1.1 Nutrients

Biology NC link:
- content of a healthy human diet: carbohydrates, lipids (fats and oils), proteins, vitamins, minerals, dietary fibre, and water, and why each is needed.

Working Scientifically NC link:
- interpret observations and data, including identifying patterns and using observations, measurements, and data to draw conclusions.

<table>
<thead>
<tr>
<th>Band</th>
<th>Outcome</th>
<th>Checkpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developing</td>
<td>Name some nutrients in a given diet (Level 3).</td>
<td>Starter 2, Plenary 2</td>
</tr>
<tr>
<td></td>
<td>Name the nutrients required by the human body (Level 3).</td>
<td>Lit, Starter 2, Plenary 1, Plenary 2</td>
</tr>
<tr>
<td></td>
<td>Extract nutritional information from food packaging (Level 4).</td>
<td>Main</td>
</tr>
<tr>
<td>Secure</td>
<td>Describe the components of a healthy diet (Level 5).</td>
<td>Lit, Main, Plenary 1, Plenary 2</td>
</tr>
<tr>
<td></td>
<td>Explain the role of each nutrient in the body (Level 6).</td>
<td>B, C, 1–3, Lit, Starter 1, Main, Plenary 1, Plenary 2</td>
</tr>
<tr>
<td></td>
<td>Interpret nutritional information on food packaging to identify a healthy food (Level 6).</td>
<td>Main</td>
</tr>
<tr>
<td>Extending</td>
<td>Explain what makes a food a healthy option (Level 7).</td>
<td>Main, Plenary 1, Plenary 2</td>
</tr>
<tr>
<td></td>
<td>Explain how each nutrient contributes to a healthy, balanced diet (Level 7).</td>
<td>1–3, Lit, Starter 1, Main, Plenary 1, Plenary 2</td>
</tr>
<tr>
<td></td>
<td>Interpret nutritional information to make health comparisons between foods (Level 7).</td>
<td>Main</td>
</tr>
</tbody>
</table>

Maths: Students interpret numerical data on food packaging, displaying this data in a suitable table to compare the nutritional information of three different cereals.

Literacy: In the student-book activity, students organise information about the different nutrients and their importance, and adapt this information for a TV advert aimed at a young audience to encourage them to eat a balanced diet. Students are also required to use scientific terminology correctly when explaining the importance of food labels, and the food traffic-light system.

APP: Students present data from food packaging from three cereal boxes in a table (AF3), and use this data to draw conclusions (AF5).

Key Words
- nutrient, carbohydrate, lipid, protein, vitamin, mineral, fibre, balanced diet

Summary Questions
1. Carbohydrates – provide energy
   Lipids – energy store and insulation
   Protein – growth and repair
   Vitamins and minerals – remain healthy
   Water – needed in cells and bodily fluids
   Fibre – provide bulk to food

2. Any two from: provides you with a store of energy, keeps you warm by providing a layer of insulation under your skin, protects your organs from damage.

3. QWC question (6 marks). Example answers:
   A balanced diet is eating food containing the right nutrients in the correct amounts.
   Nutrients are essential substances that your body needs to survive.
   A balanced diet should contain:
   - carbohydrates to provide energy
   - lipids to provide an energy store and insulation
   - proteins for growth and repair
   - vitamins and minerals to keep you healthy
   - water, which is needed in all cells and body fluids
   - fibre, which provides bulk to food to keep it moving through the gut.

(Only award a maximum of 5 marks if a definition of a balanced diet is not given.)

Food functions (5 min) Interactive resource where students connect nutrients to their function in the body. Can be used to gauge prior knowledge of students.

What’s on the menu? (10 min) Students discuss the names of the seven different nutrients before a short class discussion.

Extension: Students suggest functions of the seven nutrients.

Nuts (40 min) Introduce the seven types of nutrients, their functions, and the importance of nutrients in food. Ask students how they know if they eat healthily or not. How would students know which cereal is the healthiest given a choice of three?

Provide the students with nutritional information tables from at least three breakfast cereal packets. One should be healthy (whole wheat cereal), one should be highly processed (chocolate-coated rice cereal), and one in between (malted cereal). Students use the food labels to investigate the health value in each food shown, and complete questions on the activity sheet.

The importance of labels (10 min) Give students two minutes to discuss in groups how they decided the healthiness of the cereals in the activity. Open the discussion to the class. Students should discuss the importance of food labels, justifying their views using evidence where possible. This activity can be used to summarise the different nutrients and their functions.

The importance of a balanced diet (5 min) Review the images of different foods shown at the start of the lesson. Students give the main nutrient for each food shown, and describe the function of the nutrient.

