

# 1: Cells and cell processes – Topic questions

## Paper 6

The questions in this document have been compiled from a number of past papers, as indicated in the table below.

Use these questions to formatively assess your learners' understanding of this topic.

Question	Year	Series	Paper number
1	2016	March	62
1	2016	November	63
2	2016	June	61

The mark scheme for each question is provided at the end of the document.

You can find the complete question papers and the complete mark schemes (with additional notes where available) on the School Support Hub at [www.cambridgeinternational.org/support](http://www.cambridgeinternational.org/support)

- 1 Some students investigated the effect of temperature on the activity of amylase.

Amylase is an enzyme that catalyses the break down of starch.

Starch changes the colour of iodine solution from orange-brown to blue-black.

Step 1 The students added 2 cm<sup>3</sup> of starch solution to a test-tube, labelled it **W**, and placed it into a beaker of warm water.

Step 2 They added 2 cm<sup>3</sup> of starch solution to a second test-tube, labelled it **C**, and placed it into a beaker of iced water.

Step 3 The students placed one dropping pipette into each of test-tubes **W** and **C**.

Step 4 They waited five minutes before continuing.

Step 5 The students added 10 drops of amylase solution to each of test-tubes **W** and **C** and shook both test-tubes gently.

Step 6 They started a timer.

Step 7 The students immediately tested the liquids in test-tubes **W** and **C** for starch using iodine solution.

Step 8 The students repeated step 7 after 2, 4, 6 and 8 minutes.

- (a) Iodine solution can affect the activity of amylase.

The students tested the liquids in test-tubes **W** and **C** using iodine solution without affecting the activity of the amylase.

Describe how the students did this.

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.....[2]

The students observed that the liquid from test-tube **W** turned the iodine solution blue-black after 0 minutes, dark brown after 2 minutes, and it remained orange-brown after 4, 6 and 8 minutes.

The liquid from test-tube **C** turned the iodine solution blue-black after 0, 2 and 4 minutes and dark brown after 6 and 8 minutes.

**(b)** Prepare a table to record these observations in the space below.

[4]

**(c)** Suggest reasons for:

**(i)** waiting for five minutes at step 4

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

**(ii)** using separate dropping pipettes for test-tubes **W** and **C**.

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.....[1]

**(d)** Explain the observations for test-tube **W**.

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.....[3]

**(e)** The students concluded:

“The higher the temperature, the greater the activity of amylase.”

Do you agree with this conclusion?

Give a reason for your answer.

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.....[1]

**(f)** There is a source of error in step 5 of the method.

**(i)** Identify this source of error.

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.....[1]

**(ii)** Suggest apparatus that could be used to minimise this source of error.

.....[1]

(g) State **one** other source of error in the method used in this investigation.

Suggest how to improve the method to minimise this source of error.

error .....

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.....

improvement .....

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[2]

(h) Some students stated:

"The activity of amylase is greatest at 40°C."

Describe an investigation to test whether this statement is correct.

The investigation should be similar to that described in steps 1–8.

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.....[6]

- (i) Amylase breaks starch down into reducing sugars.

Outline how the students could show that reducing sugars are present in a solution.

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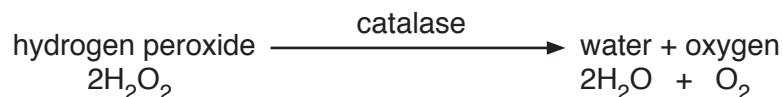
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.....[2]

**[Total: 24]**

- 1 Catalase is an enzyme found in plant and animal cells. It catalyses the breakdown of hydrogen peroxide to form water and oxygen.



Students investigated the effect of surface area on the breakdown of hydrogen peroxide by catalase.

They used potato as a source of catalase. They varied the surface area of the potato and measured the volume of oxygen gas produced by the break down of the hydrogen peroxide.

Step 1 Three potato sticks, of the same diameter, were placed next to each other on a white tile.

Each potato stick was cut to exactly 4 cm in length.

Step 2 One of the potato sticks was cut into eight equal pieces as shown in Fig. 1.1.

