8A
Food and nutrition

This unit looks at the main components in the human diet and why they are needed. The digestive system is also covered in some detail, and the idea of enzymes is introduced.

Recommended teaching time for unit: 7.5–10 hours

There is an opportunity for focused development of Literacy & Communication skills in Topic 8Ab and there is an opportunity for focused development of Working Scientifically skills in Topic 8Ae. You may wish to spend additional time on these topics should you feel that your students would benefit from these skills-development opportunities.

From KS2 most students will be able to:

- recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function (Year 6).

From previous units, most students will be able to:

- recall the main parts of the digestive system (7A)
- describe how some cells are adapted to the functions (7A)
- describe how soluble substances are carried by the blood (7C)
- explain the importance of a healthy skeleton (7C)
- recall some of the effects of alcohol on the body (7C)
- describe how animals depend on other animals and plants for food (7D)
- describe what happens during diffusion, in terms of particles (7G)
- compare energy values of different foods using labels, including interpreting nutrition information labels (7I).

Topic 8Aa introduces the unit by looking at the advertising of food. The different types of nutrients found in food are then considered.

Topic 8Ab continues work on nutrients, with a look at the uses for different nutrients. There is then a Literacy & Communication opportunity that looks at weighting and bias in writing.

Topic 8Ac considers balanced diets and malnutrition (including obesity).

Topic 8Ad focuses on the digestive system and what it does.

Topic 8Ae takes a look at how digested food is absorbed by the small intestine. The concept of diffusion is also covered and there is a Working Scientifically opportunity on the importance of surface area in biology. The unit is completed with a look at the law and food packaging.

National Curriculum coverage

This unit covers the following statements from the UK National Curriculum for Science (2013):

- content of a healthy human diet: carbohydrates, lipids (fats and oils), proteins, vitamins, minerals, dietary fibre and water, and why each is needed
- calculations of energy requirements in a healthy daily diet
- the tissues and organs of the human digestive system, including adaptations to function and how the digestive system digests food (enzymes simply as biological catalysts)
- the role of diffusion in the movement of materials in and between cells.

In addition to covering a variety of Working Scientifically statements, this unit has a focus on:

- apply mathematical concepts and calculate results.

Literacy & Communication skills

- how verbs and adjectives can be used to add ‘weight’ to an opinion bias.

Maths skills

- use appropriate units for area measurements
- calculate area for a variety of shapes, including rectangles and cuboids.

Cross-disciplinary opportunities

8Ab – Physics 8K – energy transfers
8Ae – Chemistry 8E – combustion to release energy from fuels

Cross-curricular opportunities

8Aa – Art – advertising posters
English – advertising and persuasive language
8Ab – PE – energy from food

8A Background information

8Aa Food and advertising/Nutrients

In the National Curriculum for KS3 the term 'lipids' refers to 'fats and oils'. This is potentially confusing. A lipid contains long-chain molecules called fatty acids. Fats are a subgroup of lipids, made of fatty acids and another molecule called glycerol. Some fats are solids at room temperature and we tend to call them 'fats'. Others are liquids and are called 'oils'. There are many other substances that are not fats but are lipids. To add to the confusion, food labelling only ever refers to fats. So, in this course, we will usually refer to fats but the distinction between fats and oils is made and the word 'lipid' is introduced.

Fibre mainly consists of plant cell wall material (cellulose), which humans do not have the ability to digest. Muscles in the wall of the gut squeeze the gut to push food along. This squeezing is called peristalsis. Fibre adds bulk to the food, thus aiding this process. A lack of fibre can cause a lack of solid material for the muscles to push against and the food to move very slowly, resulting in constipation.

Water is also an important component of the diet. It is used to carry dissolved chemicals around the body, and most biochemical reactions do not occur without the reactants being dissolved in water. It is also used as a lubricant.

Nutritional information labels should be familiar to most students from daily life. Note that these nutritional contents are all mean values. To make 'fair' comparisons between foods, the content in 100 g of each food is examined. The contents do not always add up to 100 g since water is very often not mentioned on the labels.

8Ab Uses of nutrients/Weighting and bias

Carbohydrates are used for energy, which is measured in the SI unit kilojoules (kJ) and in kilocalories (kcal) – often just called calories. 1 kcal = 4.1868 kJ. In general terms, more active people require more food, males need more energy foods than females, and teenagers need more energy than older people. This is not an exact science, since different people do different activities and have different metabolic rates (the speed with which food is used up in the body).

Carbohydrates consist of the elements carbon, hydrogen and oxygen. They can best be classified into two groups – those containing small molecules (sugars) and those containing sugars linked together to form long molecular chains. One of the best known examples of the latter is starch, which is the only long-chain (or complex) carbohydrate considered in this unit. There are a whole variety of other complex carbohydrates, including cellulose, a major component of fibre, which is indigestible by humans and therefore has no energy value to them.

Students often hold the misguided notion that all fat is bad for you. In fact, fat is a vital component of the diet (for example, it is one of the major components of cell membranes). Fats are also used as an energy store and as insulation under the skin. Fats also contain a store of some vitamins (see below). It should be emphasised that, whilst too much fat is not a good idea, we all need to eat some. A fat is a molecule of a chemical, called glycerol, which has three chains of fatty acids attached to it. Animal fats tend to be saturated (they have as many hydrogen atoms as will possibly fit onto the chains). Eating too much saturated fat has been linked with the over-production of cholesterol (another fatty substance that can stick to artery walls, thus blocking them and causing heart disease). We do need some cholesterol in our diet (although it can be made by the liver) since it is a precursor of many other important compounds needed by the body (including some hormones). Vegetable fats are regarded as healthier since they do not contribute so readily to the over-production of cholesterol (they tend to be unsaturated – having some 'empty gaps' where hydrogen atoms could fit on the fatty acid chains).

Proteins are chemicals vital for growth. They form essential parts in cells and nearly all enzymes are proteins. They consist of long chains of amino acids. The body breaks down proteins to their constituent amino acids, and then rebuilds them into new proteins.

Vitamins are compounds needed in small amounts. They are divided into two groups – fat-soluble vitamins and water-soluble ones. The former are vitamins A, D, E and K and all the rest are water soluble. The fat-soluble ones are most easily stored by the body in fat.

Trace elements (e.g. calcium and iron) are those that, although vital, are needed in much smaller quantities. These trace elements are in the form of chemical compounds (minerals or mineral salts) in our food. Calcium phosphate is an example of a mineral salt. This compound contains the trace elements calcium and phosphorus.

8Ac Balanced diets

A balanced diet is one that contains a wide variety of foods providing the correct amounts of all the essential nutrients and fibre. Many foods contain carbohydrates, proteins and fats, but may be lacking in some of the essential vitamins and mineral salts. It is also important to eat protein from a wide variety of different sources, since different proteins contain different amino acids (and we need a wide range of amino acids to build the proteins in our bodies).

Malnutrition refers to the effects of eating a very unbalanced diet for a long period of time. It includes deficiency diseases and obesity.

Deficiency diseases are caused by a lack of a nutrient. For example, iron is needed to make haemoglobin (the oxygen-carrying chemical in red blood cells). An iron deficiency results in anaemia (reduced oxygen-carrying ability, leading to shortness of breath and a lack of energy).

There are many terms used to recommend how much of each sort of food substance someone should eat. Reference Intakes (RIs) are estimates of the amount of energy and nutrients needed by adults in the UK. Recommended Daily Allowances (RDAs) and Guideline Daily Amounts (GDAs) have now been superseded by Reference Intakes, which are used in this course.

Dieting is something that many teenagers become concerned about. Important points that should be stressed, in class discussion, are that people all have different body shapes and sizes, partly because of who

we are (inherited causes) and what we eat (environmental causes). Many children lose excess fat as they go through puberty (the excess fat may be thought of as an evolutionary adaptation, providing insulation and a ready supply of stored energy for young, more vulnerable humans until they can fend for themselves).

Junk food contains very high levels of sugar and fat, and many essential vitamins and minerals are missing. Most of it is highly processed, which removes a great deal of the fibre.

Excess carbohydrates in the diet are converted into fat and stored. Equally, if there is not enough carbohydrate in the diet, the fat will be reconverted into a form that can be used for respiration. In starvation, when fat stores have been used up, the body converts protein into a form that can be used in respiration. This can result in the body destroying its own muscles to release protein, leading to a wasting condition called marasmus.

8Ad Digestion

The parts of the digestive system that food goes through (apart from the mouth) are collectively known as the gut. The gut contains the oesophagus or gullet, stomach, small intestine (split into duodenum and ileum), large intestine (colon), rectum and anus. The words in brackets are not used in the Student Book and do not need to be known. The rest of the digestive system consists of salivary glands, liver, gall bladder and the pancreas. Only the salivary glands and liver are referred to, on page 14.

Digestion starts in the mouth, where the salivary glands (a gland is an organ whose main function is to secrete specific chemicals) release saliva. This contains an enzyme called amylase, which converts starch into a sugar (called maltose). A slight simplification (that starch is turned into glucose directly) is implied in the Student Book and worksheets. The teeth help to grind the food, mixing it thoroughly with saliva and giving the amylase more surface area on which to work. The saliva also contains mucin, a sticky substance that holds the food together and lubricates it ready for swallowing. The lump of lubricated food is called a bolus. This passes down the gullet, moved by contractions of muscles (peristalsis).

The stomach wall secretes pepsin (which breaks down proteins into shorter chains called peptides) and hydrochloric acid (which kills bacteria and helps to activate pepsin). Students often ask why, if the contents of the stomach are between pH1 and 2, the stomach does not dissolve itself. This is because the stomach releases a sticky mucus that lines the stomach and prevents attack from the acid. Problems with mucus production can cause stomach ulcers. The stomach churns the food up into a liquid called chyme, which is released slowly into the first part of the small intestine (the duodenum).

Here, the acid from the stomach is neutralised by a constituent of bile (released from the gall bladder), allowing enzymes to work. Various enzymes are released by the wall of the small intestine and by the pancreas (another gland). These include maltase, which splits maltose into glucose, and peptidases, which split peptides into amino acids. Bile (a green liquid, produced by the liver) is released from the gall bladder. This forms an emulsion with fats, giving a suspension of small fat droplets and providing a greater surface area for lipase enzymes to work on, splitting the fats into fatty acids and glycerol.

8Ae Surface area/Absorption/Packaging and the law

Starch is often represented by a linked line of yellow hexagons because it is a polymer of glucose, which has six carbons arranged in a ring. Glucose and fructose are monosaccharides. Sucrose is two sugars joined together (a disaccharide). Lactose and maltose are also disaccharides. Students will know that too much sugar is bad for teeth and can make you fat. Eating too much carbohydrate increases body mass since any extra is turned into fat and stored.

The absorption of digested food occurs in the small intestine. To ensure that this process happens quickly, the small intestine is highly folded and has finger-like projections, called villi, sticking out. The tops of the cell membranes of the cells making up each villus are also highly folded, forming microvilli. These adaptations all increase the surface area of the small intestine to ensure rapid absorption. In addition, the outer cells on the villi are thin, allowing substances to pass quickly through and into the capillaries inside.

Sugars and amino acids (from carbohydrate and protein digestion, respectively) pass into a fine network of small blood vessels called capillaries inside the villi. At this level, students are told that it all happens by diffusion – small molecules happen to pass through the small intestine wall on their own (rather like a smell spreading through a room without anything having to move the 'smell particles'). In fact absorption is more complex than this, with some of the cells on the surface of the villi actively picking up the digested food molecules and transporting them into the capillaries.

Not all digested food enters the bloodstream. The majority of glycerol and fatty acids (from the digestion of fats) enter a blind tube in the centre of each villus, called a lacteal. The lacteals empty their contents into the lymphatic system. This is a network of tubes that run throughout the body, eventually draining into the bloodstream.

Respiration is a cellular process that occurs in certain small compartments (organelles) in the cytoplasm called mitochondria. Many students make the mistake of saying that energy is a product. This is not true since energy is not a substance. In fact, the energy released by respiration is not used instantly but is stored in another molecule called ATP, until it is needed. More properly put, the energy is transferred from the glucose to ATP.

The products of respiration are carbon dioxide and water. The carbon dioxide is excreted from the body via the lungs. The water tends to stay in the cell, or if it is not needed, it is released into the tissue fluid and the bloodstream

The energy released by respiration is used for movement and to power the body's biochemical reactions.

The wording used on food packaging is subject to various laws and EU directives. The Advertising Standards Authority (ASA) is the UK's regulator of advertising across all media, including on websites.

8Aa
Nutrients

This grid shows the basic concepts met in this topic, together with a scheme of cognitive progression for each concept. Opportunities to cover learning and progression are given. Working Scientifically concepts are integrated throughout the materials.

Conceptual statement	Cognitive progress					
	Remembering (a)	Understanding (b)	Applying (c)	Analysing (d)	Evaluating (e)	Synthesising & creating (f)
Tests can be done on foods to see what they contain.	Recall that tests can be done for nutrients in food.	Describe the food test for [starch, protein, fats, vitamin C].	Interpret the results of food tests [for starch, proteins, fat, vitamin C]. Describe the food test for [reducing, non-reducing] sugars.	Interpret the results of food tests for [reducing, non-reducing] sugars.		
The amount of energy and the substances in foods are shown on nutrition information labels.	State what is shown on food labels.	Interpret nutrition information labels.	Use nutrition information labels to calculate the totals of different things [in a meal, in a diet].	Compare nutrition information labels in which the units used are different.	Evaluate different types of [nutritional, advertising] labelling on foods.	Calculate an energy balance based on someone's diet and exercise levels.
Different nutrients in the diet have different purposes.	Recall the different names of the different nutrients in food. Recall that food contains nutrients, fibre and water. Recall good sources of [carbohydrate, fat, protein, fibre]. Recall what is meant by: nutrient.	Describe the general uses of [carbohydrate, fat, protein, vitamins, minerals] by the body. Describe the use of fibre by the body. Describe the use of water by the body.			Justify the need for protein from a variety of different sources.	
Humans need the right amounts of water and different foods in their diets to stay healthy and grow.	Recall how humans should eat and drink in order to stay healthy and grow. Recall why we need food (for energy, for growth and repair, for health). Recall what is meant by: diet.	Describe how food acts as a fuel for the body.	Explain how deficiency diseases are caused.			

Objectives
Developing:

1. Correctly use the term: diet.
2. Recall why we need food (energy, growth and repair, health).
3. State what is shown on food labelling.
4. Recall the names of the nutrients in food.
5. Interpret nutrition information labels.
6. Use nutrition information labels to perform calculations.

Securing:

7. Describe the uses of fibre and water by the body.
8. Describe tests for fat and starch.
9. Interpret results from simple food tests (e.g. fat, starch, protein, vitamin C).

Exceeding:

10. Interpret results from food tests for reducing and non-reducing sugars (glucose and sucrose).

Student materials

Topic notes

- In the National Curriculum fats and oils are referred to as 'lipids' – see Background information. We have mainly used the term 'fats' in this course.

