

1 (a) A plant produces sugars in its leaves. The sugars produced are needed by other parts of the plant and are transported through the phloem as sucrose.

Sucrose is transported to the roots where it is stored as starch. Some of the sucrose is transported to the fruit of the plant where it is stored as fructose and glucose. Sucrose is also transported to the seeds of the plant.

Water and mineral ions are taken up through the roots where they are transported through the xylem to the rest of the plant.

Solutions were made to represent extracts of different tissues and fluids found in a plant:

- fluid in the phloem
- root tissue
- seed tissue
- fruit tissue
- fluid in the xylem

You are provided with 4 solutions, **S1**, **S2**, **S3** and **S4**.

You will:

- identify the biological molecules present in each of the 4 solutions
- suggest which solution, **S1**, **S2**, **S3** or **S4**, could represent each of the plant extracts.

You are provided with the materials shown in Table 1.1.

**Table 1.1**

labelled	contents	hazard	volume / cm <sup>3</sup>
<b>A</b>	dilute hydrochloric acid	irritant	20
<b>H</b>	sodium hydrogencarbonate powder	low	-
<b>Benedict's</b>	Benedict's solution	harmful irritant	40
<b>Iodine</b>	iodine solution	irritant	20
<b>S1</b>	solution 1	low	60
<b>S2</b>	solution 2	low	60
<b>S3</b>	solution 3	low	60
<b>S4</b>	solution 4	low	60

If any solution comes into contact with your skin, wash off immediately with cold water.

It is recommended that you wear suitable eye protection.

You will need to:

- carry out the test for reducing sugars
- carry out the test for non-reducing sugars
- carry out the test for starch
- identify the biological molecules in **S1**, **S2**, **S3** and **S4**.

(i) State the reagent or reagents that are used to test for reducing sugars **and** the colour or colours produced if reducing sugars are present.

reagent or reagents .....

colour or colours .....

Describe how you will carry out the test for reducing sugars.

.....  
 .....  
 .....

[1]

step 1 Label 4 test-tubes **S1**, **S2**, **S3** and **S4**.

step 2 Put 1 cm<sup>3</sup> of each solution into the appropriately labelled test-tube.

step 3 Carry out the test for reducing sugars on **S1**, **S2**, **S3** and **S4** described in (a)(i).

step 4 Record the colours observed in (a)(iii).

(ii) State the reagent or reagents that are used to test for non-reducing sugars **and** the colour or colours produced if non-reducing sugars are present.

reagent or reagents .....

colour or colours .....

Describe how you will carry out the test for non-reducing sugars.

.....  
 .....  
 .....  
 .....  
 .....

[2]

step 5 Label 4 clean test-tubes **S1**, **S2**, **S3** and **S4**.

step 6 Put 1 cm<sup>3</sup> of each solution into the appropriately labelled test-tube.

step 7 Carry out the test for non-reducing sugars on **S1**, **S2**, **S3** and **S4** described in (a)(ii).

step 8 Record the colours observed in (a)(iii).

step 9 Label 4 clean test-tubes **S1**, **S2**, **S3** and **S4**.

step 10 Put 1 cm<sup>3</sup> of each solution into the appropriately labelled test-tube.

step 11 Carry out the test for starch on **S1**, **S2**, **S3** and **S4**.

step 12 Record the colours observed in (a)(iii).

(iii) Record your results in an appropriate table.

[5]

(iv) Complete Table 1.2 to suggest which solution (**S1**, **S2**, **S3** or **S4**) could represent each of the plant extracts.

Use your results in (a)(iii) and the information on plant transport given in (a).

A solution could represent more than one plant extract.

**Table 1.2**

plant extract	solution
fluid in the phloem	<b>S...</b>
root tissue	<b>S...</b>
seed tissue	<b>S...</b>
fruit tissue	<b>S...</b>
fluid in the xylem	<b>S...</b>

[2]

(v) Protein could be present in some of the solutions.

Describe how you would identify which solutions contain protein.

.....  
 .....  
 .....  
 .....

[2]

(b) A scientist investigated the effect of light on the concentration of sugars in a plant for 24 hours. The plant was kept in the dark for the first 8 hours and then exposed to light for the remaining 16 hours.

Samples were taken from the leaves and from the phloem sieve tubes. The concentration of sugars in each sample was measured.

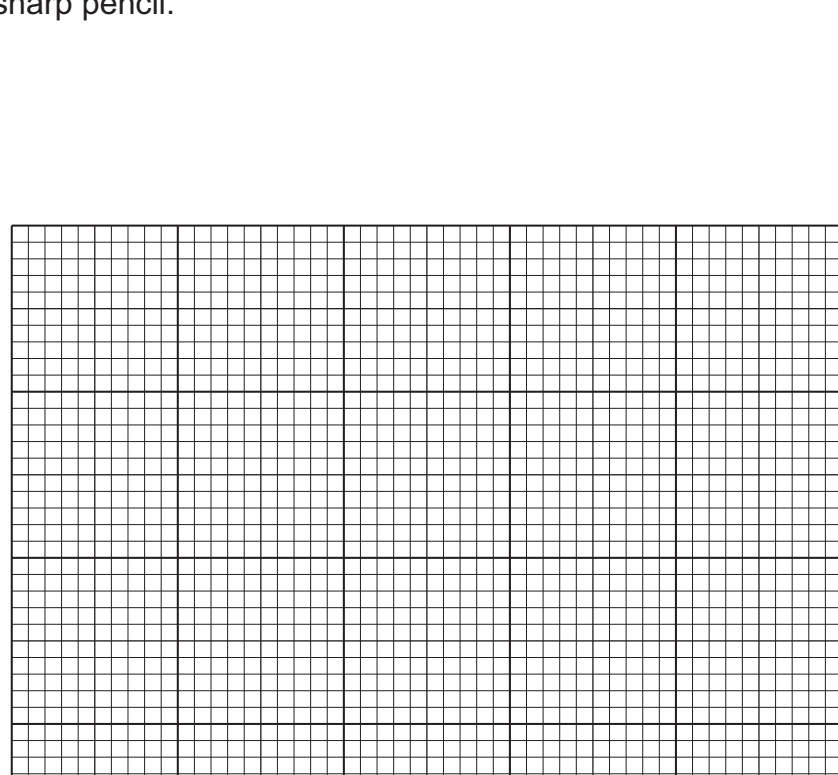
The results are shown in Table 1.3.

**Table 1.3**

time / hours	concentration of sugars / μmol	
	leaves	phloem sieve tubes
0	0.38	0.22
5	0.21	0.17
8	0.13	0.11
15	0.24	0.16
24	0.39	0.22

(i) Plot a line graph of the data in Table 1.3 on the grid in Fig. 1.1.

Use a sharp pencil.



**Fig. 1.1**

[4]

(ii) Describe the trend for the concentration of sugars in the leaves and phloem sieve tubes shown in Fig. 1.1.

.....  
 .....  
 .....

[1]

(iii) Suggest an explanation for the trend in the data when the plant was in the dark and when the plant was in the light.

plant in the dark .....

.....  
 .....  
 .....  
 .....

[2]

(iv) Calculate the percentage increase in the concentration of sugars in the leaves between 15 and 20 hours.

Show your working.

percentage increase .....%

[2]

[Total: 21]