Healthy eating
- Advert should include all seven nutrients, emphasise their function in a healthy diet, and be engaging to young people to encourage them to eat a balanced diet.

Activity

Answers from the student book

In-text questions
- A. An essential substance the body needs to survive
- B. Provide energy
- C. For growth (new cells) and to repair body tissues
- D. Any four from: sweat, tears, urine, feces, breathing out

Homework
- Students research the traffic-light system of nutritional information on food packaging. Students research what information it provides, why it may be useful, and give at least two examples of it. Further information on the traffic-light system can be found on the ‘Live Well’ section of the NHS website.
1.2 Food tests

State that food can be tested for starch, lipids, sugar, and protein.

Explain why testing food for starch, lipids, sugar, and protein is required amounts of different chemicals in food. Include foods that will be less obvious for students to guess as a way of introducing the importance of food tests.

Food and nutrients (5 min) Display pictures of different foods on the board and ask students to write the main nutrients shown on their mini-whiteboards. Include foods that will be less obvious for students to guess as a way of introducing the importance of food tests.

Testing not tasting (5 min) We like food that tastes nice, but we need to know what each food contains. Ask students how they think scientists can learn what chemicals are present in food. Lead the discussion to the idea of doing chemical tests, and how scientists need clear results to tell us whether a food contains a chemical or not.

Starter
- Food tests (30 min) Introduce the tests for starch, lipids, sugar, and protein, and observations for positive results in each experiment.
- Students work in small groups to carry out a circus activity where they will test for themselves, during their allocated time at each station, the presence of starch, lipids, sugar, and protein in the foods provided. Students should be given the opportunity to test for all four chemicals during this practical.
- Students then work through the questions that follow on the practical sheet.

Main
- Food tests (60 min) Introduce the tests for starch, lipids, sugar, and protein, and observations for positive results in each experiment.
- Students work in small groups to carry out a circus activity where they will test for themselves, during their allocated time at each station, the presence of starch, lipids, sugar, and protein in the foods provided. Students should be given the opportunity to test for all four chemicals during this practical.
- Students then work through the questions that follow on the practical sheet.

Plenary
- Food tests and results (30 min) Ask students why it is important for scientists to find out the contents of food. Lead the discussion towards specific types of people who may require this information, and why they need to do so. Students then link chemicals in food to the food test and positive result, using the interactive resource provided. This can also be done using mini-whiteboards to increase class participation.

Homework
- Food tests (30 min) Introduce the tests for starch, lipids, sugar, and protein, and observations for positive results in each experiment.
- Students work in small groups to carry out a circus activity where they will test for themselves, during their allocated time at each station, the presence of starch, lipids, sugar, and protein in the foods provided. Students should be given the opportunity to test for all four chemicals during this practical.
- Students then work through the questions that follow on the practical sheet.

Summary Questions
1. Starch – turns blue-black
   Sugar – turns orange-red
   Lipids – makes paper translucent
   Protein – turns purple
   (4 marks)
2. Crush cereal with a pestle and mortar, add a few drops of water, mix well. (3 marks)
3. GPC question (6 marks). Example answers:
   Take three samples of the gingerbread-biscuit solution. To test for starch add iodine to one sample. If solution turns blue-black then starch is present.
   To test for sugar add Benedict’s solution to another sample and heat in a water bath. If solution turns orange-red then sugar is present
   To test for protein add copper sulfate and sodium hydroxide to the third sample. If solution turns purple then protein is present.
1.3 Unhealthy diet

**Biology NC link:**
- calculations of energy requirements in a healthy daily diet and the consequences of imbalances in the diet, including obesity, starvation, and deficiency diseases.

**Working Scientifically NC link:**
- interpret observations and data, including identifying patterns and using observations, measurements, and data to draw conclusions.

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### Table: Unhealthy diet

<table>
<thead>
<tr>
<th>Band</th>
<th>Outcome</th>
<th>Checkpoint</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developing</td>
<td>State one potential problem for someone with an unhealthy diet (Level 3)</td>
<td>B–D, 1, 3</td>
<td>Starter 1, Starter 2, Plenary 2</td>
</tr>
<tr>
<td></td>
<td>State that different people require different amounts of energy (Level 4)</td>
<td>2</td>
<td>Main, Plenary 1</td>
</tr>
<tr>
<td>Secure</td>
<td>Describe some health issues caused by an unhealthy diet (Level 5)</td>
<td>B–D, 1, 3</td>
<td>Starter 1, Starter 2, Plenary 2</td>
</tr>
<tr>
<td></td>
<td>Calculate the energy requirements of different people (Level 6)</td>
<td>2</td>
<td>Main, Plenary 1</td>
</tr>
<tr>
<td></td>
<td>Collect experimental data and draw conclusions from results obtained (Level 6)</td>
<td></td>
<td>Main</td>
</tr>
<tr>
<td>Extending</td>
<td>Explain how an unhealthy diet causes health issues (Level 7)</td>
<td>3</td>
<td>Starter 1, Starter 2, Plenary 2</td>
</tr>
<tr>
<td></td>
<td>Explain that different people require different amounts of energy, using energy calculations and data to support explanations (Level 7)</td>
<td>2</td>
<td>Maths, Main, Plenary 1</td>
</tr>
<tr>
<td></td>
<td>Interpret experimental data and suggest ways to improve the experiment (Level 8)</td>
<td></td>
<td>Main</td>
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</tbody>
</table>