Be prepared
Whole unit: It is quite useful in the teaching of this unit to have a class set of laminated nutrition information panels taken from foods. A reasonable collection can be put together quite quickly by asking colleagues to bring in labels. Make sure that the name of the food is on the label before laminating.

STARTERS

1: Quick Quiz
Developing/Securing/Exceeding
BA
Use the 8A Quick Quiz for baseline assessment. Students can use the 8A Quick Quiz Answer Sheet to record their answers. You could use all of the Quick Quiz as a starter for the whole unit or just the first four questions, which relate to this topic.

Once students have carried out the quiz, they will be aware of what they know and any questions they have about the 8A topics. Ask students to write two questions they have about each topic (based on the statements on the Quick Quiz Answer Sheet) and then to share these in small groups. Each group should then prioritise two questions for each topic (10 questions in all, two for each of 8Aa, 8Ab, etc.) to contribute to a list of class questions. Display the class questions on a noticeboard, and encourage students to add sticky notes to these as they get insights into their questions. Tell students you'll be looking for the best contributions as you go through the topic, so they should write their initials on the sticky notes.

Course resources
ASP: 8A Quick Quiz; 8A Quick Quiz Answer Sheet.

2: Food adverts
Developing/Securing
Lit
Ask students to imagine that they are working for an advertising agency looking to recruit people. They must choose the best from a selection of adverts from several people applying for a job. There is one job available. They should work in groups to choose an advert that they think works the best at persuading people to buy that food. They should agree on two statements to explain their choice of advert. Each group appoints a spokesperson to report their group's finding to the class – showing the class which advert they picked and giving the two reasons why the group thought it was the best (and so giving the creator of that advert the job).

It is useful to try to limit the selection of adverts to one type of food (for example, breakfast cereals) although this may not be possible. As an alternative, consider using video clips to show TV food adverts.

Developing: Give students a limited choice of adverts.

Securing: Give students a larger choice.

Exceeding: Ask students to think about the language of adverts themselves, identifying key phrases used in food advertising.

Ask students to articulate the criteria they used to judge the advert. Get them to discuss whether their choice would be different if scientific accuracy had been important.

Equipment
Food adverts cut from magazines and newspapers.

3: Food words
Developing
BA
Write the words given in bold on Student Book spread 8Aa Nutrients on the board. Challenge

groups of students to write sets of sentences, each one of which includes two or more of the words. Students should aim to use each of the words in at least one sentence. Students could save their sentences to improve on them, as suggested in Plenary 4.

4: What do our bodies need food for?

Developing

BA

Ask students to work in groups to answer the question: What do our bodies need food for? Give them a few minutes to come up with some suggestions. Ask the groups to read out their suggestions and use them as part of a discussion to agree on three main categories that uses for food can be grouped into. Compare the categories that the students agree on, with the categories often used in text books: energy, growth and repair, and health. Discuss how these are similar to or different from the students' categories. Explain that having groups with commonly agreed names like this encourages a shared understanding of scientific ideas, then ask students to think up a mnemonic to remember these three things. A suggestion might be: Enjoy GReat Health.

EXPLORING TASKS

1: Nutrition information labels

Developing/Securing

Ask students to generate questions that they could answer from nutrition information labels (e.g. What are the main nutrients in food? Which sorts of foods contain mainly one sort of nutrient? Which sorts of foods contain things that some people are allergic to?). Nutrition information labels cut from packets are handed out to groups of students who are then challenged to answer their questions and identify the main nutrients in foods in general. Ask students how information from nutrition labels can help them make healthier choices. Students will ask what 'saturates' are. At this level it is acceptable to simply explain that they are a type of fat that may cause health problems, especially in the circulatory system.

In the National Curriculum, fats and oils are referred to as 'lipids' – see Background information.

Alternatively, the **AT** interactive *Food labels* asks students to compare two different nutrition information labels and answer questions based on them.

The interactive asks students to click on hotspots and use the information in the food labels to answer the questions. They may need to use a calculator to answer some of the questions.

Course resources
AT: Interactive *Food labels.*

Equipment
Food labels showing nutrition information.
Optional: calculator.

2: Simple food tests

Developing/Securing

Prac **WS**

Remind students that many scientists are employed to check what is in foods to make sure that their labels are accurate and consumers can trust what they are buying. The scientists use the same sorts of tests for starch (a carbohydrate), lipids and protein that are given in the Student Book and on Worksheets 8Aa-2, 8Aa-3 and 8Aa-5.

The blue-black colour produced by the iodine test shows up better in powdered food samples that have been mixed with an equal volume of water. Other, non-powdered foods can easily be tested by adding iodine solution directly to the food.

The test for lipids is very simple, if a bit messy. A food sample is rubbed into a piece of paper. Filter paper tends to work best. A greasy mark, visible when the paper is held up to the light, indicates the presence of lipids.

The Biuret test for protein involves using either pre-made Biuret solution or sodium hydroxide and copper sulfate solutions. The Student Book indicates the former approach, since it is easier for students to do. Both approaches are indicated on Worksheet 8Aa-5. For both tests, the food sample has to be in water. A spatula of powdered food can simply be shaken with about 2 cm depth of water in the test tube. However, the tests work better if foods are mashed with 2–3 cm^3 of water using a pestle and mortar first. A positive result is indicated by a purple colour, which may take a couple of minutes to appear.

Before starting the practicals, show students the apparatus they will be using and ask them how they will use the apparatus in a safe way.

Developing: Students do the tests for starch and lipids, recording their results and conclusions on Worksheet 8Aa-4.

Securing: Students do tests for starch, lipids and proteins. They design their own tables to compare the different foods. Challenge students to say how they will check their work and encourage them to compare their results with nutrition information labels for the foods.

Exceeding: Students do the tests for starch (Worksheet 8Aa-2), lipids (Worksheet 8Aa-3) and proteins (Worksheet 8Aa-5). Challenge students to display their results as a Venn diagram, showing

which foods contain just starch, which contain starch and proteins, which contain all three nutrients, etc.

Iodine solution stains skin and may irritate the eyes. Biuret solution and sodium hydroxide are irritants. Wear eye protection. Students should not consume the foods tested.

Course resources
AP: Worksheets 8Aa-2; 8Aa-3; 8Aa-4; 8Aa-5.

Equipment
Starch test: iodine solution (1 g iodine in 100 cm^3 0.5 mol dm^{-3} potassium iodide solution), spotting tile, test tube(s), test-tube stopper(s), test-tube rack, food sample(s), pipette, spatula, water, eye protection.
Fat test: dry food sample(s), filter paper.
Protein test: food sample(s), test tube(s), test-tube rack, pestle and mortar, pipette, spatula, Biuret solution (obtainable from an educational supplier or made up as per Biuret solution for Year 7/8 on CLEAPSS Recipe Sheet 15), eye protection.

3: Testing for vitamin C

Securing
Prac WS

Students use freshly prepared DCPIP (2,6-dichlorophenolindophenol) to test for vitamin C in mashed foods and drinks (e.g. fruit juices, squashes). Vitamin C decolourises DCPIP but note that in acidic conditions the resulting decolourised solution may be pink rather than colourless. Note also that some other substances will decolourise DCPIP although vitamin C is the main one. Worksheet 8Aa-6 contains full instructions.

Eye protection should be worn. You may also wish to consider class behaviour before issuing pipettes and/or syringes. DCPIP is of low hazard. Students should not consume the drinks/foods tested.

Course resources
AP: Worksheet 8Aa-6.

Equipment
Dropping pipette, selection of fruit juices (or fruits, squashes) and other foods to test, 0.1% DCPIP solution (freshly prepared), test tubes (one for each food), test-tube rack, labels. Optional: syringe for measuring out 1 cm^3 of DCPIP (rather than 0.5 cm depth), pestle and mortar (to grind solid foods), distilled water, stirring rod.

4: Testing for sugars

Exceeding
Prac WS

Worksheet 8Aa-7 provides further food tests for reducing and non-reducing sugars (such as glucose and sucrose, respectively). It is suggested that only the test for glucose is performed by students. The sucrose test should be done as a teacher demonstration only. Note that glucose is not found in normal packet sugar (which is pure sucrose).

Boiling water hazard. Wear eye protection. Students should not consume the drinks/foods tested.

Course resources
AP: Worksheet 8Aa-7.

Equipment
For reducing sugars: Bunsen burner, heat-resistant mat, boiling tube, Benedict's solution, tripod, gauze, pipette, food sample(s), pestle and mortar, beaker, eye protection.
For non-reducing sugars: Bunsen burner, heat-resistant mat, boiling tube, Benedict's solution, tripod, gauze, pipette, food sample(s), pestle and mortar, beaker, spatula, eye protection, dilute hydrochloric acid (0.5 mol dm^{-3}), sodium hydrogen carbonate solution (1 mol dm^{-3}).

5: Examining fibre

Securing
Prac WS

Students examine fibre under a microscope. This is easily done with boiled celery or well-soaked bran-stick cereal. Iodine stains the fibrous tissue (but point out to students that it does not change colour – we are not testing for starch). Students could be encouraged to work out what fibre is made from, using their knowledge from Unit 7A about plant cell structure. Use Skills Sheets UE 2 and UE 3 from the Year 7 Activity Pack.

Iodine solution stains the skin and may irritate the eyes. Wear eye protection.

Course resources
AP: Skills Sheets UE 2; UE 3 (Year 7).

Equipment
Microscope, boiled celery or bran-stick cereal (soaked in water for 2 hours), iodine solution (1 g iodine in 100 cm^3 1.0 mol dm^{-3} potassium iodide solution), cavity slides, coverslips, eye protection, forceps.

EXPLAINING TASKS

1: 8Aa Food and advertising (Student Book)

Developing/Securing/Exceeding

BA

This first page of the Student Book for this unit looks at how claims are made in food advertising, and how these claims have changed over the years.

Start by asking students to suggest some slogans that they know, which are used to advertise food. Ask students why food companies use slogans and elicit the idea that they are trying to sell more of their product. Tell students that a 'claim' is a statement that is supposed to be true. Ask students what sort of claims are made in food advertising and why these claims are made. Then go on to look at the Student Book. Questions 1–5 can be used for baseline assessment for concepts that will be met and extended in this unit.

The **AT** presentation *Advertising claims* examines the claims made in adverts for health products.

Course resources
AT: Presentation *Advertising claims*.

2: 8Aa Nutrients (Student Book)

Developing/Securing/Exceeding

FA

This spread introduces students to why we need food and the different nutrients contained within food. Some simple food tests are also explored. You may need to make sure that students are aware that 'per 100 g' refers to the amount of a nutrient in 100 g of the food. Worksheet 8Aa-1 is the Access Sheet.

Question 10 can be used for formative assessment, with students working in groups to identify the nutrients in milk powder and how they can be tested.

The **AT** interactive *Food labels* challenges students to answer multiple-choice questions based on some food labels.

The **AT** animation *Food tests 1* and the AT document *Food tests 2* can be used here; see Explaining 4.

Course resources
AP: Worksheet 8Aa-1.
AT: Animation *Food tests 1*. Document *Food tests 2*. Interactive *Food labels*.

3: Why do we need water?

Developing/Securing

Tell students that people have been known to live for over 60 days without food but only for a few days without water. Explain that water is used to give cells their shape (linking to ideas in Unit 7A), as a solvent in the body (linking with ideas in Unit 7E) and to cool you down through sweating (linking to adaptations in Unit 7D). Explain that some animals, such as oryx, don't need to drink and obtain all the water they need from the plants that they eat. Explain that animals living in dry environments also have other ways in which to conserve precious water (e.g. camels produce very concentrated urine, only sweat when the temperature is above 41 °C and store water in their stomachs). Note that water is also used as a raw material for some of the body's reactions but we don't generally think of it as a nutrient.

4: Food test predictions

Developing/Securing

WS

Ask students to make predictions before carrying out the simple food tests (see Exploring tasks). You could challenge some students to explain their predictions. After the various food tests have been carried out by students or demonstrated, ask students to check the results against their predictions. Ask them how useful they think it was to think about what they were going to find before actually carrying out the tests. The **AT** animation *Food tests 1* shows some examples of simple food tests. The **AT** document *Food tests 2* contains simple questions to support this task.

Course resources
AT: Animation *Food tests 1*. Document *Food tests 2*.

5: Testing for water

Securing

Prac

Water is an important component of the diet and some students may be interested in finding out which foods contain a lot of water. Food standards scientists also test the water content of foods, since some foods can have water pumped into them to make them look more appetising. Illustrate this by using this experiment as a demonstration. Place anhydrous (blue) cobalt chloride paper on a food sample. It will turn pink in the presence of water. Obviously, food scientists use more complicated tests, but this experiment provides another example of how components in food can be tested. This test for water is met more formally in Units 8E and 8C.

Cobalt chloride paper should be directly handled as little as possible: use forceps. Hands should be washed if direct contact is made with the skin.

Equipment
Anhydrous cobalt chloride paper, forceps, food samples (e.g. fruit, low-fat spread).

PLENARIES

Most plenaries can be used for formative assessment. Suggested assessment, feedback and action strands of formative assessment can all be modified. See the ASP for further information and ideas on formative assessment.

1: Quick Check

Developing/Securing/Exceeding

FA

Assessment: Students work individually on question 1 of the 8Aa Quick Check sheet.

Feedback: Let students look at Student Book spread 8Aa Nutrients and improve or correct their work on question 1. Questions 2 and 3 should be completed in groups.

Action: Get students to highlight parts of answers to questions 2 and 3 that represent ideas that they found the most difficult to understand. Use this information, along with students' answers to question 3b, to inform how you approach the teaching of this next topic. Re-explaining ideas in the context of the new topic should aim to make links between ideas.

Course resources
ASP: 8Aa Quick Check.

2: Thinking about nutrients

Developing/Securing

FA

Assessment:
Odd One Out: carbohydrates, proteins, fibre, vitamins. (Possible answers: fibre is not a nutrient; vitamins as we only need them in small amounts.)

Odd One Out: fibre, water, sugar. (Possible answers: sugar is the only carbohydrate; sugar is the only nutrient; water is the only liquid; fibre is the only one that won't disappear when mixed with water.)

Odd One Out: beef fat, vegetable oil, corn starch. (Possible answers: corn starch is not a lipid; vegetable oil is a liquid; beef fat comes from animals.)

What Was The Question: diet. (Possible question: What do you call the food you eat?)

What Was The Question: Your intestines get blocked. (Possible questions: What happens if you get constipation? What can happen if you don't eat enough fibre?)

Feedback: Students answer the thinking skills questions in groups, thereby feeding back their thoughts to one another. Ask students to write down their best answers and consider why they think they are the best.

