.
d. It contained a good balance of carbohydrate, fibre, protein and fat.
e. He had a lot of salt in the bread and beans. He could have done with less butter.

**Red**

a. If the food wasn’t digested quickly, it would pass out of the digestive system without having the nutrients extracted and passed into the blood to nourish the body.
b. i. At about 40°C.
   ii. yes
   iii. Very little, if any, starch would have been broken down at 0°C and none would have been broken down at 70°C.
c. i. meat
   ii. protein
   iii. The digestive juice in the stomach was working.

**A4 Total breakdown**

**Green**

a. Gullet (or oesophagus).
b. Enzymes are chemicals which break down food particles into small molecules.
c. Enzymes make the digestion of food happen more quickly.
d. When starch is digested it is broken down into glucose molecules.
1. Carbohydrates, proteins and fats have ... big molecules.
   Digested foods in the small intestine have ... small molecules. Food is digested by ... chemicals called enzymes.
2. a, b

**Red**

a. Individual answers.
b. i. The villi increase the surface area of the small intestine.
   ii. The increased surface area allows the digestion process to be carried out more quickly.
   c. They have bacteria in their gut that produce cellulase.

**A5 Taking it in**

**Green**

a. The digested food becomes nutrients which go to every cell in the body.
b. i. The large fish in the net.
   ii. The small fish.
   iii. The net.
c. To break up the large food particles into tiny molecules which can pass through the wall of the small intestine.

**Red**

a. Individual answers containing information such as: starch molecules in our food are broken down by enzymes into smaller glucose molecules.
A Food and digestion (continued)

When these reach the small intestine they are absorbed through the villi in the small intestine and pass into the bloodstream.

2 To provide a large surface area so that digestion can be carried out more quickly.

3 Vitamins and minerals have molecules that are small enough to pass directly through the wall of the small intestine. Fibre molecules are much larger and cannot pass through the wall.

4 Individual answers explaining or describing that water is absorbed into the blood through the large intestine and that fibre and waste pass through the large intestine and out of the body through the anus.

5 a Insufficient fibre in the diet. More fruit and vegetables should be eaten.
   b Infection of the large intestine. Drink lots of fluids.

A6 Chewing it over

Green
   a Copy of graph with straight line of best fit.
   b no
   c 'Taking some of the readings a bit late' is the best explanation of those provided.
   d A linear pattern.
   e The time taken for digestion decreases linearly as the amount of salivary amylase increases.
   f Any acceptable reason such as inaccurate reading of the clock, inaccurate measuring out of the starch and/or amylase.
   g So that she could predict from the graph how long it would take for digestion to occur with 1.5% of salivary amylase.

Red
   a Suitable plot of points.
   b no
   c Inaccuracies in the measurements of the input and outcome variables.
   d A linear pattern.
   e The time taken for digestion decreases linearly as the amount of salivary amylase increases.
   f Approximately 220 seconds.
   g So that she could predict from the graph how long it would take for digestion to occur with 1.5% of salivary amylase.
   h Approximately 20 seconds.