**Maths**
- In the student-book activity students interpret a graph showing typical energy requirements for different types of people. Students extract information from this graph to answer the question posed.
- In the practical students carry out simple calculations of temperature changes and energy transferred from the food to the water, using appropriate equations and units.

**Literacy**
- Students use scientific terminology when discussing and explaining experimental results and conclusions, forming links between a healthy diet and energy consumption.

**APP**
- Students carry out an experiment on food energy (AF4), record results in a table (AF3), and draw conclusions from experimental data (AF5).
- Some students also suggest improvements to the experimental procedure (AF5).

**Key Words**
- malnourishment, starvation, obese, deficiency

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**Activity**

<table>
<thead>
<tr>
<th>Question Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy requirements</strong></td>
</tr>
</tbody>
</table>

**Summary Questions**

1. energy, joules/kilojoules, gain, obese, heart, tired (6 marks)
2. a. $11 000 \text{ kJ} - 9000 \text{ kJ} = 2000 \text{ kJ}$ (2 marks)
   b. Difference in energy requirement = $15 000 \text{ kJ} - 10 000 \text{ kJ} = 5000 \text{ kJ}$
   c. Percentage increase from original job = $5000 \text{ kJ} / 10 000 \text{ kJ} \times 100 = 50\%$ (4 marks)
3. QWC question (6 marks). Example answers:
   - Underweight people often suffer from health problems, such as a poor immune system, often lack energy to do things, and are likely to suffer from a lack of vitamins or minerals.
   - Overweight people have increased risk of heart disease, strokes, diabetes, and some cancers.

**Unhealthy diets (5 min)** Write these four words on the board: scurvy, rickets, obesity, and starvation. Ask students how these words are linked to each other and to this lesson.

**Investigating the energy content of food (5 min)** Introduce the idea that all the energy we require for life comes from food. Allow students to discuss in pairs for a few minutes potential ways of comparing energy content in different foods. Demonstrate the energy provided in food by sprinkling fine custard powder onto a Bunsen flame. This is a dramatic demonstration that creates a huge roaring flame. Keep students at a reasonable distance away from the experiment.

**Mass effect (5 min)** Introduce some of the health issues for people who are underweight or overweight. Ask students to discuss the importance of vitamins and minerals before introducing issues caused by deficiencies.

**Investigating the energy content of food (5 min)** Introduce the idea that all the energy we require for life comes from food. Allow students to discuss in pairs for a few minutes potential ways of comparing energy content in different foods. Demonstrate the energy provided in food by sprinkling fine custard powder onto a Bunsen flame. This is a dramatic demonstration that creates a huge roaring flame. Keep students at a reasonable distance away from the experiment.

**Homework**
- Students keep a log of their energy intake for one day. They must record the foods consumed, food types, quantity, energy provided in 100 g of food, and energy intake. Students then calculate their total energy intake for that day and compare this against the energy requirements for a typical teenager of their age. For fresh food, students will need to use the Internet for energy values.

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**Support/Extension Resources**

**Summary Questions**

1. energy, joules/kilojoules, gain, obese, heart, tired (6 marks)
2. a. $11 000 \text{ kJ} - 9000 \text{ kJ} = 2000 \text{ kJ}$ (2 marks)
   b. Difference in energy requirement = $15 000 \text{ kJ} - 10 000 \text{ kJ} = 5000 \text{ kJ}$
   c. Percentage increase from original job = $5000 \text{ kJ} / 10 000 \text{ kJ} \times 100 = 50\%$ (4 marks)
3. QWC question (6 marks). Example answers:
   - Underweight people often suffer from health problems, such as a poor immune system, often lack energy to do things, and are likely to suffer from a lack of vitamins or minerals.
   - Overweight people have increased risk of heart disease, strokes, diabetes, and some cancers.