Action: Ask a spokesperson from a number of groups to read out their best answers. Identify any ideas that are missing or incorrect and share them with the class. If understanding is poor then ask students to make a list of the concepts that are needed to produce better answers to the thinking skills questions using Student Book spread 8Aa Nutrients. Using their list and the Student Book, they could attempt to improve on their first attempts. Students could also write questions (with ideal answers) for each area of weakness. They then test each other using their own questions next lesson.

The **AT** presentation *8Aa Thinking skills* can be used for this activity.

Course resources
AT: Presentation *8Aa Thinking skills.*

3: Word definitions

Developing/Securing

FA

Give students copies of the Word Sheet for this topic but with the definitions missing. Ask students to put a number from 1 to 5 against each word to show how confident they are that they know the meaning (5 meaning 'absolutely certain', 1 meaning 'no idea'). Then read out the words one by one and ask for a show of hands for Certainty of Response Index scores of 4 and 5 (see Introduction), identify the two or three words that students are least sure about and revise their meanings, before quickly running through the meanings of the other words.

Ask students to reflect on why some of these words were less familiar/easy to recall than others. For example, is it because they were only recently introduced, or because they represent a difficult idea (rather than a label), or because they are not in everyday use.

Course resources
ASP: 8A Word Sheets.

4: Food words revisited

Developing/Securing

SA

Students look back at each of the sentences that they wrote in Starter 3. For each sentence they

suggest improvements that could be made based on what they have learned in this topic.

HOMEWORK TASKS

1: Nutrition labels

Developing/Securing

Worksheet 8Aa-8 contains straightforward questions about food labelling and nutrients.

Course resources
AP: Worksheet 8Aa-8.

2: SuperFibre Bars

Developing/Securing

Lit

Worksheet 8Aa-9 contains questions on food labelling, nutrients and food tests. You may not wish students to do the last question.

Course resources
AP: Worksheet 8Aa-9.

3: Sorghum syrup

Securing/Exceeding

WS

Worksheet 8Aa-10 challenges students to interpret data on reducing and non-reducing sugars. You may not wish students to do the last question.

Course resources
AP: Worksheet 8Aa-10.

ActiveLearn

Three ActiveLearn exercises are available for this topic: Nutrients 1; Nutrients 2; Nutrients 3.

8Ab
Uses of nutrients

This grid shows the basic concepts met in this topic, together with a scheme of cognitive progression for each concept. Opportunities to cover learning and progression are given. Working Scientifically concepts are integrated throughout the materials.

Conceptual statement	Cognitive progress					
	Remembering (a)	Understanding (b)	Applying (c)	Analysing (d)	Evaluating (e)	Synthesising & creating (f)
Vitamins and minerals, although only required in tiny quantities, have important functions in the body.	Recall the [approximate, relative] amounts of the different nutrients required on a daily basis. Recall sources of some individual vitamins and mineral salts (e.g. vitamin A, vitamin C, calcium, iron). Recall the units used for measuring quantities of dietary nutrients in foods.	Describe the functions of [vitamin C, vitamin D, calcium] in the body.				
To maintain a constant weight/mass, a person's energy intake must match their energy use.	Describe the factors that may lead to [being overweight, obesity]. State the meaning of: obese. Recall the effects of obesity on health. Calculate energy requirements for daily needs and activities. Recall that if a person's energy intake is different from the amount of energy that they need, their mass will change.	Describe the relationships between diet, exercise, age, sex and energy. Explain the effects of obesity on health.	Explain why mass changes if energy input into the body does not match energy output.	Calculate and use body mass indices (BMIs) to draw conclusions.	Examine rates of obesity in an area and suggest reasons for any trends.	
Different nutrients in the diet have different purposes.	Recall the different names of the different nutrients in food. Recall that food contains nutrients, fibre and water. Recall good sources of [carbohydrate, fat, protein, fibre]. Recall what is meant by: nutrient.	Describe the general uses of [carbohydrate, fat, protein, vitamins, minerals] by the body. Describe the use of fibre by the body. Describe the use of water by the body.			Justify the need for protein from a variety of different sources.	

8Ab

Conceptual statement	Cognitive progress					
	Remembering (a)	Understanding (b)	Applying (c)	Analysing (d)	Evaluating (e)	Synthesising & creating (f)
Humans need the right amounts of water and different foods in their diets to stay healthy and grow.	Recall how humans should eat and drink in order to stay healthy and grow. Recall why we need food (for energy, for growth and repair, for health). Recall what is meant by: diet.	Describe how food acts as a fuel for the body.	Explain how deficiency diseases are caused.			

Objectives
Developing:

1. Recall why we need food (energy, growth and repair, health).
2. Recall how food acts as a fuel for the body.
3. Recall some good sources of carbohydrates, fats, proteins and fibre.
4. Recall that if a person's energy intake is different from the amount of energy that they need, their mass will change.
5. Calculate energy requirements for daily needs and activities.
6. Describe the general uses of carbohydrates, fats (lipids), proteins, vitamins and minerals by the body.

Securing:

7. Describe the relationships between diet, exercise, age, sex and energy.
8. Explain why body mass changes if energy input into the body does not match energy output.
9. Recall sources of some individual vitamins and mineral salts (e.g. vitamin A, vitamin C, calcium, iron).

Exceeding:

10. Describe the roles of vitamin A, vitamin C, calcium and iron in the body.

Focused Literacy & Communication Objectives
This topic provides an opportunity to focus on key Literacy & Communication skills.

1. Recall that information may be presented to persuade an audience.
2. Spot ways in which words are used to add weight to arguments.
3. Distinguish between points that are supported by evidence and those that are not.
4. Use vocabulary to add weight to arguments to create bias.
5. Identify bias.

Student materials

Topic notes

- Note that weight and mass are not the same. Weight is a measure of the force by which something is attracted to Earth by the Earth's gravity. As a force, it is measured in newtons. Mass is a measure of the amount of material something is made of and is measured in kilograms. So, in the context of foods, while it is possible to correctly refer to the weight changing, that weight change would be measured in newtons and not kilograms.
- The range of options for activities and worksheets in this topic can be supplemented by some of the worksheets and activities suggested for use in Topic 7Ia.

STARTERS

1: Nutrient needs
Developing
BA
Ask students to name the main categories of nutrients in food. Use their responses to write a list on the board: carbohydrates, fats (or lipids or fats and oils), proteins, vitamins, minerals. Then write on the other side of the board: growth and repair, energy, health. Ask students: Which nutrients are mainly used as a fuel for the body? Which nutrients are the most important for growth and repair? Which nutrients do you need for health? Draw lines to match carbohydrates and fats with energy, proteins with growth and repair and all of them with health.

Extend this activity by asking students to draw a concept map centred on a function (for example, growth and repair), then link out to the nutrients that are needed for that function – and then examples of foods containing each nutrient.

2: Nutrients in foods

Securing

BA

Worksheet 8Ab-5 provides a list of common foods. Ask students to tick the main nutrients in each foodstuff. Give students 5 minutes to complete their sheets, then a class discussion can be held to compare opinions. If you ask students to complete the sheet in pencil, they can revisit it at the end of the topic (Plenary 5) and make any necessary corrections.

Developing: Students simply draw in ticks to show the main nutrients in each food.

Securing: Ask students to use two ticks for foods that contain a lot of a nutrient, and one tick for foods that only contain a little of it.

Extend this activity by asking students to draw concept maps (as suggested in Starter 1).

Course resources
AP: Worksheet 8Ab-5.

3: Foods and their nutrients

Securing

BA **Prac** **WS**

Have a selection of foods available (e.g. potato, pasta, frankfurter sausages, hard-boiled egg, milk, an orange). Ask students to work in groups to divide these foods into three categories. After a couple of minutes ask two groups to explain what categories they have chosen to divide the foods into. Value the categories that students have chosen, before explaining that one way of categorising these items is to think about the function of nutrients in the body. Tell students that some foods contain a lot of nutrients that are used mainly for energy, some foods contain a lot of nutrients that are very important for growth and repair, and some are very important because they contain vitamins and minerals for health. Give students another couple of minutes to sort the foods into these new groups. Establish that potatoes and pasta contain a lot of starch, which is important for energy. Frankfurters and eggs contain lots of proteins that are important for growth and repair. Milk contains a lot of calcium (a mineral). Oranges contain lots of vitamin C. Then ask which food was the most difficult to group. Milk is quite difficult because it contains a lot of proteins and fat as well as vitamins and minerals.

Extend this activity by asking students to draw a Venn diagram showing the overlap of nutrients and foods (see Skills Sheet PD 8 from the Year 7 Activity Pack).

⚠ Students must not consume the foods.

Course resources
AP: Skills Sheet PD 8 (Year 7).

Equipment
Selection of foods to demonstrate those that are rich in carbohydrates (e.g. pasta, potatoes), proteins (e.g. frankfurter sausages, hard-boiled egg), vitamins and/or minerals (e.g. milk, an orange).

EXPLORING TASKS

1: What's in our food?

Securing

WS

Ask students to look through nutrition information panels to find the answers to questions such as: Which food contains the highest amount of fat? Students should be encouraged to frame their own questions.

Alternatively, the nutrition information on Skills Sheet DS 3 could be used, or the **AT** spreadsheet *What food contains* shows a table showing the constituents of everyday foods.

Bar charts or pie charts (Skills Sheets PD 3 and PD 7 from the Year 7 Activity Pack) could be plotted to show the levels of nutrients in different foods, or the foods rich in certain nutrients.

Exceeding: Students use the spreadsheet alongside information panels taken from foods and current prices to answer questions such as: Are high-protein foods more expensive than others?; What are good sources of protein in a vegetarian diet?; How does the nutrient content of pre-packaged meals compare with freshly cooked meals?

Course resources
AP: Skills Sheets DS 3; PD 3 (Year 7); PD 7 (Year 7).
AT: Spreadsheet *What food contains*.

Equipment
Nutrition information labels.
Optional: sheet of current food prices downloaded from the Internet.

2: Energy in food

Developing/Securing

Prac **WS**

Exploring 2 in Topic 7Ia can also be used here, along with the corresponding Activity Pack worksheets. Various foods are burned to compare energy contents.

Do not use foods that contain nuts. Students must not consume the foods.

Equipment
Crisps/crackers/bite-sized cereals/other foods such as crispbreads together with the packets (for energy information), measuring cylinder, boiling tube, clamp and stand, thermometer, water, pin stuck into a cork with the point outwards, coil of wire mounted in cord, Bunsen burner, heat-resistant mat, eye protection.

3: Food adverts

Developing/Securing

Lit

Give students some pictures of food products cut from magazines or downloaded from the Internet. Ask them to work in groups to produce posters to advertise the products, using adjectives and verbs that add 'weight'.

Alternatively, the **AT** presentation *Creating an advert* provides some artwork and helpful phrases that students could use to produce their posters.

This activity can be extended using audio-visual equipment, with students making TV or radio adverts.

Exceeding: Challenge students to base their adverts on evidence, and to use the evidence in a biased way.

Course resources
AT: Presentation *Creating an advert.*

Equipment
Food labels showing nutrition information. Optional: Video/audio recording equipment and editing software.

4: Food wheels

Developing/Securing

Using Worksheet 8Ab-2, students could construct a food wheel. There are many possibilities on how to fill this in. Some suggestions are listed below.

Developing: Nutrient types on the outer ring of wheel 2 and a good source of each on the inner one. Or different activities on the outer ring of wheel 2 and how much energy they require per hour on the inner one.

Securing: Nutrient types on the outer ring of wheel 2 and what they are used for on the inner one.

Exceeding: Ask students to research E numbers, and put the numbers on the outer ring and their corresponding names on the inner ring. Or students could be challenged to think up their own ideas on what to put on the wheels and to make more than one wheel.

Students are asked to make holes in their wheels using scissors and modelling clay. Some teachers may wish to do this themselves.

Course resources
AP: Worksheet 8Ab-2.

Equipment
Scissors, brass butterfly paper fastener, modelling clay.

5: Matching energy and foods

Developing/Securing

Prac **WS**

Worksheet 8Ab-3 contains a series of cards; some show activities and how much energy they 'transfer' and some show the energy values of servings of food. There are a variety of ways in which these cards could be used. One suggestion is to give the cards to groups of students who then need to cut them out and match each activity with two foods that store the energy needed. Alternatively, if you have a class with a number of students divisible by three, each student could get a card and then students need to sort themselves out into groups of three (one activity card and two food cards). See the answer section for how the cards pair with one another.

When the activity is complete, ask students to say what would happen if the amount of activity stayed the same but double the food was consumed. Ask students what can happen in the long term if more food is consumed than is required. Establish that weight/mass gain is the likely outcome.

Note that the figures for energy requirements are an average for a 45 kg person. The exact figures will depend on the precise nature of the exercise, the sex of the person and their age.

Developing: Use only the cards on the first page of the worksheet.

Securing: Use all the cards.

Exceeding: Increase the level of demand for this activity by removing the energy stored values from the food cards. Students then use Skills Sheet DS 3 in order to work out the energy stored in each serving of the food.

Ensure that discussion of weight/mass is handled sensitively, since some students will have problems with this issue.

Course resources
AP: Skills Sheet DS 3 (optional).
Worksheet 8Ab-3.

Equipment
Scissors (unless cards are pre-cut).

6: Energy needs

Securing

Worksheet 8Ab-6 gives students a chance to calculate their own energy requirements for a day. Alternatively, this can be done using the AT spreadsheet *Activity diary 1* where students keep an activity diary that calculates their energy use. The AT spreadsheet *Activity diary 2* requires students to then enter the correct formulae to calculate their total energy use for the day.

Extend this activity by asking students to use Skills Sheet DS 3 or the AT spreadsheet *What food contains* to design a set of meals for a day that would allow them to have the right amount of energy stored in their food.

Securing: Challenge students to say where inaccuracies in the total calculation may have crept in (e.g. difficult to work out/remember exactly how long you did each activity for during the day; the energy required for an activity will depend on the precise nature of the activity, sex and age).

Course resources
AP: Skills Sheet DS 3 (optional). Worksheet 8Ab-6.
AT: Spreadsheets *Activity diary 1; Activity diary 2; What food contains.*

Equipment
Calculator (optional).

7: Researching vitamins and minerals

Securing/Exceeding

Challenge students to research and write down a list of vitamins and minerals needed by the body. For each one they should find out why the body needs it. Challenge students to find a different source of information for each use and to record their information sources.

Students can use the AT interactive *Vitamins and minerals* to compare with their own research. Students can click on the names of four vitamins and minerals to find out what they are needed for in the human body. Additionally it explains which foods are good sources of vitamins and minerals.

Course resources
AT: Interactive *Vitamins and minerals*.

Equipment
Internet/library access.

EXPLAINING TASKS

1: 8Ab Uses of nutrients (Student Book)

Developing/Securing/Exceeding

FA

This spread looks at the basic uses for the different nutrients in food, which are split into three broad categories: energy, growth and repair, health. Students should remember that these are broad categories and most nutrients will be used in each category, but some are more important than others. Worksheet 8Ab-1 is the Access Sheet.

