Exercise 1.1  The beginning of photosynthesis

This exercise will remind you about how we can use rocks to find out what happened long ago. You will also need to think about what is produced by photosynthesis.

The chart shows some important events that occurred during the very early history of the Earth.

- **4600 million years ago**  
  The Earth was first formed.

- **4000 million years ago**  
  Living organisms first appeared on Earth.

- **3000 million years ago**  
  The first organisms that could photosynthesise appeared.

- **1500 million years ago**  
  The first, very simple animal-like organisms appeared.
1 How long after the formation of Earth did the first life appear?

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2 Suggest how we know when the different kinds of organisms first appeared on Earth.

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……………………………………………………………………………………
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3 Up to about 3000 million years ago, there was no oxygen in the Earth’s atmosphere. Today, about one fifth of the atmosphere is oxygen gas.
Use the information on page 6 to suggest what caused this change.

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4 Suggest why animal-like organisms did not appear on Earth until after the first organisms that could photosynthesise had appeared.

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Unit 1  Plants

Exercise 1.2  Drawing leaves

You don’t need to be a good artist to be able to make good scientific drawings. This exercise will help you to learn some of the important things to think about when you are drawing a biological specimen.

Choose an interesting leaf. In the space provided below, make a large, labelled drawing of the upper surface of the leaf.

Before you start, read through the checklist on the next page. When you have completed your drawing, give yourself a mark out of three for each statement.
Unit 1  Plants

Checklist

0 = I didn’t even try
1 = I tried, but didn’t do very well
2 = I did quite well
3 = I did really well

<table>
<thead>
<tr>
<th>Statement</th>
<th>Mark out of 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>I used a sharp pencil for my drawing.</td>
<td></td>
</tr>
<tr>
<td>I used a good eraser and completely erased all the mistakes I made.</td>
<td></td>
</tr>
<tr>
<td>I did not use any colour or shading on my drawing.</td>
<td></td>
</tr>
<tr>
<td>I made my drawing bigger than the actual leaf.</td>
<td></td>
</tr>
<tr>
<td>The shape and proportions of my drawing are exactly like those of the leaf.</td>
<td></td>
</tr>
<tr>
<td>I showed the edges of the leaf very clearly.</td>
<td></td>
</tr>
<tr>
<td>I showed the pattern of veins on the leaf very clearly.</td>
<td></td>
</tr>
<tr>
<td>I labelled at least three things on my drawing.</td>
<td></td>
</tr>
<tr>
<td>I used a ruler to draw the labelling lines.</td>
<td></td>
</tr>
<tr>
<td>I made sure the end of each labelling line touched the part of the leaf I was labelling.</td>
<td></td>
</tr>
<tr>
<td>I wrote the labels around the drawing, not on top of it.</td>
<td></td>
</tr>
<tr>
<td><strong>Total (maximum possible mark = 33)</strong></td>
<td></td>
</tr>
</tbody>
</table>
Unit 1  Plants

Exercise 1.3  The effect of different colours of light on the rate of photosynthesis

Sunil wanted to find out which colour of light would make a plant photosynthesise fastest.

The diagram shows the apparatus that he set up.

Sunil shone a light onto each piece of pondweed. He counted the number of bubbles that was given off in one minute. He did this three times for each piece of pondweed.

These are his results.

red – 10, 12, 11  blue – 8, 12, 10

green – 4, 5, 6  colourless – 11, 13, 12
Unit 1  Plants

1  What was the variable that Sunil changed in his experiment?

…………………………………………………………………………………………

2  What was the variable that Sunil measured in his experiment?

…………………………………………………………………………………………

3  List three variables that Sunil should have kept the same in his experiment.

first variable ………………………………………………………………………

second variable …………………………………………………………………

third variable ……………………………………………………………………

4  Draw a results table in the space below, and fill in Sunil’s results so that they are easy to understand. Remember to include a column where you can write in the mean value for each set of results.
Unit 1 Plants

5 Complete the bar chart to show Sunil’s results.

6 Write down a conclusion that Sunil can make from his results.

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The International Space Station has been orbiting the Earth since the year 2000. More than 200 astronauts, from many different countries, have worked on the Space Station.

Some of the astronauts carry out experiments to investigate how plants grow in space. The plants are grown in small, enclosed, transparent containers. They are given artificial light. Air and water are pumped around their roots.

The experiments show that, when there is no gravity at all, the plant roots and shoots grow randomly in all directions. So some of the plants are spun gently in a machine called a centrifuge. This produces a force to which the plants respond just as they would respond to gravity.

One experiment has tested how the plants grow in different kinds of soils. If a soil has very large particles, the water in it escapes easily. The water forms little droplets and floats away into the air. If the particles in the soil are very small, then air does not flow through it easily and the roots don’t get enough oxygen to survive.

The plants grown in the Space Station include dwarf wheat, strawberries and mizuna. If humans ever travel to Mars, they will need plants to provide them with oxygen and food. The experiments also show that the astronauts enjoy growing the plants.

1 Suggest why the plants in the Space Station are grown in enclosed containers.

2 Suggest why water has to be pumped directly to the plant roots, rather than just poured into the container from a watering can.
Unit 1 Plants

3 a Explain why the roots of a plant grow in all directions if there is no gravity.
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b Describe how this problem has been solved in the Space Station.
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4 Explain why a sandy soil would not be a good choice for growing plants in the Space Station. (Use what you know about soils, and also the information on page 13, to help you write your answer.)
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…………………………………………………………………………………………
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5 Describe three reasons why it would be useful for astronauts travelling on a long journey to grow plants in their spaceship.
first reason ………………………………………………………………………
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second reason ………………………………………………………………………
…………………………………………………………………………………………
third reason ………………………………………………………………………
…………………………………………………………………………………………
Exercise 2.1  Fibre in food

This exercise asks you to use data in a table, and to look for a particular pattern in the data. You’ll also practise drawing a bar chart.

The table shows the fibre content of some different foods.

<table>
<thead>
<tr>
<th>Food</th>
<th>Grams of dietary fibre per 100 g of food</th>
</tr>
</thead>
<tbody>
<tr>
<td>apples</td>
<td>2</td>
</tr>
<tr>
<td>bananas</td>
<td>3</td>
</tr>
<tr>
<td>beans</td>
<td>5</td>
</tr>
<tr>
<td>bread, brown</td>
<td>7</td>
</tr>
<tr>
<td>bread, white</td>
<td>4</td>
</tr>
<tr>
<td>chicken</td>
<td>0</td>
</tr>
<tr>
<td>coconut</td>
<td>14</td>
</tr>
<tr>
<td>com</td>
<td>4</td>
</tr>
<tr>
<td>eggs</td>
<td>0</td>
</tr>
<tr>
<td>fish</td>
<td>0</td>
</tr>
<tr>
<td>fries (potato chips)</td>
<td>2</td>
</tr>
<tr>
<td>mutton</td>
<td>0</td>
</tr>
<tr>
<td>peas</td>
<td>5</td>
</tr>
<tr>
<td>plantain</td>
<td>6</td>
</tr>
<tr>
<td>potatoes</td>
<td>3</td>
</tr>
<tr>
<td>rice</td>
<td>3</td>
</tr>
<tr>
<td>spinach</td>
<td>6</td>
</tr>
<tr>
<td>sweet potatoes</td>
<td>2</td>
</tr>
<tr>
<td>yam</td>
<td>4</td>
</tr>
</tbody>
</table>

1  Explain why we need fibre in our food.

………………………………………………………………………………………………………………

………………………………………………………………………………………………………………

2  Which kinds of food do not contain any fibre?

………………………………………………………………………………………………………………