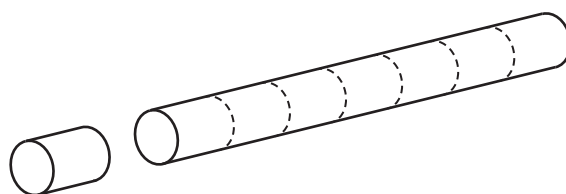


Fig. 1.1

Step 3 Step 2 was repeated with another potato stick. The last potato stick was left whole.

Step 4 A 25cm<sup>3</sup> measuring cylinder was submerged in a tub of water and allowed to fill with water. The measuring cylinder was turned upside down keeping the open end under the water in the tub as shown in Fig. 1.2.

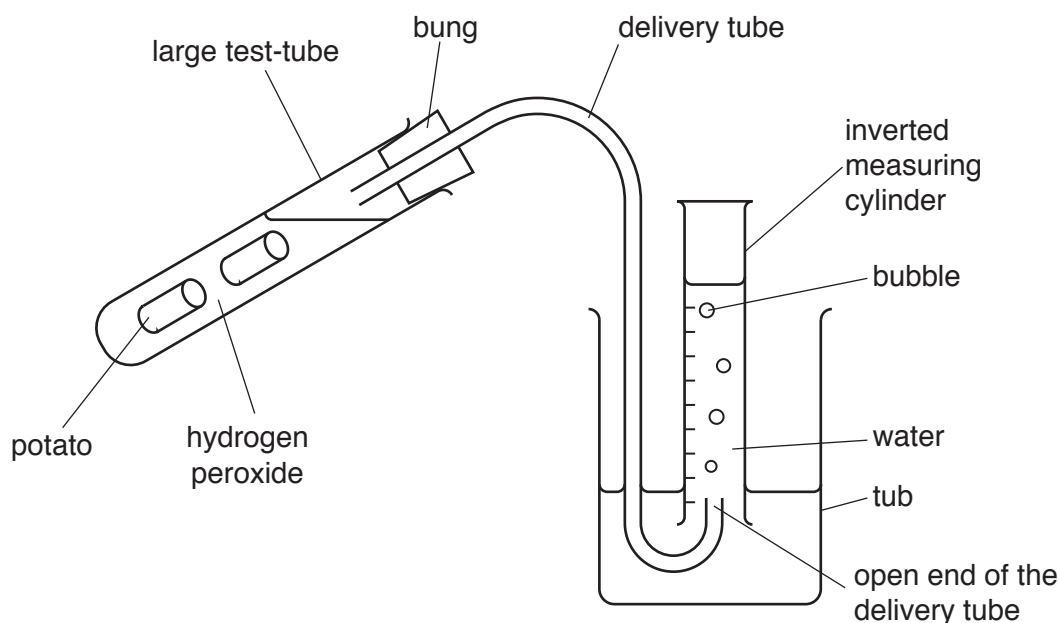


Fig. 1.2

A practice experiment was carried out using one of the potato sticks that had been cut into eight pieces.

- Step 5 The open end of the delivery tube was placed into the inverted measuring cylinder in the tub of water.
- Step 6 A syringe was used to add  $20\text{ cm}^3$  of hydrogen peroxide to a large test-tube.
- Step 7 All eight pieces of potato were added to the large test-tube and the delivery tube bung was immediately placed into the large test-tube.
- Step 8 A timer was started and the large test-tube was shaken every 30 seconds for three minutes.
- Step 9 The volume of oxygen gas collected in the measuring cylinder for the practice experiment was recorded as  $2.5\text{ cm}^3$ .
- Step 10 The contents of the large test-tube were discarded. The large test-tube was rinsed with distilled water before being reused.
- Step 11 Steps 4 to 8 were repeated with the remaining whole potato stick. The volume of oxygen gas collected is shown in Fig. 1.3.
- Step 12 Steps 4 to 8 were repeated using the remaining potato stick that had been cut into eight pieces. The volume of oxygen gas collected is shown in Fig. 1.3.