Ensure that students understand the units used in table D – kJ/h is the number of kilojoules needed every hour.

Question 11 is suitable for use in formative assessment, with students working together to prepare the table to answer the question.

The AT presentation *Calories and joules* shows the difference between energy values of calories and joules. See Explaining 4.

The AT spreadsheets *Activity diary 1* and *Activity diary 2* were also used in Exploring 6.

The AT interactive *Vitamins and minerals* was also used in Exploring 7 and gives the opportunity to explore the functions of some common vitamins and minerals. Students click on the names of four vitamins and minerals to find out what they are needed for in the human body. It also explains which foods are good sources of vitamins and minerals.

An AT spreadsheet *What food contains* includes an extensive list of common foods and their nutrient and energy contents. This list is also found on Skills Sheet DS 3.

The AT presentation *8Ab Thinking skills* is also used in Plenary 3.

Course resources
AP: Skills Sheet DS 3. Worksheet 8Ab-1.
AT: Interactive *Vitamins and minerals*.
Presentations *8Ab Thinking skills; Calories and joules.* Spreadsheets *Activity diary 1; Activity diary 2; What food contains.*

2: 8Ab Weighting and bias (Student Book)
Developing/Securing/Exceeding
FA Lit

This Literacy & Communication spread looks at the various ways in which language is used to give weight to a point to persuade the reader that the point is right/important, and at how evidence can be used or misused. Old TV adverts could be used for students to spot different examples of weighting using verbs and adjectives. Try an Internet search for 'old tv adverts'.

Question 6 can be used for formative assessment, with students working in groups to produce a final advert.

Note that, in their response to question 2, students may include 'terribly' as an adjective. This is an acceptable answer.

The **AT** video opens *ASA ruling*, which explains a ruling by the Advertising Standards Authority in 2011. After complaints by MP Jo Swinson, the Advertising Standards Authority ruled that L'Oréal magazine adverts for make-up and an anti-ageing products breached the advertising standards code for exaggeration and being misleading and banned them from future publication. The adverts, showing images of Julia Roberts and Christy Turlington, had been digitally manipulated.
(Please note the transcript of this video is not available.)

Course resources
AT: Video *ASA ruling.*

3: What effect do adverts have?
Securing

Show students a range of adverts that encourage us to eat certain types of foods or make us feel overweight. Show students the adverts in turn (it is a good idea to scan them if you can and display on an interactive whiteboard). Ask students what the advert or image makes them feel like. In each advert point out the nutrients that the food is rich in. Point out that the adverts for the fatty foods all feature healthier-than-normal looking people who are undoubtedly thin and very active. Foods that are advertised to contain a lot of protein are often advertised using muscle-bound models.

Equipment
Range of adverts for fatty/junk foods, foods containing proteins, foods containing vitamins and minerals.

4: Calories and joules
Securing

Explain to students that energy is often measured in both calories and joules. Show students a nutrition information label with the values for both given. Tell students that joules and kilojoules are the better unit to use because they are part of the modern SI system of internationally agreed units. What we call calories are in fact kcal, or kilocalories, and these units, although not part of the SI system, are still given because people understand them. Students should take care not to muddle them up: 1 kcal = 4.1868 kJ.

Show students this relationship graphically, by using the **AT** presentation *Calories and joules*. This contains the same data as presented in bar chart C, but the data are shown in cal, kcal, J and kJ. Get students to watch carefully what happens to the scale on the *y*-axis.

Course resources
AT: Presentation *Calories and joules*.

Equipment
Nutrition information label.

PLENARIES

Most plenaries can be used for formative assessment. Suggested assessment, feedback and action strands of formative assessment can all be modified. See the ASP for further information and ideas on formative assessment.

1: Quick Check
Developing/Securing/Exceeding
FA

Assessment: Students work individually on the cloze exercise on the 8Ab Quick Check sheet.

Feedback: Small groups of students compare papers and identify any disagreement in the answers. They agree on the correct answer, with help from the teacher if necessary.

Action: Using the Student Book as an aid, students write their own exercise statements for the topics in which there was disagreement about the answers from the original exercise. If there is time, the new cloze statements could be gathered together, and read out by you with the list of missing words written on the board and students selected at random to say what the missing words are.

Extend the action by asking students to design a crossword with clues using these terms. Crosswords could then be swapped for completion by peers.

Course resources
ASP: 8Ab Quick Check.

2: Quick Check Literacy

Developing/Securing/Exceeding

FA Lit

Assessment: Students use the 8Ab Quick Check Literacy sheet to identify weighting and bias in an advert.

Feedback: Students pair up and discuss their answers.

Action: Explain weighting and bias again, with reference to Student Book spread 7Ab Weighting and bias. Tell students that, in 2012, scientists showed that a compound called 'epi' improved the memories of snails and that this compound is found in chocolate (*A flavonol present in cocoa [(–) epicatechin] enhances snail memory* by Fruson *et al*.; J Exp Biol 215, 3566–3576, October 2012). Then ask each student to write a couple of sentences for an advert for a chocolate bar using words that add 'weight' in order to persuade the reader that chocolate is good for them.

Course resources
ASP: 8Ab Quick Check Literacy.

3: Thinking about uses of nutrients

Developing/Securing

FA

Assessment:

Plus, Minus, Interesting: The body should not store fat. (Possible answers: **Plus** – People would not get fat; **Minus** – People may die if they can't get any food when they are hungry; people may get very cold; **Interesting** – Do some people naturally store less fat than others? In a condition called muscular fibrositis disproportion, the body cannot store fat.)

Plus, Minus, Interesting: People should do more sport. (Possible answers: **Plus** – People would be fitter; **Minus** – People may have to eat more to get the energy they need; **Interesting** – What could be done to encourage more people to do sport? It is recommended that people do at least 2.5 hours of moderate activity each week.)

Consider All Possibilities: It is hard for some people to buy the foods that they need. (Possible answers: some people don't live near large supermarkets; some people can't afford to buy much food; healthy foods are more expensive than junk food.)

Odd One Out: vitamins, starch, sugars, fats. (Possible answers: vitamins do not provide energy and are only needed in small amounts; fats are the only ones used for insulation.)

Odd One Out: meat, fish, vegetables, dairy products. (Possible answers: vegetables are the only things that contain fibre and lots of vitamins and minerals, or the only things that do not contain much fat; vegetables are the only things that come from plants; dairy products can be liquids.)

What Was The Question: respiration. (Possible questions: What process uses up sugar? What process releases energy from food in your body?)

Feedback: Ask each group to appoint a spokesperson to read out the agreed answers to the class. Ask other spokespeople to add to the list.

Action: Get other groups to identify and, if possible, to correct any misconceptions evident in the answers given. Even if they can't correct an answer, students should be encouraged to identify where they are not sure that something is correct and to suggest the idea or topic that would help them produce a better answer. After a class discussion on the key ideas needed, students can then refer to the Student Book to improve their answers.

The **AT** presentation *8Ab Thinking skills* can be used for this activity.

Course resources
AT: Presentation *8Ab Thinking skills.*

4: Food quiz

Developing/Securing

FA

Ask students to design a quiz sheet (with answers) about this topic (and the last) and swap their sheets with other students for them to answer. The questions should involve one-word answers only, to make marking easier. Papers are returned to the authors for marking and then given back to the students who completed the test. Students should make corrections, supported by the Student Book, then check these against the answer list produced by the quiz's author. Disagreements over the answers should be brought to the teacher for adjudication.

Equipment
Paper.

5: Nutrients in foods revisited

Securing

BA

Students add to/amend/correct their copies of Worksheet 8Ab-5 from Starter 2. Get some individual students to reflect on which ideas have been reinforced for them while studying this topic.

Course resources
AP: Worksheet 8Ab-5.

HOMEWORK TASKS

1: Take away

Developing/Securing

Worksheet 8Ab-4 contains straightforward questions about energy needs, nutrients and their uses in the body.

Course resources
AP: Worksheet 8Ab-4.

2: Foods and energy

Developing/Securing

Worksheet 8Ab-7 contains questions on food labelling, nutrients and food tests. You may not wish students to do the last question.

Course resources
AP: Worksheet 8Ab-7.

3: Diet diaries

Developing/Securing

Ask students to keep a diary of everything that they eat before the next science lesson (when they will examine their diaries in Starter 1). Encourage them to record which type of nutrient is in the highest amounts in each food.

4: The work of food scientists

Securing/Exceeding

WS

Worksheet 8Ab-8 challenges students to interpret data on a nutrition information label for a food, which includes calculations. You may not wish students to do the last question.

Course resources
AP: Worksheet 8Ab-8.

ActiveLearn

Five ActiveLearn exercises are available for this topic: Uses of nutrients 1; Uses of nutrients 2; Uses of nutrients 3; Weighting and bias 1; Weighting and bias 2.

8Ac
Balanced diets

This grid shows the basic concepts met in this topic, together with a scheme of cognitive progression for each concept. Opportunities to cover learning and progression are given. Working Scientifically concepts are integrated throughout the materials.

Conceptual statement	Cognitive progress					
	Remembering (a)	Understanding (b)	Applying (c)	Analysing (d)	Evaluating (e)	Synthesising & creating (f)
Blood glucose regulation is disrupted in people with diabetes.	Recall causes of [Type 1, Type 2] diabetes. State the meaning of: diabetes.	Explain how [Type 1, Type 2] diabetes can be controlled.	Explain how, in Type 1 diabetes, the level of physical activity and diet affect the amount of insulin required.	Explain the reasoning behind different regimes in the control of Type 1 diabetes symptoms.	Evaluate the correlation between obesity and Type 2 diabetes.	
To maintain a constant weight/ mass, a person's energy intake must match their energy use.	Describe the factors that may lead to [being overweight, obesity]. State the meaning of: obese. Recall the effects of obesity on health. Calculate energy requirements for daily needs and activities. Recall that if a person's energy intake is different from the amount of energy that they need, their mass will change.	Describe the relationships between diet, exercise, age, sex and energy. Explain the effects of obesity on health.	Explain why mass changes if energy input into the body does not match energy output.	Calculate and use body mass indices (BMIs) to draw conclusions.	Examine rates of obesity in an area and suggest reasons for any trends.	
Malnutrition is caused by a lack of or excess of one or more nutrients.	Recall and identify examples of deficiency diseases caused by a lack of different nutrients. State the meaning of: malnutrition, starvation.	Describe why malnutrition occurs in a certain population. Explain the links between specific forms of malnutrition, diet and lifestyle.		Draw conclusions from James Lind's experiments on scurvy.	[Links to genetics, golden rice.]	
Humans need to eat a balanced diet.	Recall what is meant by: a balanced diet.	Explain the benefits of having a balanced diet.	Use [dietary advice, nutrition information] to design a healthy diet.	Analyse and produce feedback on a diet diary for a person with a particular lifestyle. Interpret [GDA, RDA, RI] information.		

Conceptual statement	Cognitive progress					
	Remembering (a)	Understanding (b)	Applying (c)	Analysing (d)	Evaluating (e)	Synthesising & creating (f)
Humans need the right amounts of water and different foods in their diets to stay healthy and grow.	Recall how humans should eat and drink in order to stay healthy and grow. Recall why we need food (for energy, for growth and repair, for health). Recall what is meant by: diet.	Describe how food acts as a fuel for the body.	Explain how deficiency diseases are caused.			

Objectives
Developing:

1. Recall what is meant by a balanced diet.
2. Explain the benefits of a balanced diet and correctly use the term: malnutrition.
3. Explain how deficiency diseases are caused.
4. Describe the factors that may lead to obesity.

Securing:

5. Describe the effects of obesity on health.
6. Use dietary advice and nutrition information to design a healthy diet.
7. Interpret Reference Intake (RI) information.
8. Recall and identify examples of deficiency diseases (kwashiorkor, scurvy, rickets).
9. Explain the links between specific forms of malnutrition, diet and lifestyle.

Exceeding:

10. Describe the causes and control of Type 2 diabetes.

Student materials

Topic notes

- Care should be taken when discussing 'weight problems' and obesity since some students will be sensitive about their weight.
- There are many different measures of how much of the different nutrients a person should eat in a day, including Guideline Daily Amounts (GDAs), Dietary Reference Values (DRVs), Reference Intakes (RIs), Estimated Average Requirements (EARs), etc. The new recommended traffic light labels for foods in the UK refer to Reference Intakes so that is the term we have used throughout the course. However, GDAs often appear on traffic light labels so it is worthwhile telling students that GDAs and RIs are equivalent.

Be prepared
Starter 1 needs the diet diaries created as part of Homework 3 in the last topic.

STARTERS

1: Diet diaries
Developing/Securing
BA

Ask students to look at their diet diaries, if they were asked to do them in Homework 3 in Topic 8Ab. Ask them to look at the foods that they have eaten and say whether they think they have a healthy diet or not. Introduce the term 'balanced diet' as meaning eating 'suitable amounts of a wide range of nutrients' and then challenge students to identify how their diets could be improved (better balanced). They could do this by highlighting foods in their diet sheet; for example, red (I should eat less of this), amber (I am eating the right amount of this type of food) and green (I should be eating more of this type of food).

You can also use the information collected by students to discuss whether how they recorded what they ate was appropriate to the task and any conclusions made. Most students will not have noted down the exact amounts of food, others will miss out drinks and snacks between meals, and this makes it difficult to do a detailed, accurate analysis of diets.

Equipment
Diet diaries from 8Ab Homework 3.

2: Obesity

Securing

BA

Obesity rates have increased greatly in the last 30 years. Now, most people in the UK are overweight, including about 60% of adults and 30% of children (aged 2–15 years). Share these facts with students and ask them to discuss in groups:

(a) why they think this has happened
(b) what problems obesity can cause
(c) what can be done about the increasing numbers of obese people.

After 5 minutes, show students the **AT** video *Obesity*. This is a news report about the problem and describes the increasing levels of obesity in Britain, the reasons for the rise, some of the problems that obesity can cause and some possible solutions.
(Please note the transcript of this video is not available.)

Give students time to add to their answers as they identify things in the video they did not think about in discussion.

Reflect with students on any differences between the type of information that they were familiar with and the ideas that were less familiar. What are their main sources of information about their own health?

Course resources
AT: Video *Obesity*.

3: Malnutrition

Securing

BA

Ask students to work in groups to come up with a definition of 'malnutrition' and some examples, if they can think of any. It is useful if you have the word written on the board as students come in.

After a few minutes, show students the **AT** presentation *Malnutrition.* Students can use this presentation to study the causes and effects of malnutrition. It defines the word and then gives some examples.

Stop the presentation after the first deficiency disease has been shown. Then ask students to write down something that they now know about malnutrition that they did not know before. Ask students at random to read out their new learning. Reflect on this in a similar way to the suggestion for Starter 2.

Course resources
AT: Presentation *Malnutrition*.