**Main Support/Extension Resources**

**Investigating the energy content of food**
- Support: The accompanying support sheet includes a suggested table of results.
- Extension: If there is time, you may wish to introduce the concept of specific heat capacity. This is the origin of the equation in Extension Question 1.

**Plenary Support/Extension Resources**

**Energy consumption**
- Support: Students suggest foods to eat using data from their practical.
- Interactive: Energy consumption

**Consequences of an unhealthy diet**
- Support: Students may require prompts on how to calculate energy from food.
- Interactive: Students evaluate the healthiness of their diet.
## 1.4 Digestive System

### Biology NC link:
- 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).

### Band	Outcome	| Checkpoint	| Activity
---|---|---|---
**Developing**
- Name the main parts of the digestive system (Level 4).
  - **Check:** B Starter 1, Starter 2, Main, Homework
- State what is meant by digestion (Level 3).
  - **Check:** A Main, Plenary 1, Homework
- Label a diagram of the digestive system by identifying correct information in text (Level 4).
  - **Check:** Main

### Secure
- Describe the structure and function of the main parts of the digestive system (Level 6).
  - **Check:** 1, 2 Main, Homework
- Describe the process of digestion (Level 6).
  - **Check:** 4 Main, Homework
- Give a structured account of digestion using information gathered by research (Level 6).
  - **Check:** Main, Plenary 2

### Extending
- Explain how each part of the digestive system works in sequence, including adaptations of the small intestine for its function (Level 8).
  - **Check:** 2, 4 Main, Plenary 1, Homework
- Explain why food needs to be digested (Level 7).
  - **Check:** Main, Plenary 1.
- Give a detailed explanation of digestion in sequence using information gathered by research (Level 7).
  - **Check:** Main, Plenary 2

### Literacy
- Students retrieve and collate information from a range of different sources to write their own extended account of the digestion of food in the human body.
- They organize ideas into well-developed paragraphs, explaining scientific terms and processes in a logical and coherent manner.

### Answers from the student book
- **In-text questions**
  - A Large molecules are broken down into smaller molecules.
  - B gullet
  - C Muscles in the wall of the gut squeeze food along it.

- **Activity**
  - **Wordbank**
    - Wordbanks should include all the key words on the student book spread. Credit sensible additions to this list.

### Summary Questions
1. **Stomach** — food is mixed with acid and digestive juices.
2. **Small intestine** — small molecules of nutrients are absorbed into the bloodstream.
3. **Large intestine** — water is absorbed back into the body.
4. **Rectum** — feces are stored here until they pass out of the body.
5. **Mouth** — food is chewed and mixed with saliva.
6. **Spleen** — a small intestine with a thin wall, large surface area due to villi, and blood capillaries to carry away any nutrients absorbed.
7. **Liver** — not digested. It adds bulk to the food, allowing muscles to push against this as food is squeezed along the gut. This prevents constipation.
8. **QWC question (6 marks)**. Example answers:
   - Food is chewed and mixed with saliva in the mouth. Teeth help to break the food into smaller chunks. Food passes down the gullet into the stomach. Food is churned with digestive juices and acid in the stomach. Small molecules pass through the villi of the intestinal wall into the bloodstream in the small intestine. Water passes back into the body in the large intestine. This leaves a solid waste of undigested food called feces. Feces are stored in the rectum. They are passed out of the body through the anus.

### Key Words
- digestive system, digestion, gullet, stomach, small intestine, large intestine, rectum, anus, villi

### Parts of the digestive system (5 min)
- Students label the parts of the digestive system using the diagram provided on the interactive resource. This should be used as a recap of organ systems met in Biology 1.

### Differentiation
- **Main**
  - **Support**/**Extension** Resources
- **Interactive** Parts of the digestive system

### The digestive system (40 min)
- The activity sheet contains an unlabelled diagram of the human digestive system. Students are given access to a range of textbooks, including the student book, for 20 minutes. They label the diagram and add notes to describe the digestive process. After 20 minutes, remove the textbooks and students use their notes to create a piece of extended writing, describing the journey of food through the human body. Encourage them to plan their accounts before writing. Differentiation can also be provided in this activity by targeting the research materials available to different groups of students. For example, giving students in need of extension the more advanced textbooks.

### Why digest? (10 min)
- Ask students the question: “Why do we digest food?” Allow students thinking time before opening up as a class discussion.
- This activity recapitulates the definition of digestion, and the idea that small molecules are needed for absorption in the small intestine.

### Developing skills (5 min)
- Ask students what skills they developed in the research and planning activity. Students discuss their research process from the naming of the skill to how they improved that skill during the lesson.