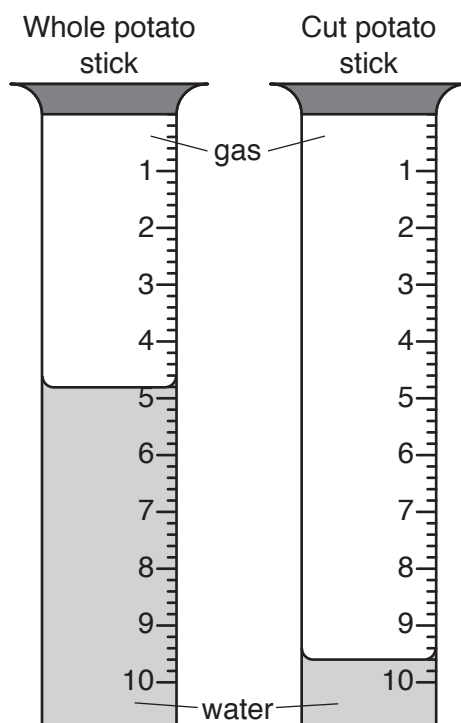


Fig. 1.3

- Step 13 Read the volume of oxygen gas collected in the two measuring cylinders shown in Fig. 1.3 and record the results in your table in **1(a)**.



- (a) Prepare a table to record the results shown in Fig. 1.3. Complete the table by entering the results.

[4]

- (b) (i) The students measured the volume of oxygen gas produced in three minutes. Calculate the rate of oxygen gas production for each of the values in your table. Give your answer in  $\text{cm}^3$  per minute.

Show your working.

whole potato stick .....  $\text{cm}^3$  per minute

cut potato stick .....  $\text{cm}^3$  per minute  
[2]

- (ii) Describe the effect on the surface area of the potato of cutting the potato stick into eight pieces.

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.....[1]

- (iii) Describe **and** explain, using the results from (b)(i), the effect of surface area on the volume of oxygen gas produced.

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.....[3]

- (c) The student used a 25cm<sup>3</sup> measuring cylinder to collect the gas in their practice experiment. The practice volume of oxygen gas recorded was 2.5cm<sup>3</sup>. Suggest why the student then chose to use a 10cm<sup>3</sup> measuring cylinder for the rest of their investigation.

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

- (d) State **two** variables that were kept constant in this investigation.

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

- (e) Identify **two** sources of error in this method and suggest an improvement for each error.

error .....  
.....  
improvement .....  
.....  
.....  
error .....  
.....  
improvement .....  
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.....  
[4]

(f) Hydrogen peroxide breaks down slowly without catalase enzyme being present.

Describe a suitable control for this investigation.

.....[2]

**(g)** Another student wanted to investigate the amount of catalase present in different food plants.

Describe a method the student could use to carry out this investigation.

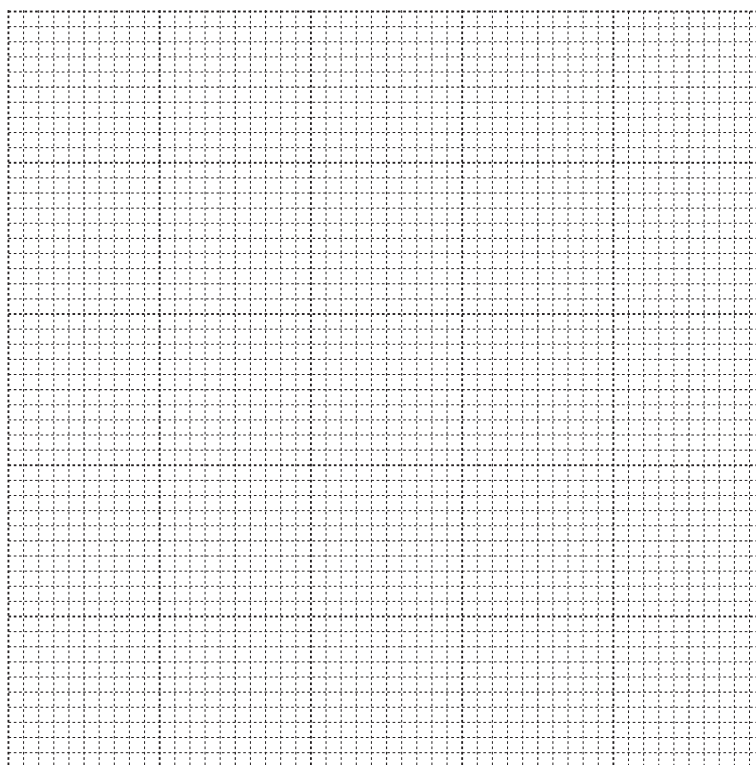
.....[5]