EXPLORING TASKS

1: Fizzy drinks tax

Developing/Securing

Worksheet 8Ac-6 contains a newspaper article. Before using the article you may need to explain that there are different types of a disease called diabetes that stops your body controlling the levels of sugars in the blood, which can damage organs. There is a higher risk of developing one type of diabetes (Type 2) if you are overweight.

Developing: Students work in groups to answer the questions at the bottom of the sheet.

Securing: Ask students to write a question that can be answered from the article, together with a mark scheme. Each question should be worth 2 or 3 marks. Students then challenge one another to answer their questions and the question setters mark the questions.

Exceeding: Encourage students to look up unfamiliar words (such as diabetes) and challenge them to write a summary of the article in no more than 50 words.

Course resources
AP: Worksheet 8Ac-6.

Equipment
Internet/library access (optional).

2: Research work

Securing/Extending

Ask students to use books and/or the Internet to find out about problems caused by a poor diet. Skills Sheet RC 2 from the Year 7 Activity Pack may also be helpful. Ask students to produce a list of key points as their report. Before starting, they should decide what key points they are going to include in their reports so that they do not waste time researching information that they do not need. Key points could be: What is wrong with the diet; The name of any condition/disease caused by the diet; The effects of the poor diet; Where in the world this is most commonly a problem; Why it is a problem in these parts of the world; What is being done to help improve people's diets.

Developing: Give students three or four of the key points to research, or give them a list of key points and ask them to choose three or four of them. Allow students to use the Student Book.

Securing: Ask students to work in groups, discussing first what their key points are going to be and how many poor diets they are going to research.

Exceeding: Ask students to research diseases that require special diets to stop them having bad effects on someone's health (e.g. coeliac disease, phenylketonuria, diabetes).

Course resources
AP: Skills Sheet RC 2 (Year 7).

Equipment
Internet/library access.

3: Meal matching

Securing

Explain to students that a balanced diet is when someone eats the right amounts of a wide range of foods over a long period of time. It is not necessary to make sure that every meal is balanced but it's always a good idea. Worksheet 8Ac-2 contains a series of cards with meal items on them. They can either be used by a group putting the cards together to form five balanced meals or, with the right number of students in the class, you could give each class member a card and ask students to sort themselves into five meals. For each of the five meals, the energy value needs to add up to 3000 kJ. Give additional credit to students who add water to meals that don't contain a drink.

Developing: Reduce the level of demand by only using the cards on the first page of Worksheet 8Ac-2.

Securing: Challenge students to identify the least well-balanced meal, with reference to the eatwell plate on Student Book spread 8Ac Balanced diets.

Course resources
AP: Worksheet 8Ac-2.

4: Designing meals

Developing/Securing

Ask students to use Skills Sheet DS 3 to design a set of meals for one day that satisfy the intake recommendations in the table below. This activity can also be undertaken using nutrition information labels from foods. Note that the values given are all for 11–14 year olds and so may be different from adult Reference Intake/Guideline Daily Amount values on food packaging.

	Energy	Protein	Calcium	Iron	Total Fat	Sat. Fat	Salt
Boys	9300 kJ	42.1 g	1000 mg	11.3 mg	≤ 86.3 g	≤ 27.1 g	≤ 6 g
Girls	7700 kJ	41.2 g	800 mg	14.8 mg	≤ 71.6 g	≤ 22.6 g	≤ 6 g

Course resources
AP: Skills Sheet DS 3.

Equipment
Food nutrition information labels (optional).

5: Scurvy and beriberi

Developing/Securing

Worksheet 8Ac-3 tells the story of James Lind and scurvy. Extend the activity by asking students to use Skills Sheet SI 1 from the Year 7 Activity Pack to draw a flowchart to show how James Lind used the scientific method.

The **AT** document *Beriberi* challenges students to examine experiments that identified the causes of beriberi.

Developing: Students answer questions 1–3 on Worksheet 8Ac-3.

Securing: Students answer all the questions on Worksheet 8Ac-3. Question 4 will need appropriate reference books or Internet access. Then challenge students to complete the **AT** document *Beriberi*.

Exceeding: Challenge students to show how Eijkman and/or Hopkins used the scientific method during their research into the causes of beriberi.

Course resources
AP: Skills Sheet SI 1 (Year 7). Worksheet 8Ac-3.
AT: Document *Beriberi.*

Equipment
Internet/library access.

6: Traffic lights

Securing

Worksheet 8Ac-4 explains the traffic light system used on food packaging. It should be noted that the labels presented here are the government-approved design but this is not statutory. Some companies have decided to use their own system of traffic lights and there is some variation. Note also that the labels on this sheet refer to reference intake (in accordance with Department of Health and Food Standards Agency guidelines, June 2013). Other labels may refer to GDAs (Guideline Daily Allowances), which are equivalent.

To introduce the activity, it is useful to display some real traffic light labels from food packaging. It is worthwhile going through question 1c with a different example, so that students can follow the working (which is given in the answers).

Exceeding: Remove the percentage reference intake amounts from the labels for question 3 on the sheet before photocopying/printing, and ask students to work out these percentages, rounded up to the nearest whole number, using the reference intake values given in the table below. Ensure that students know how to calculate percentages (e.g. 27 g of fat is 27/70 = 0.39 = 39%).

Energy (kJ)	8400
Energy (kcal)	2000
Fat	70 g
Saturates	20 g
Sugars	90 g
Salt	6 g

Course resources
AP: Worksheet 8Ac-4.

Equipment
Coloured pencils.
Optional: Traffic light symbols from food packaging.

EXPLAINING TASKS

1: 8Ac Balanced diets (Student Book)

Developing/Securing/Exceeding

FA

This spread looks at the importance of a balanced diet and some of the consequences of poor diets. Worksheet 8Ac-1 is the Access Sheet. Question 5a can be used for formative assessment, with students working in groups to identify the diseases in the photos.

The **AT** weblink *Make a balanced plate* links to an interactive activity that helps to illustrate what makes up a balanced diet and the importance of having a balanced diet.

The **AT** presentation *Malnutrition* may be useful here. See Starter 3 and Explaining 3.

The **AT** video *Famine* is a news report on the food shortage in Somalia, caused by a combination of conflict and drought. The lack of food can cause deficiency diseases as well as deaths from starvation.

The **AT** video *Obesity* shows a news report describing the increasing levels of obesity in Britain, the reasons for the rise, some of the problems that obesity can cause and some possible solutions. See Starter 2.

(Please note the transcript of these videos are not available.)

The **AT** document *Beriberi* asks students to examine experiments that identify the causes of beriberi disease.

Course resources
AP: Worksheet 8Ac-1.
AT: Document *Beriberi*. Presentation *Malnutrition.* Videos *Famine*; *Obesity*. Weblink *Make a balanced plate*.

Equipment
Food nutrition information labels (optional).

2: Visit from a dietician

Developing/Securing

Invite a dietician or other healthcare professional to talk to the class about balanced diets. The visitor should be asked to talk not only about diets but also about their career and what they do to help people. Encourage students to do some background research and think of some questions to ask before the visit.

3: Deficiency diseases

Securing

You may have used the **AT** presentation *Malnutrition* in Starter 3. Continue with the presentation to show students the slides of various deficiency diseases. Each slide shows and/or describes the symptoms of a deficiency disease, together with further information about what causes it and the people who are most at risk. Show students the presentation, stopping to point out the symptoms on the photographs.

Extend the activity by asking students to take notes about the causes of different deficiency diseases. Then challenge students to turn their notes into a two-column table, showing the different diseases and the lack of which nutrient causes each one.

Course resources
AT: Presentation *Malnutrition*.

PLENARIES

Most plenaries can be used for formative assessment. Suggested assessment, feedback and action strands of formative assessment can all be modified. See the ASP for further information and ideas on formative assessment.

1: Quick Check

Developing/Securing/Exceeding

FA

Assessment: Students work individually on the 8Ac Quick Check sheet, which asks students to explain what one of six words means. They choose which word to explain using a pencil and the table of numbers at the top, or they could use dice.

Feedback: After students have written their explanations, they follow the instructions on the sheet to gather together in groups that have all explained the same word. They read one another's work before writing a new and improved version of their original explanation.

Action: The exercise can be repeated or students could ask friends who have explained other words to help them fill in the rest of the sheet. Students then compare their work with what is written in

the Student Book and/or in the Word Sheet for 8Ac. They could highlight the words to show how confident they are in their meaning (red, amber or green).

Course resources
ASP: 8Ac Quick Check; 8A Word Sheets.

Equipment
Dice (optional).

2: Thinking about balanced diets

Developing/Securing

FA

Assessment:
Plus, Minus, Interesting: School meals should always provide a balanced diet. (Possible answers: **Plus** – Students would stay healthy; **Minus** – It might restrict the choice of food; **Interesting** – Is it possible to do this and still keep the meals interesting?)

Plus, Minus, Interesting: There are too many different foods to choose from when you go shopping. (Possible answers: **Plus** – It's always good to have lots of choice; **Minus** – You may not choose the right ones for a balanced diet; it takes longer to shop; **Interesting** – Would it help to make a list first?)

Consider All Possibilities: Not everyone eats enough vegetables. (Possible answers: some people can't eat vegetables for medical reasons; children are often fussy eaters; not everyone knows that vegetables are good for you; vegetables are not available in some very poor regions or regions hit by natural disasters.)

Consider All Possibilities: It is hard for some people to buy the foods that they need. (Possible answers: some people don't live near large supermarkets; some people can't afford to buy much food; healthy foods are more expensive than junk food.)

Odd One Out: kwashiorkor, scurvy, obesity. (Possible answers: obesity is about having too much but the other problems are caused by a lack of a nutrient; scurvy can be cured by eating more fresh fruit; kwashiorkor can be cured by eating more protein.)

Feedback: Ask each group to appoint a spokesperson to read out the agreed answers to the class. Ask other spokespeople to add to the list.

Action: Get other groups to identify and, if possible, to correct any misconceptions evident in the answers given. Even if they can't correct an answer, students should be encouraged to identify where they are not sure that something is correct. Allocate to small groups tasks that involve researching a range of areas where students are less confident. Students can summarise any important new facts or ideas they have found out at the start of the next lesson.

The **AT** presentation *8Ac Thinking skills* can be used for this activity.

Course resources
AT: Presentation *8Ac Thinking skills.*

3: Looking back

Developing/Securing/Exceeding

FA

If students produced a class list of questions at the start of the unit (Starter 1, 8Aa), identify any progress in understanding and areas that still need to be addressed by looking at the questions for this topic and the last. Encourage students to add sticky notes to the questions as appropriate.

4: Balanced plate

Developing/Securing

FA

Ask students to write the name of a single food on a sticky note. Draw an empty version of the eatwell plate (shown on Student Book spread 8Ac Balanced diets) on the board or on a large piece of paper. Ask students to put their sticky notes in the relevant sections of the plate. Once complete, challenge students to suggest which sticky notes should be removed to try to make the plate more balanced. Alternatively, ask students to choose foods from each section to design two healthy, balanced meals.

HOMEWORK TASKS

1: Balanced meals

Developing/Securing

WS

Worksheet 8Ac-5 contains straightforward questions about balanced diets.

Course resources
AP: Worksheet 8Ac-5.

2: Food and health

Developing/Securing

WS

Worksheet 8Ac-7 contains questions about malnutrition. Consider going through a similar calculation to question 2b with students before they do the sheet.

Course resources
AP: Worksheet 8Ac-7.

3: Diabetes and diet

Securing/Exceeding

WS

Worksheet 8Ac-8 introduces students to diabetes and challenges them to interpret a text about Type 2 diabetes, its causes and control. Referring students to Year 7 Student Book spread 7Dc Paragraphs may help students to answer question 3.

Course resources
AP: Worksheet 8Ac-8.

ActiveLearn

Three ActiveLearn exercises are available for this topic: Balanced diets 1; Balanced diets 2; Balanced diets 3.

8Ad
Digestion

This grid shows the basic concepts met in this topic, together with a scheme of cognitive progression for each concept. Opportunities to cover learning and progression are given. Working Scientifically concepts are integrated throughout the materials.

Conceptual statement	Cognitive progress					
	Remembering (a)	Understanding (b)	Applying (c)	Analysing (d)	Evaluating (e)	Synthesising & creating (f)
We can use models to account for the activity and specificity of enzymes.	Use a model to describe basic enzyme action. Recall that enzymes are highly specific. Define the meaning of: substrate.	Describe the functions of [carbohydrases, amylases, pepsin, proteases, lipases] in the human digestive system. Explain the action of enzymes using the lock-and-key hypothesis.	Explain why humans cannot digest all of the nutrients that other animals can.	Use the lock-and-key hypothesis to explain how enzyme action is affected by different factors.	Evaluate different models of basic enzyme action (e.g. scissors, nuts and bolts). Evaluate different models of enzyme action to explain specificity and the factors that affect activity.	Given parameters, design a set of enzymes that will turn a nutrient polymer into its component monomers. Develop a model to describe basic enzyme action.
Digestive systems contain a large number of bacteria.	Recall that many different types of bacteria live in animal digestive systems. Recall some [drawbacks, benefits] of bacteria in the digestive system.	Explain how some bacteria are useful in the gut.		Compare the [benefits, drawbacks] of the presence of these bacteria.	Evaluate the evidence for the claims made by products containing [probiotics, prebiotics].	
Enzymes digest food molecules.	Recall the role of enzymes [as catalysts] in digestion. Recall that enzymes are found in secretions from the [salivary glands, stomach, small intestine, pancreas]. Define the meaning of: substrate.	Describe the actions of [different types of digestive enzymes, amylase, carbohydrase, protease, pepsin]. Explain why the stomach wall secretes acid.	Use apparatus to model the effect of enzymes in the gut.	Describe the importance of surface area in the speed at which food can be digested by enzymes.		
Food passes along the [alimentary canal, gut] and unused materials are [egested, eliminated].	Recall the order in which organs of the digestive system are involved in digestion. Describe the effect of fibre on egestion. Define the meanings of: ingestion, egestion, absorption.	Explain how food is moved through the [alimentary canal, gut, digestive system].	Explain the problems caused by [food intolerances, Crohn's disease].			

Conceptual statement	Cognitive progress					
	Remembering (a)	Understanding (b)	Applying (c)	Analysing (d)	Evaluating (e)	Synthesising & creating (f)
The digestive system breaks down food.	[Identify, recall] the main [parts, organs] of the human digestive system. State the function of the digestive system.	Explain why digestion is necessary. Describe the functions of the main parts of the digestive system.	Create a flow chart to show what happens in the different parts of the digestive system.	Describe how the different parts of the human digestive system work together. Explain how organs in the digestive system are adapted to their functions.		

Objectives
Developing:

1. Identify and recall the main parts of the human digestive system.
2. Explain why digestion is necessary.
3. Describe the functions of the organs in the human digestive system.
4. Describe the role of enzymes as catalysts in digestion.
5. Recall some benefits and drawbacks of bacteria in the digestive system.