### Homework
- Students draw a comic strip showing the journey of Sandy the sandwich. The comic strip must describe the digestion process accurately, using at least 10 scientific words from this topic.
1.5 Bacteria and enzymes in digestion

Biology NC link:
- enzymes simply as biological catalysts
- the importance of bacteria in the human digestive system.

Working Scientifically NC link:
- make and record observations and measurements using a range of methods for different investigations, and evaluate the reliability of methods and suggest possible improvements.

Summary Questions
1. Carbohydrates, carbohydrase, amino acids, protease, fatty acids and glycerol, lipase (6 marks)
2. Live yoghurt contains useful bacteria that remain in your gut. These help to break down fibre and produce important vitamins. (3 marks)
3. Visual summary example answers (6 marks):
   - Enzymes are proteins/catalysts.
   - Bacteria are organisms that aid the digestion process.
   - They speed up digestion by breaking down large molecules into small molecules.
   - Three different enzymes exist.
   - Carbohydrase break down carbohydrates into sugar molecules.
   - Lipase break down lipids into fatty acids and glycerol.
   - Proteases break down proteins into amino acids.

### Band | Outcome | Checkpoint | Question | Activity
---|---|---|---|---
Developing | Name same enzymes used in digestion (Level 4). | 1, 3 | Lit, Main, Plenary 1; Plenary 2 | 2, 3 | Lit, Plenary 1 | Record measurements from an experiment (Level 4). | Main |
Secure | Describe the role of enzymes in digestion (Level 5). | B, 1, 3 | Lit, Main, Plenary 1; Plenary 2 | A, 2, 3 | Lit, Plenary 1 | Describe the role of bacteria in digestion (Level 6). | Main |
Extending | Explain how enzymes affect the rate of digestion (Level 6). | 3 | Lit, Main, Plenary 1 | Explain how some bacteria improve health (Level 7). | A, 2, 3 | Lit, Plenary 1 | Record experimental data using a suitable results table (Level 6). | Main |

### Support/Extension Resources
**Starter**
- **Getting a reaction (5 min)** Demonstrate the decomposition of hydrogen peroxide: first without a catalyst (where nothing seems to happen), then with a piece of potato added (there should be fizzing).
  - This demonstration serves as a good introduction to enzymes as biological catalysts that speed up reactions, without being used up.

- **Breaking down (5 min)** Introduce the definition of an enzyme by holding up a chain of plastic beads and breaking the beads off the chain one by one as a model of enzymatic digestion.
  - Explain how enzymes are biological catalysts that help to break down large ‘unusable’ molecules in our foods to small molecules that can be absorbed through the walls of our small intestines, all without being used up.

**Main**
- **Investigating enzyme action (40 min)** Formally introduce the idea of catalysts, biological catalysts, and enzymes. Give the definition of an enzyme, examples of enzymes, and their function in the human body.
  - Students then carry out a practical to observe the action of carbohydrase on the breakdown of starch, and answer the questions that follow.
  - You may wish to demonstrate the importance of timing in this practical, and explain what results students are looking for. Encourage students to read the method thoroughly before starting the practical.

**Plenary**
- **Human digestion (10 min)** Students use the clues provided on the interactive resource to complete a crossword that contains key words from this lesson.
  - Extension: Students should link all the key words together in explaining the action of bacteria and enzymes in human digestion.

- **Enzyme jigsaw (10 min)** Create sets of sort cards (one per group) with the following words: carbohydrates, carbohydrase, sugar, proteins, proteases, amino acids, lipids, lipase, fatty acids, and glycerol, and three arrow cards.
  - Give each group of students a set of cards for them to explain enzymatic digestion.
  - Students should then write the resulting word equations in their books.

**Homework**
- Students draw a cartoon diagram to show how an enzyme works. They should add as many labels to the cartoon as possible. Encourage students to research the lock and key mechanism for enzymes and include this in their cartoons.

**Literacy**
- **Students interpret a set of complex experimental procedures to carry out an experiment using enzymes, and use scientific terminology when explaining observations from their experiment.**

**APP**
- **Students present experimental observations in a suitable table (AF3), and use the data obtained to draw a valid conclusion (AF3).**

**Key Words**
- enzyme, catalyst, carbohydrase, protease, lipase, bile.

Answers from the student book

**In-text questions**
- A. Bacteria in the digestive system make vitamins.
- B. They speed up the reaction where large molecules are broken down, without being used up.
- C. To break lipids down into small droplets.

**Activity**
- **What happens to the bread you eat?**
  - The flow diagram should start from the breaking down of starch using carbohydrase in saliva, include absorption in the small intestine, and finally the excretion of feces through the anus. There should also be a mention of the importance of bacteria in digestion.