1 Seeds from the plant family *Papilionaceae* form an important part of the human diet.

Fig. 1.1 shows three different types of seed that have been soaked in water for 24 hours.

**Fig. 1.1**

(a) Describe the differences in shape and appearance of the seed coat (testa) between the three types of seed.

Write your answers in Table 1.1.

<table>
<thead>
<tr>
<th>feature</th>
<th>lentil</th>
<th>chickpea</th>
<th>soya bean</th>
</tr>
</thead>
<tbody>
<tr>
<td>shape of seed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>appearance of seed coat</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A group of students were planning an investigation into the effect of temperature on the germination of seeds.

The teacher gave them a list of possible variables.

<table>
<thead>
<tr>
<th>temperature</th>
<th>number of seeds germinated</th>
</tr>
</thead>
<tbody>
<tr>
<td>intensity of light</td>
<td>time</td>
</tr>
<tr>
<td>length of seedling</td>
<td>volume of water</td>
</tr>
</tbody>
</table>

From this list, select the most suitable:

- variable to change: ...........................................
- variable to measure: ...........................................

[2]
Fig. 1.2 shows the same three seeds after they have been germinated in suitable conditions.

(c) (i) Make a large, labelled drawing of the lentil seedling.
(ii) You are going to calculate the magnification of your drawing.

Measure the length of the line \( ST \) on Fig. 1.2.

\[
\text{length of line } ST \quad \text{mm}
\]

Draw line \( ST \) on your drawing in the same position as in Fig. 1.2.

Measure the corresponding length of \( ST \) on your drawing.

\[
\text{length of } ST \text{ in drawing } \quad \text{mm}
\]

Calculate the magnification of your drawing.

Show your working.

\[
\text{magnification} \times \quad [4]
\]

Lentils contain protein and a small quantity of fat.

(d) Describe the food tests you could carry out to show that lentil seeds contain:

(i) protein;

\[
\text{.................................................................}[2]
\]

(ii) fat.

\[
\text{.................................................................}[3]
\]
The percentage of protein and fat in five types of seed, are shown in Table 1.2.

**Table 1.2**

<table>
<thead>
<tr>
<th>type of seed</th>
<th>percentage of protein / %</th>
<th>percentage of fat / %</th>
</tr>
</thead>
<tbody>
<tr>
<td>chickpea</td>
<td>8.0</td>
<td>2.5</td>
</tr>
<tr>
<td>lentil</td>
<td>9.0</td>
<td>0.6</td>
</tr>
<tr>
<td>lima bean</td>
<td>8.0</td>
<td>0.4</td>
</tr>
<tr>
<td>mung bean</td>
<td>7.0</td>
<td>0.4</td>
</tr>
<tr>
<td>soya bean</td>
<td>16.0</td>
<td>8.0</td>
</tr>
</tbody>
</table>

(i) Construct a bar chart to show the percentages of protein and fat in the five types of seed. Use the same axes for the two sets of data.

(ii) Meat is a good source of protein.

Name the type of seed in Table 1.2 that would be a good alternative to meat in the human diet.

..........................................................
Fig. 1.3 shows part of a label from a packet of soya bean seeds. The label shows the energy content measured in kilojoules.

![Soya Beans Table]

### Soya Beans

<table>
<thead>
<tr>
<th>Typical composition</th>
<th>provides</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>230 kJ</td>
</tr>
<tr>
<td>Protein</td>
<td>8.5 g</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>4.5 g</td>
</tr>
<tr>
<td>Fat</td>
<td>4.0 g</td>
</tr>
</tbody>
</table>

**Fig. 1.3**

Fig. 1.4 shows a simple calorimeter. This apparatus can be used to find the energy content of a soya bean seed. The soya bean seed is burned and the energy released is absorbed by the water in the test-tube.

![Calorimeter Diagram]

**Fig. 1.4**

(f) Suggest how you could **safely** carry out a simple investigation to find the energy content of a sample of soya bean seeds.

State what you would need to measure and control.

[3]

[Total: 27]
A student investigated the effect of solution E on cucumber.

A thin slice, approximately 2 mm thick, was cut from a cucumber as shown in Fig. 2.1.

![Diagram of cucumber slice with labeled parts]

**Fig. 2.1**

The centre of the slice was removed as shown in Fig. 2.2A. The slice was cut in half as shown in Fig. 2.2B.

![Diagram of cucumber slice cut in half with labeled parts]

**Fig. 2.2**
One piece (half slice) of cucumber was placed in solution E. A second piece was placed in water. After 5 minutes the shape of the pieces in solution E and water had changed. Table 2.1 shows the pieces of cucumber before and after being placed in solution E and water.

Table 2.1

<table>
<thead>
<tr>
<th>Table 2.1</th>
<th>the shape of the piece of cucumber before being placed in solution E</th>
<th>the shape of the piece of cucumber before being placed in water</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><img src="image1" alt="Diagram" /></td>
<td><img src="image2" alt="Diagram" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2.1</th>
<th>the shape of the piece of cucumber after being placed in solution E</th>
<th>the shape of the piece of cucumber after being placed in water</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><img src="image3" alt="Diagram" /></td>
<td><img src="image4" alt="Diagram" /></td>
</tr>
</tbody>
</table>

(a) Describe the effect of solution E and water on:

(i) the dark green outer tissue of the pieces of cucumber;

- in solution E ..................................................................................................................

- in water ...........................................................................................................................

........................................................................................................................................ [2]
(ii) the pale green inner tissue of the pieces of cucumber.

[2]

(b) Explain the effect of solution $E$ on the tissues of the cucumber.

[3]

(c) State one possible source of error in the method used in this investigation.

Suggest a suitable improvement.

[2]

[Total: 9]
3 Slugs and snails are molluscs that can live in water or on land.

Fig. 3.1 shows a slug and a snail.

Fig. 3.1

(a) (i) Describe two features, visible in Fig. 3.1, that suggest the slug and the snail belong to the same group of molluscs.

1 ........................................................................................................................................ [2]

(ii) Describe one difference, other than size, visible in Fig. 3.1, between the slug and the snail.

........................................................................................................................................ [1]

Fig. 3.2 shows a shell of a mollusc.

Fig. 3.2

(b) Suggest the importance of the shell to molluscs that belong to this group.

........................................................................................................................................ [1]

[Total: 4]