Securing:

6. Describe what happens during ingestion, absorption and egestion.
7. Explain how food is moved through the digestive system.
8. Use a model to describe basic enzyme action.

Exceeding:

9. Evaluate different models of basic enzyme action.

Student materials

STARTERS

1: What's in the gut?
Developing
BA
Students will have met the names of some parts of the digestive system in KS2 and in Unit 7A, although they will not specifically have studied digestion. Ask students what we need food for and what they think happens to their food when they have eaten it. Explain that food passes through a long tube in their body called the gut. Ask students to name any parts of the gut that they know – and what they think that part does.

Ask students to consider whether or not food is inside their body when it is in a hollow tube that passes straight though them.

2: Order the parts
Developing/Securing
BA
Write these words up on the board: anus, gullet, intestines, mouth, stomach. Ask students what they all have in common. Establish that these are organs in the gut and then ask students to put the organs in the order in which a piece of fibre (indigestible food) will go through them. An alternative is to ask students to write the words on pieces of paper or sticky notes. Students work in groups to either put the pieces of paper in order or stick the notes on themselves and put themselves in the correct order.

Students should return to this ordering as they learn more about the gut, and re-order any parts that are incorrectly placed.

Equipment
Paper or sticky notes.

3: A bag of oranges
Developing/Securing
BA **Prac**
Ask students where in the body food is used for the processes already discussed (growth and repair, energy, etc.). Elicit the idea that food needs to get from the gut and into the body. Show students a nylon mesh bag of fruit, such as one that oranges are sold in. Ask how the oranges could be got out of the bag without cutting the bag. Most will be able to see that the oranges need to be cut into smaller pieces. Ask students what a 'model' is and explain that this is a model for what happens in the digestive system. Challenge students to explain how this is a model: food (the oranges) is chopped up inside the gut (the mesh bag) and the smaller

pieces of food can then get out of the mesh bag and into the body (outside the bag).

Equipment
Nylon mesh bag containing fruit (e.g. bag of oranges from a supermarket).

EXPLORING TASKS

1: Digestive system parts

Securing

Worksheet 8Ad-5 provides a set of cards containing the names of organs in the digestive system, drawings of the organs and statements of the functions of the organs. Ask students to group the cards together into sets of three, and then to arrange their sets into the order in which they occur in the body.

Course resources
AP: Worksheet 8Ad-5.

Equipment
Scissors.

2: Amylase action

Developing/Securing/Exceeding

Prac **WS**

In this investigation students find out about an enzyme called amylase, which is found in digestive juices produced in the salivary glands and pancreas. If you don't want to introduce enzymes at this stage, and you have the electronic copy of the worksheets, you can substitute the word 'digestive juice' for amylase on Worksheets 8Ad-3 and/or 8Ad-4.

At its most basic level, each group takes two tubes containing 2.5 cm^3 of 1% starch suspension. To one tube 2.5 cm^3 of 0.25% amylase solution is added and to the other 2.5 cm^3 of distilled water is added. The tubes are then left in a warm place for 10 minutes, during which time iodine solution is added to the wells of a well tray. After 10 minutes, a drop is taken from each tube using a pipette and added to the iodine solution in a well. A blue-black colour indicates the presence of starch, and this should fail to appear for the tube that had the enzyme added.

Worksheets 8Ad-3 and 8Ad-4 take this idea and turn it into an investigation of the effects of temperature on enzyme action. It is suggested that the tubes containing the starch solution and the enzyme solution are placed in water baths for 5 minutes before being mixed to ensure that the solutions are all at the correct temperatures before the experiment is started (see Worksheet 8Ad-3). The amylase suggested for use (see below) works best at around 37 °C (body temperature).

Other factors could be altered instead, including the concentration of enzyme and pH. For the latter, the starch and amylase should be added to 10 cm^3 of buffer solution (see below). Alternatively, addition of dilute hydrochloric acid or sodium hydrogen carbonate solution to the starch solution (prior to adding amylase) and testing with pH paper/meter will give a reasonable range of pH values to test. Amylase works best at about pH7.

Developing: Worksheet 8Ad-3 deals only with the effect of temperature on amylase action. It should be noted that this worksheet assumes bacterial amylase is not being used (it does not have optimum activity at 37 °C).

Securing: Worksheet 8Ad-4 is a sheet to help students plan the investigation.

Exceeding: Explain that amylase is an enzyme found in digestive juices in the mouth and small intestine that breaks down starch. Show the students the solutions that they will be given (including iodine solution) and ask them to plan an investigation to find out how temperature affects how well the enzyme works.

Note that the timings, volumes and concentrations of the different solutions have been developed for use with hog amylase. Different amylases from different sources will have different temperatures at which they work best (optimum temperatures) and different activities, so it is advisable to check this experiment with the amylase that you have in stock before students carry out their work. Avoid using amylase from bacterial sources since these often have very high optimum temperatures. Mammalian amylase or pancreatin (essentially ground-up pancreas) works best.

This practical can be used to carry out a Working Scientifically investigation. A set of assessment descriptions is provided in the ASP. Note that use of the worksheets will prevent the assessment of some strands (notably planning). Even if this is not formally assessed, the assessment descriptors could be used for students to mark each other's work and to provide formative feedback to each other.

Eye protection should be worn.

Course resources
AP: Worksheets 8Ad-3; 8Ad-4.
ASP: 8A WS Investigations.

Equipment
Iodine solution, six test tubes, test-tube rack(s), two 5 cm^3 pipettes, spotting tile or well tray, 0.5% pancreatin solution or 0.25% mammalian amylase solution (making sure that its peak activity is around 40 °C – i.e. not bacterial amylase), 1% starch suspension, stop clock, eye protection, access to water baths at various temperatures (e.g. 20 °C, 40 °C and 60 °C), thermometers (one for each water bath), access to ice, empty beaker or access to sink, access to water for washing pipette (e.g. in a beaker), access to distilled water.

Optional: pH paper/meter, various concentrations of acids and alkalis, e.g. 0.2 mol dm^{-3} and 0.1 mol dm^{-3} sodium carbonate, 0.2 mol dm^{-3} and 0.1 mol dm^{-3} hydrochloric acid, or citric acid–sodium phosphate buffer solutions:

pH	Volume of 0.2 mol dm^{-3} Na_2HPO_4	Volume of 0.1 mol dm^{-3} citric acid
3	20.55	79.45
4	38.55	61.45
5	51.50	48.50
6	63.15	36.85
7	82.35	17.65
8	97.25	2.75

3: Flicker book

Securing

Worksheet 8Ad-6 provides the pieces to make a flicker book that shows a model of digestive enzyme action.

Course resources
AP: Worksheet 8Ad-6.

Equipment
Scissors, stapler.

4: Probiotic bacteria

Developing/Securing

Prac **WS**

In this experiment, students inoculate pre-prepared MRS agar plates with yoghurt that contains gut bacteria. The main intention here is only to show that these yoghurts contain live organisms, since results can be very variable.

Different probiotic yoghurts could be compared to see if students can spot any differences between them (e.g. number of bacterial colonies produced, shape and size of bacterial colonies). Alternatively, a number of probiotic yoghurts could be used and labelled X, Y and Z. Students are told the names of the yoghurts that may be X, Y and Z and what bacteria they contain. They then make up plates using X, Y or Z and have to use their results to say which yoghurt was X, which was Y, etc.

Practically all yoghurts contain *Lactobacillus bulgaricus* and/or *Streptococcus thermophiles*. Common probiotic bacteria are: *Bifidobacterium lactis, Bifidobacterium bifidum* and *Lactobacillus acidophilus*. *Bifidobacterium* are unlikely to grow because they require anaerobic conditions.

Tween 80 is important for differentiation of the different *Lactobacillus* strains. It can be omitted if this is not considered important. In the suggested MRS/fructose/Tween 80, growth of colonies will be:

L. bulgaricus – forms large smooth colonies, often with an oval shape, needs anaerobic conditions to grow.

L. acidophilus – forms round, fluffy colonies.

S. thermophileus – is unlikely to grow in MRS/fructose/Tween 80. Colonies are small and yellowish if they do grow. Use MRS agar with 0.5% glucose, leaving out the fructose and Tween 80, to get these to grow.

B. lactis – is unlikely to grow because it is anaerobic. Colonies are very small, round and white if they do grow.

B. bifidum – is unlikely to grow because it is anaerobic. If they do grow, colonies are small, round and white, and larger than *B. lactis.*

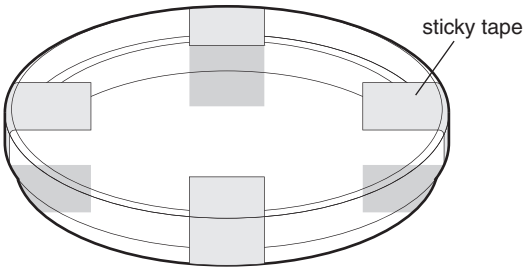
This practical introduces students to some basics of aseptic technique (preparing a sterile area and using the updraft from a Bunsen burner). Students take sterilised cotton-wool swabs and carefully dip them in pre-prepared, diluted solutions of probiotic yoghurts. Students then swipe the cotton-wool swabs over the surface of MRS agar plates, which are then incubated at 25 °C for about 5 days. Students then inspect their plates but do not open them. Full instructions are given on Worksheet 8Ad-2.

It is also possible to make 'pour plates' (by mixing probiotic solutions and molten agar medium at 50 °C). However, this involves flaming the ends of tubes and so should not be attempted by students at this level. Refer to the CLEAPSS or Nuffield Foundation websites for protocols.

With thanks to Dr Teresa Requena (CSIC, Spain) for the recipe for MRS-fructose agar (below) and supply of the colony photo used on Worksheet 8Ad-2.

Ensure students do not ingest the yoghurts. Students should not place cotton-wool swabs in their mouths, noses or ears. Seal the agar plates using four short strips of sticky tape, as shown below. Plates should not be sealed all the way around since potentially hazardous anaerobic microbes may grow.

Plates should be incubated upside down (to stop condensation forming drips that fall onto the agar). Used agar plates must *not* be opened and must be autoclaved at the end of this practical. The plates can be sealed completely *after* incubation (to make them more secure before students inspect them). Students should wash their hands well after handling plates.



Course resources
AP: Worksheet 8Ad-2.

Equipment
MRS agar plate(s) (made by making up MRS fermentative broth with the addition of 1% fructose with 0.2% Tween 80, 0.8% casein acid hydrolysate, 0.05% cysteine and 1.5% agar OR without fructose or Tween 80 but with 0.5% glucose), probiotic drinking yoghurts diluted to 25% with sterile, distilled water, cotton swabs prepared by wrapping small pieces of cotton wool around the ends of cocktail sticks and sticking with strong tape (e.g. autoclave tape) followed by autoclaving wrapped in foil or in glass bottles (note that commercial cotton wool buds may contain antimicrobial agents), warm place or incubator to store plates, sticky tape, marker to write on plates. Incubation of inoculated plates should be at 25 °C. *L. bulgaricus* and *B. lactis* need anaerobic conditions to grow in plates.
Optional: pre-prepared slides of bacterial colonies, microscopes.

5: Stop-motion enzymes

Exceeding

Use the (AT) animation *Enzymes at work,* which shows enzymes at work in the digestive system.

In groups, students should watch the animation, which gives a simplified account of how amylase cuts up starch molecules, and then plan how to make a stop-motion video of amylase action.

If time allows, students could make animations using a stop-motion app on a smartphone or computers with stop-animation software attached to an appropriate camera or webcam. If students make their own animations, encourage different groups to view one another's animations and state two ways in which an animation is good and a way in which it could be improved. It is helpful if students consider the criteria they are going to use for their evaluations of one another's work first (e.g. the enzyme does not get destroyed, the starch is broken down into molecules containing two units/molecules/glucose molecules from the original polymer as shown in the animation, clearly identifying the enzyme, clearly identifying the starch).

Course resources
AT: Animation *Enzymes at work*.

Equipment
Smartphones with stop-motion apps or computers with stop-animation software attached to an appropriate camera or webcam.

EXPLAINING TASKS

1: 8Ad Digestion (Student Book)

Developing/Securing/Exceeding

FA

This spread looks at the digestive system and the process of digestion. The work on bacteria can be illustrated using YouTube clips advertising probiotic yoghurts. Worksheet 8Ad-1 is the Access Sheet.

Question 2 can be used for formative assessment, with students working in groups to draw out the flowchart.

The (AT) interactive *The digestive system* allows students to label a diagram to show the names and functions of the human digestive organs.

The (AT) presentation *An introduction to gut bacteria* examines the bacteria found in our intestines.

The (AT) video *Advertising bacteria* is a news report from 2009 about the banning by the Advertising Standards Authority of a TV advert for a popular yoghurt, which claimed it was scientifically proven to support children's natural defences against disease. Before showing the video to students, ask them what is meant by 'the scientific method' and re-establish the idea that science is about collecting evidence to support a hypothesis. In the case of

this advert, the Advertising Standards Authority did not agree that the evidence the manufacturers had supported their claims.

(Please note the transcript of this video is not available.)

The **AT** animation *Enzymes at work* could be useful here. See Exploring 5.

Course resources
AP: Worksheet 8Ad-1.
AT: Animation *Enzymes at work*. Interactive *The digestive system*. Presentation *An introduction to gut bacteria.* Video *Advertising bacteria*.

2: Enzyme demonstration

Exceeding

Prac

Use molecular models to represent a long food molecule. Illustrate the action of enzymes by breaking up the molecule, perhaps by comparing the enzymes to a pair of scissors.

Having watched the demonstration, students could be asked to draw a series of diagrams showing what happens when large molecules are digested by enzymes. They should be asked to annotate their drawings with text to say what they are illustrating.

Equipment
Molecular modelling kit.

3: Catalase demonstration

Securing

Prac

Hydrogen peroxide is poisonous but is a by-product of some reactions in the body. Catalase is an enzyme that quickly destroys the hydrogen peroxide. Liver contains large amounts of catalase, which makes for a memorable demonstration of an enzyme in action (albeit not a digestive enzyme). Place a small piece of liver in a large beaker and add a pipette-full of 3% hydrogen peroxide. A fizzing will be observed. Point out to students that this fizzing would never occur in the body but does here because the hydrogen peroxide used is very concentrated.

⚠ Teacher and students should wear eye protection.

Equipment
Fresh liver, 3% hydrogen peroxide solution, large beaker, eye protection.

4: Model torso

Securing

Prac **WS**

Show students a model torso, indicating where the different parts of the digestive system are and what they do. Explain that this is a much closer approximation to what is actually found inside us than the diagrams found in the student materials. Ask students why diagrams have been drawn in the student materials rather than real representations of the organs. Explain to students that diagrams are 'models' – ideas used to help us understand how something occurs. Illustrate this by reference to the Student Book and the diagram of the digestive system. Challenge students to identify the differences between the model torso and the diagram in the Student Book (which is simpler). Ask students to suggest some advantages and disadvantages of using models. Elicit the idea that models aid understanding but to do this they are often simplified. Sometimes they can be too simplistic, and it is important to use a model that is appropriate.

Equipment
Model torso.

5: Peristalsis

Securing

Prac **WS**

Explain that the movement of food along the gut is caused by waves of muscle contractions – known as peristalsis. This is simply demonstrated using a bicycle inner tube and a smooth stone of slightly greater diameter. Soak the inner tube in water containing washing-up liquid. Without rinsing the tube, insert the stone. Use your thumb and forefinger to form a circle of 'muscle' around the tube above the stone. By moving your forefinger along the thumb, the diameter of the inner tube can be made to get smaller, pushing the stone down the tube. Students could be asked to say what the inner tube, thumb and forefinger, and stone represent in this model. The demonstration can also be done with a sock and a tennis ball.

Lungs from sheep with the gullet (oesophagus) still attached may be available from a butcher, or it may be possible to order a length of oesophagus separately. These could be used in conjunction with the demonstration.

⚠ If sheep oesophagus is used, this must be disposed of according to CLEAPSS guidance: do **not** put in food waste bin.

Equipment
Bicycle inner tube, washing-up liquid solution, smooth stone of similar diameter to the tube (or tennis ball and large sock).
Optional: sheep lungs and oesophagus.

PLENARIES

Most plenaries can be used for formative assessment. Suggested assessment, feedback and action strands of formative assessment can all be modified. See the ASP for further information and ideas on formative assessment.

1: Quick Check

Developing/Securing/Exceeding

FA

Assessment: Students work in groups to label a diagram of the human digestive system with its parts and what happens in each different part. Before photocopying or printing the sheet, note that some or all of the boxes at the bottom of the sheet can be removed to increase the challenge of the sheet.

Feedback: Groups share their work with one another, with each group providing feedback on the work of another group in the form of two points that are good about the work and one area where the work can be improved. Give students an opportunity to do this.

Action: Ask each group to say what they improved on their diagrams and which parts of the gut are more difficult to remember. Write these up on the board and then go over them again, with reference to the Student Book. Get students to review the ordering of the gut parts activity if they carried this out in Starter 2.

Course resources
ASP: 8Ad Quick Check.

2: Thinking about digestion

Securing

FA

Assessment:

Plus, Minus, Interesting: The human gut is about 8 metres long but should be much longer. (Possible answers: **Plus** – This would give the food longer to be completely digested and absorbed; **Minus** – It would be difficult to fit it all in; **Interesting** – Do animals of different sizes have different lengths of gut? An elephant's gut can be up to 19 metres long.)

Plus, Minus, Interesting: Enzymes in humans work best at 37 °C. (Possible answers: **Plus** – This is body temperature; **Minus** – If the body temperature is higher or lower than normal, enzymes won't work properly; **Interesting** – How does human body temperature compare with that of other mammals? Cats have an average body temperature of 39 °C.)

Odd One Out: gullet, liver, small intestine, large intestine, stomach. (Possible answers: liver since food passes through all the other parts except this; stomach is the only place that is very acidic; gullet does not contribute to the digestion of food.)

Consider All Possibilities: Carbohydrate isn't absorbed by someone's small intestine. (Possible answers: the person hasn't eaten any carbohydrate; the carbohydrate that has been eaten is all insoluble and hasn't been digested yet; the person's small intestine is not working properly; enzymes have not been released to break down the carbohydrate.)

Feedback: Ask students to work individually on one of the thinking skills questions and when finished to pair up with someone else who has answered the same question. The students compare answers and agree on the better one or combine them into a new answer. The pairs then pair up again to make groups of four and the process is repeated.

Action: Ask groups to read out their agreed answers and correct any misconceptions that have arisen by reference to the Student Book.

The **AT** presentation *8Ad Thinking skills* can be used for this activity.

Course resources
AT: Presentation *8Ad Thinking skills.*

3: How would you like to learn?

Developing/Securing/Exceeding

FA

Ask selected students to describe how they have learnt about digestion and the digestive system, and which form of learning they have found the best (e.g. video, animation, doing a worksheet, the Student Book). Write their ideas on the board and then hold a class vote on the most effective technique. You could separate this into, for example: learning new terms and their definitions; learning names of parts of the body along with their function; learning new explanations. Discuss whether the best learning technique depends on what is being learnt. Use the suggested techniques in the teaching of the next topic.

HOMEWORK TASKS

1: Human digestion

Developing/Securing

WS

Worksheet 8Ad-7 contains straightforward questions about digestion and the digestive system. Question 3 challenges students to write using complex and/or compound sentences. For some students, it may be useful to revise these concepts before they complete the sheet, using pages 48–49 of the Year 7 Student Book.

Course resources
AP: Worksheet 8Ad-7.

2: Enzymes and digestion

Securing/Exceeding

WS

Worksheet 8Ad-8 contains questions about enzymes and digestion.

Course resources
AP: Worksheet 8Ad-8.

3: Enzyme action

Securing/Exceeding

WS

Worksheet 8Ad-9 challenges students to evaluate different models of digestive enzyme action and to develop their own models.

Course resources
AP: Worksheet 8Ad-9.

4: Quiz questions

Developing/Securing/Exceeding

Ask students to use the words on the Word Sheets for this and the previous topics to help them to produce 10 questions for a verbal test. These questions can be used in Starter 1 of the next topic.

Course resources
AP: 8A Word Sheets.

ActiveLearn

Three ActiveLearn exercises are available for this topic: Digestive system 1; Digestive system 2; Digestive system 3.

8Ae
Absorption

This grid shows the basic concepts met in this topic, together with a scheme of cognitive progression for each concept. Opportunities to cover learning and progression are given. Working Scientifically concepts are integrated throughout the materials.

Conceptual statement	Cognitive progress					
	Remembering (a)	Understanding (b)	Applying (c)	Analysing (d)	Evaluating (e)	Synthesising & creating (f)
Fats are broken down by the actions of bile and lipases.	Describe the role of the [liver, gall bladder] in fat digestion. State the role of bile.	Explain how the digestion of [fats, lipids] is helped by bile.				
The small intestine is adapted for efficient absorption of digested food into the blood.	Describe the features of the small intestine wall.	Explain how the structure of villi allows efficient absorption of the soluble products of digestion.	Use a knowledge of diffusion to explain how nutrients enter the blood from the small intestine.	Explain the problems caused by [food intolerances, food allergies, coeliac disease].		
Alcohol can damage the body.	Recall that alcohol is a [legal] drug and can be harmful. Recall how the alcohol content of a drink is measured.	Describe the short- and long-term effects of alcohol on the body.	Explain the possible [short-term, long-term] effects of drinking alcohol.	Analyse alcohol consumption over the last 300 years and suggest reasons for any trends.	Justify an increase in tax on alcoholic drinks. Use knowledge of the effects of alcohol to describe the social issues surrounding its consumption.	
The [kinetic theory, particle model] can be used to explain diffusion.	State what is meant by: diffusion. Recall some effects of diffusion.	Use the kinetic theory to explain diffusion in liquids and gases. Explain why diffusion is a physical change.	Calculate the speed of diffusion.	Use the kinetic theory to explain why diffusion is faster in some materials than in others. Link the speed of diffusion to the mass of the molecules. Explain how Brownian motion supports the kinetic theory.	Evaluate how well kinetic theory explains diffusion.	Carry out a calculation to determine the speed of diffusion. Use ideas of random motion to justify why diffusion is a physical change which is irreversible.

Conceptual statement	Cognitive progress					
	Remembering (a)	Understanding (b)	Applying (c)	Analysing (d)	Evaluating (e)	Synthesising & creating (f)
The blood contains many different types of cells, each with its own function.	List the components of blood. Describe the structures of [red blood cells, white blood cells, plasma, platelets]. State where the [red blood cells, white blood cells, platelets] are made.	Describe the functions of [red blood cells, white blood cells, plasma, platelets].	Explain how a red blood cell is adapted to its function.			

Objectives
Developing:

1. Recall what happens in respiration (only in terms of releasing energy from food using oxygen).
2. Recall where digested food enters the blood.
3. Describe the function of blood plasma.
4. Describe the features of the small intestine wall.
5. Explain how diffusion occurs in terms of movement of particles.
6. Explain the short- and long-term effects of alcohol.

Securing:

7. Explain how the structure of the small intestine allows efficient absorption of the soluble products of digestion.
8. Explain how the cells in the small intestine are adapted to absorb nutrients quickly.
9. Use a knowledge of diffusion to explain how nutrients enter the blood from the small intestine.

Exceeding:

10. Explain how bile helps in the digestion of lipids.

Focused Working Scientifically Objectives
This topic provides an opportunity to focus on key Working Scientifically skills.

1. Recall what is meant by area and use a formula to calculate the area of a rectangle.
2. Use a formula to calculate the areas of cuboids.

Student materials

Topic notes

- Refer back to Year 7 topics for additional activity ideas to support the learning in this topic; for example, 7Ca: respiration (objective 1); 7Cb: blood plasma (objective 3); 7Gd: diffusion (objective 5); 7Ce: the effects of alcohol (objective 6); 7Ea colloids and emulsions (objective 10); 7Fd and 7Fe: neutralisation (objective 10).
- Absorption can be a tricky word for students to spell, since it has a 'p' where students might expect there to be a 'b'.

Be prepared
Starter 1 may need the questions prepared as part of 8Ad Homework 4.

STARTERS

1: What's in the gut?

Developing/Securing/Exceeding

FA

Carry out a verbal quiz to revise the work of earlier topics using your own questions (and, if students have done Homework 4 from the last topic, their questions). Draw the head of a millipede on the board (the 'Misconception Millipede'). Tell students that for each question where there is a difference of opinion on the answer, a section will be added to the millipede. To add a section, draw a circle behind the head, with four legs. Ask students questions at random, and for each question ask two or three students. If there is a disagreement in the answers add a section to the millipede and make a note of the misconception above the section. Then discuss what the correct answer should be before moving on. At the end of the quiz, come back to the millipede and recap the various misconceptions, ensuring that students now understand them.

What is added to food in the stomach? *very acidic digestive juices (and enzymes to digest proteins)*

What happens to food in the large intestine? *water is absorbed from undigested food*

Name a nutrient that we only need in small amounts. *vitamins or minerals*

Name a liquid we need that is not a nutrient. *water*

What type of nutrient is starch? *carbohydrate*

Name two foods that contain a lot of fibre. *e.g. cereals, wholemeal bread, brown rice*

Name two foods that contain a lot of protein. *e.g. meat, fish, nuts, dairy produce*

Why do we need carbohydrates? *for energy*

What is a balanced diet? *a diet that contains all the nutrients we need in the right amounts*

What happens if you do not eat enough food? *you feel weak and tired, you starve*

How is food moved along the gut? *muscles in the wall of the gut contract and push it along*

Where are small molecules absorbed into the body? *small intestine*

What does diet mean? *the food we eat*

What happens if our bodies do not get enough fibre? *constipation or blocked intestines*

What chemical is used to test for starch? *iodine solution*

How can you test for fat? *it leaves a greasy mark on paper*

Name two foods that contain a lot of fat. *e.g. dairy produce, cakes, fried foods*

Which foods are best for vitamins and minerals? *fruit and vegetables*

Why do we need protein in our diets? *to make new cells and repair our bodies*

Why do we need fats? *as an energy store and to insulate our bodies*

What disease can be caused by eating too much fat? *heart disease*

Where is saliva made? *in the mouth*

Equipment
Students' questions from 8Ad Homework 4 (optional).

2: Travelling food

Securing/Exceeding

BA

Ask students to write a list of bullet points of how they think a food molecule needed by a leg muscle gets from the small intestine to the leg muscle cell. Students should keep hold of the lists and refine them during the study of this topic.

Equipment
Paper for list making.

3: Silent animation

Securing/Exceeding

BA

The **AT** animation *Diffusion in the small intestine* shows how soluble molecules like glucose are absorbed through the wall of the small intestine and travel around the body in the blood. Show students the animation without the sound and ask them to say what they think is happening and what the various parts are. Ask for volunteers to add a voiceover to a section of the animation. Show students the animation again with the sound on so that they can hear the voiceover explanation and consider how good their initial thoughts and the students' voiceovers were.

Get students to identify which parts of the animation showed unfamiliar ideas – and reinforce what is happening at these points.

Course resources
AT: Animation *Diffusion in the small intestine*.

4: Surface area

Securing

BA **Prac**

This is an effective demonstration to get students to think about the effects of surface area. Take two pieces of potato, cut to the same size and as square as possible. Establish with students that the potatoes are the same size and then cut up one of the potato pieces into smaller cubes. Put all of the potato pieces into a beaker of iodine solution so that all the potato is covered. After 10 minutes, take out the potato pieces and cut each one in half. Show students how far the iodine solution has penetrated into each potato, and establish that, in total, the potato that was cut into smaller chunks has absorbed more iodine solution because this potato has a larger surface area.

Iodine solution stains skin and may irritate the eyes. The potato from the iodine solution should be handled using forceps. Wear eye protection. Ensure good security of knives, i.e. count them out and then back in.

Equipment
Large beaker, iodine solution, two pieces of potato cut into blocks of the same size and shape, forceps, stop clock, knife, board on which to cut.

5: Sweet bread

Securing

Prac

This simply involves chewing bread. If bread is chewed for 5–10 minutes, the taste becomes sweeter. Students could be asked to chew a piece of bread, describe what happens and try to explain why this happens.

Ensure that this practical is **not** done in a lab and only in an area suitable for consuming food (e.g. dining hall or food technology room).

Equipment
Small piece of bread.

EXPLORING TASKS

1: A model small intestine 1

Securing

Prac **WS**

Visking tubing will let small, soluble sugar molecules through it, but not large starch molecules. This practical will demonstrate that starch molecules are too big to pass through the tiny holes in the wall of the tubing. Worksheet 8Ae-2 contains the instructions. After 20 minutes, the water from the boiling tube surrounding the tubing can then be tested for starch using iodine solution (a blue-black colour denotes the presence of starch). It should be found that no starch has diffused through the tubing. This model is built upon and extended in the following activity.

Course resources
AP: Worksheet 8Ae-2.

Equipment
15 cm length of Visking tubing, beaker, boiling tube, elastic band, eye protection, iodine solution (1 g iodine in 100 cm^3 1.0 mol dm^{-3} potassium iodide solution), three pipettes, 2% starch suspension, well tray or spotting tile, access to warm water bath (37 °C), access to clean warm water (37 °C).

2: A model small intestine 2

Securing

Prac **WS**

This is an extension of Exploring 1. The set-up is the same, except that enzymes are added to the 2% starch suspension. After a time, the water from the boiling tube surrounding the tubing can be tested for starch and sugars. It should be found that sugars have diffused through the tubing whereas the starch has not. The less concentrated the enzyme solution, the longer time it will take to get an obvious result from doing the test for reducing sugars with Benedict's solution. The table below shows the colours obtained in the test at different concentrations of enzyme used in our trials of this experiment (green shows some sugar, brown shows more, red shows even more). It should be noted that the major sugar being detected here is maltose, and not glucose. Amylase splits starch down into maltose, which consists of two glucose molecules joined together. Another enzyme in the small intestine, maltase, splits maltose into glucose.

% amylase	5 min	10 min	15 min	20 min	25 min	30 min
4	blue	blue	blue-green	bluey green	pea green	brown
6	blue	blue	blue-green	pea green	brown	brown
8	blue	blue-green	brown	brown	brown	red

Full instructions are given on Worksheet 8Ae-3.

If time is short, consider using the **AT** presentation *Modelling the small intestine*, which invites students to predict the results of the experiment and explain the reasons why those results are obtained.

Eye protection should be worn. Iodine solution stains skin. Some students may be allergic to enzymes. When using the enzyme solutions avoid skin contact (and the rubbing of eyes). Wash hands at once if contact is made.

Course resources
AP: Worksheet 8Ae-3.
AT: Presentation *Modelling the small intestine.*

Equipment
Beaker, Benedict's solution, boiling tube, Bunsen burner, digestive juice solution (0.5% pancreatin), two elastic bands, eye protection, gauze, heat-resistant mat, iodine solution (1 g iodine in 100 cm^3 1.0 mol dm^{-3} potassium iodide solution), four pipettes, 1% starch suspension, tripod, two pipettes, two test tubes, 15 cm Visking tubing (pre-soaked for 15 min in water), water bath (set to 37 °C).

3: Bath towels

Developing/Securing

Prac **WS**

In this practical, the effectiveness of increasing the surface area of towels can be looked at. Strips (3 cm × 15 cm) of white towelling and cotton sheet material are left for 1 minute with about 2 cm touching a coloured liquid in a shallow tray. It should be seen that the liquid

travels faster up the bath towelling, and this can be explained in terms of speed of absorption (although this is only partly true). Alternatively, compare the amount of liquid that each can absorb in 15 seconds when immersed in the solution. Students may ask why most tea towels are not covered in 'villi'. This may be explained by considering the expense, and the fact that tea towels need to dry out quickly, they can't be too thick (otherwise they won't fit into glassware, etc.) and they should not deposit fluff as they dry.

Equipment
Shallow tray, 3 cm × 15 cm strip of white bath towelling, 3 cm × 15 cm strip of white sheeting, coloured liquid (e.g. orange squash).
Optional: measuring cylinder.

4: Calculating surface areas
Developing/Securing/Exceeding
Worksheet 8Ae-5 provides practice in surface area calculation as well as providing illustrations of how important increasing surface area is for digestion.

Course resources
AP: Worksheet 8Ae-5.

Equipment
Some students may require a calculator.

5: Interpreting food labels
Exceeding
Provide students with food packaging and ask them to examine the packs using knowledge gained in this unit. This could include traffic lights, 'use by' and 'best before' dates, regulated words, health claims, etc. Ask students to prepare letters to the manufacturers of the foods in the packaging, explaining two good points about the packaging and identifying one area of the packaging that could be improved (with reasons why).

An alternative is to ask students to examine some food packaging and then design their own.

Equipment
Selection of food packaging (showing health claims).

6: Go to work on an egg
Exceeding
If you do an Internet search for 'Go to work on an egg' you will find the original TV adverts for eggs from the 1960s. The adverts all end with the slogan 'Go to work on an egg'. Show students one of the adverts and ask them what they think the slogan means. Then tell them that there was a plan to run the adverts again in 2005 but they were banned by the Broadcast Advertising Clearance Centre (BACC), which has to approve all TV adverts. They said that the adverts did not promote eating a balanced diet. Ask students what they think of this decision and to consider the role played by weight and bias in the adverts. Hold a class vote at the end or get students to write to the BACC expressing their opinion.

7: Debate
Exceeding
Lit
There is an opportunity for a debate presented on Student Book page 8Ae Packaging and the law. Refer to Skills Sheet RC 5 from the Year 7 Activity Pack for ideas on how to run a debate. Some people are of the opinion that the consumer must be told the nutritional values for every food, while others believe that increasing the number of regulations further complicates things and would serve no purpose (for example, displaying nutritional information for variable products such as fresh fruit and vegetables).

Course resources
AP: Skills Sheet RC 5 (Year 7).

EXPLAINING TASKS

1: 8Ae Surface area (Student Book)
Developing/Securing/Exceeding
FA WS
This spread covers surface area and how it is calculated for different shapes. The idea of surface area is then applied to the adaptations of cells and organs, particularly the small intestine, on the next spread.

Ask students to work in groups to prepare a poster display of how to calculate areas for different shapes.

The AT presentation *Rectangles and cuboids* explains how the calculations are done and provides further opportunities for students to do calculations. See also Plenary 1.

Course resources
AT: Presentation *Rectangles and cuboids*.

Equipment
Students may require calculators.

2: 8Ae Absorption (Student Book)
Developing/Securing/Exceeding
FA
This spread describes how small molecules are absorbed by the small intestine. A useful prop is

to have a bathmat made of long loops, which can be rolled up so that the loops are on the inside, to provide a useful model of villi inside the small intestine. This includes discussion of the effects of surface area on the rate of diffusion. Referring students back to the work they did in Topic 7Gd may be useful. Worksheet 8Ae-1 is the Access Sheet.

Question 7 is suitable for formative assessment, with students working on the question in groups. After they have finished, ask selected groups to read out their answers to question 7c and ask students to comment on how to improve an answer. Construct an agreed answer on the board.

An (AT) presentation *Modelling the small intestine* could be useful here. See Exploring 2.

The Year 7 (AT) animation *Diffusion*, from Topic 7Gd, could be revisited.

The (AT) animation *Diffusion in the small intestine* shows how diffusion is important in the process of absorption. It includes a consideration of how the soluble particles move randomly so there is an overall movement out of the small intestine and into the blood, because there are more particles in the small intestine and fewer in the blood. It goes on to show that, by the continual flowing of blood to remove the molecules, the imbalance is maintained and therefore the overall flow of soluble food molecules out of the small intestine is maintained.

An (AT) link allows you to turn the labels on and off on figure D.

In the (AT) presentation *Villi,* students explore the villi that exist within the intestines.

Course resources
AP: Worksheet 8Ae-1.
AT: Animation *Diffusion in the small intestine*. Labels on/off *The small intestine is adapted to its function.* Presentations *Modelling the small intestine*; *Villi.*

Equipment
Bath mat with long loops on material.

3: 8Ae Packaging and the law (Student Book)
Developing/Securing/Exceeding
FA

The last page in this unit looks in a bit more detail at the information found on food packaging, including health claims and advertising.

The (AT) interactive *Concept cartoon: Are there molecules and cells in food?* asks students to comment on speech balloons to discuss whether there are molecules and cells in food. The concept cartoon for this unit helps students with any misconceptions they might have about the difference between cells, atoms and molecules. The concept cartoon is set in the context of the unit.

Question 4 is suitable for formative assessment, with students working on the question in groups.

The (AT) interactive *Starch as a fuel* is a drag-and-drop sequencing activity that describes how starch is broken down and glucose reaches cells for respiration. Students show how starch from food provides the fuel (glucose) that cells need for respiration by placing the events in the correct order.

Students can use this activity after they have done their own work on question 4, and then return to their own answers and correct and add information to them as necessary.

The (AT) interactive *Food packaging* allows students to explore the various features of standard food packaging. Students can click on hotspots to find out what the information on food packaging tells us about what the food contains.

The (AT) video *Food wastage* is a news report on the amount of food waste in the UK and the reasons people throw away so much unopened fresh food.

(Please note the transcript of this video is not available.)

Course resources
AT: Interactives *Concept cartoon: Are there molecules and cells in food?; Food packaging; Starch as a fuel*. Video *Food wastage*.

PLENARIES

Most plenaries can be used for formative assessment. Suggested assessment, feedback and action strands of formative assessment can all be modified. See the ASP for further information and ideas on formative assessment.

1: Quick Check WS
Developing/Securing/Exceeding
FA **WS**

Assessment: This sheet challenges students to make up a question and mark scheme about the area of a cuboid. When they have finished writing their questions, they share them with one another and calculate answers.

Feedback: Students compare the answers to the mark schemes they have written.

Action: Students note any discrepancies and work with one another to improve the quality both of the questions and of the answers/mark schemes, making sure that all necessary dimensions are

shown in the questions and working is shown, together with units, in the answers/mark schemes. As they carry out this work, students should identify any areas of difficulty or misconceptions.

The AT presentation *Rectangles and cuboids* explains how the calculations are done and provides further opportunities for students to do calculations. This can be used to clarify areas of misconception that came up in the main activity, and also to demonstrate how questions can be clearly set out and how answers should show all working and units.

Course resources
ASP: 8Ae Quick Check WS.
AT: Presentation *Rectangles and cuboids*.

Equipment
Students may require calculators.

2: Quick Check

Developing/Securing/Exceeding

FA

Assessment: The 8Ae Quick Check sheet contains the start of a concept map. Students can use this to build up their own concept maps to summarise the unit, either working individually or as part of a group. The Word Sheets for all the topics in this unit will prove useful for students.

Feedback: Students compare their concept maps and identify areas where there was confusion or areas that were forgotten about. Students highlight these on the concept map – they can use a colour code to denote confidence (red, amber, green).

Action: Ask students to share their lists of points of confusion and omission. Revisit these areas, with reference to the Student Book and/or Summary Sheets. The concept maps can be built upon by adding examples and further explanations.

Course resources
ASP: 8Ae Quick Check; 8A Summary Sheets; 8A Word Sheets.

3: Thinking about absorption

Securing

FA

Assessment:
Plus, Minus, Interesting: Only small molecules can diffuse through the wall of the small intestine. (Possible answers: **Plus** – This makes sure only digested food goes into the blood; **Minus** – The body can't absorb useful insoluble molecules; **Interesting** – Are there any diseases that mean that even soluble molecules don't get absorbed properly? Alcohol slows down the absorption of useful nutrients.)

Plus, Minus, Interesting: Using a model small intestine is a good way of showing what happens in the gut. (Possible answers: **Plus** – A simple model is easy to understand; **Minus** – A simple model doesn't show exactly what happens; **Interesting** – Can Visking tubing be used to demonstrate how other digested food molecules are absorbed by the small intestine or does it only work for glucose? There are over 15 different types of digestive enzyme found in the small intestine.)

Consider All Possibilities: Starch is not being broken down in Miles' small intestine. (Possible answers: he hasn't eaten any starch; he's eaten something that stops the starch enzymes working; his body can't produce starch enzymes.)

Consider All Possibilities: In the model small intestine, nothing is found in the water outside the tubing. (Possible answers: no enzyme was added to the tubing; no starch was added to the tubing; it's too cold for the enzyme to work; it's the wrong pH for the enzyme to work; the experiment has not been left long enough.)

Feedback: Each student chooses one of the thinking skills questions to answer. Rather than answer it, students make a list of key words/phrases that they think a good answer will contain. Each student then passes on his/her choice of question and list of key words/phrases to a partner, who then completes the question. Students then discuss in pairs how good the original lists of key words/phrases were and any that were missing.

Action: Ask students to say what additional key terms they used in their answers that were missing in the original lists. Establish that students understand the meanings of and importance of these words by reference to the Student Book, Summary Sheets and/or Word Sheets.

The AT presentation *8Ae Thinking skills* can be used for this activity.

Course resources
ASP: 8A Summary Sheets; 8A Word Sheets.
AT: Presentation *8Ae Thinking skills.*

4: Food packaging: Open-ended Assessment Task

Developing/Securing/Exceeding

FA SA

Ask students to carefully examine some food packaging and then to prepare a poster about the packaging. Students should explain why each part of the packaging is there (following the list of bullet points on the 8A Assess Yourself! sheet) and so demonstrate

knowledge from all parts of this topic, including digestion and using powerful adjectives and verbs.

You can assess this activity by using the 8A Open-ended Assessment Task sheet or students can assess their own performance by using the 8A Assess Yourself! sheet (see the ASP). Get students to reflect on what they did well in this activity and what they need to improve on. After feedback, give students an opportunity to improve their work and have it re-assessed.

Course resources
ASP: 8A Assess Yourself!; 8A Open-ended Assessment Task.

Equipment
Selection of food packaging.

5: Quick Quiz revisited
Developing/Securing/Exceeding

FA SA

Revisit the 8A Quick Quiz to test students' knowledge of the content of this unit. Students could fill in their answers on the 8A Quick Quiz Answer Sheet.

Encourage students to identify for themselves areas where their understanding is still weak and decide how they are going to remedy this. For example, ask students why they found certain questions more difficult. They can categorise their issues as, for example: 'do not understand the science'; 'did not read the question properly'.

Extend this activity by challenging students to design Quick Quiz questions on the subjects that they still find difficult. The additional questions could be tried out in groups.

Course resources
ASP: 8A Quick Quiz; 8A Quick Quiz Answer Sheet.

6: End of Unit Test
Developing/Securing/Exceeding

SA

Use either or both of the End of Unit Tests. A Mark Scheme is given in the ASP. Encourage students to identify areas that are still weak and to formulate plans to strengthen those areas. Summary Sheets are provided to help students with revision.

Extend this activity by getting students to produce questions on areas where they need further clarification. Spread these out around the room. Other students then choose one question to attempt to answer – writing this on the same piece of paper. Students then return to their original question and comment on how well they think the answer provided helps them.

Course resources
ASP: 8A End of Unit Test Standard (S); 8A End of Unit Test Higher (H); 8A Mark Scheme; 8A Summary Sheets.

7: Progression Check
Developing/Securing/Exceeding

SA

Students should circle the stars next to each statement on the Progression Check to record what they feel they know, and how certain they are of it. Encourage students to plan how to do further work on the things about which they remain unsure. Students can pair up with a 'critical friend' who is responsible for checking their action plan for addressing any remaining areas of uncertainty and checking that any suggested actions have been carried out. Notes on this check should then be reported to the teacher.

Course resources
ASP: 8A Progression Check.

HOMEWORK TASKS

1: The small intestine
Developing/Securing

WS

Worksheet 8Ae-4 contains straightforward questions about the small intestine and absorption.

Course resources
AP: Worksheet 8Ae-4.

2: Absorbing digested food
Securing/Exceeding

WS

Worksheet 8Ae-6 contains questions about digestion and absorption.

Course resources
AP: Worksheet 8Ae-6.

3: More digestive enzymes
Securing/Exceeding

WS

Worksheet 8Ae-7 challenges students to think about the roles of different enzymes and bile in digestion and absorption.

Course resources
AP: Worksheet 8Ae-7.

ActiveLearn
Three ActiveLearn exercises are available for this topic: Absorption 1; Absorption 2; Absorption 3.