- (h) Table 1.1 shows the volume of oxygen produced when the student carried out the experiment for three different food plants.

**Table 1.1**

food plant	volume of oxygen produced / cm <sup>3</sup>
<b>A</b>	9.2
<b>B</b>	0.8
<b>C</b>	6.7

Plot a graph of the data from Table 1.1 on the grid.



[4]

- (i) Describe how the student could test food prepared from these plants for the presence of reducing sugars.

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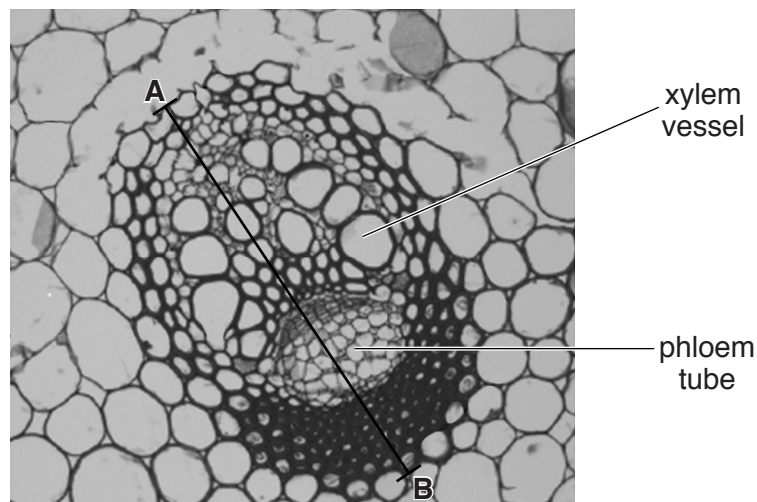
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.....[3]

**[Total: 31]**

- 2 Fig. 2.1 is a photograph of a cross-section of a vascular bundle in a leaf.  
Line **AB** shows the length of the vascular bundle.



**Fig. 2.1**

- (a) (i) Make a large drawing to show the different regions of the vascular bundle shown in Fig. 2.1.  
Do **not** draw any individual cells.  
Identify and label on your drawing the position of the xylem vessel as shown in Fig. 2.1.

- (ii) Measure the length of line **AB** as shown on Fig. 2.1. **Include the unit.**

Length of **AB** .....

Mark on your drawing a line in the same position as **AB**.

Measure the line you have drawn.

Length of line on drawing .....

$$\text{magnification} = \frac{\text{length of line on drawing}}{\text{length of } \mathbf{AB}}$$

Calculate the magnification of your drawing using the information above and your answers.

Show your working.

magnification ..... [3]

- (iii) State **one** way **visible** in Fig. 2.1 in which the xylem vessel is different from the phloem tube.

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.....[1]

- (b) The walls of xylem vessels are supported by a chemical called lignin, which can be stained by a red dye. This makes the xylem vessel walls easily seen when using a microscope.

Use this information to plan how you could find the position of the vascular bundles in a stem.

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.....[4]

[Total: 13]

### Abbreviations used in the Mark Scheme:

;	separates marking points
/	alternatives
I	ignore
R	reject
A	accept (for answers correctly cued by the question, or guidance for examiners)
AW	alternative wording (where responses vary more than usual)
AVP	any valid point
ecf	credit a correct statement / calculation that follows a previous wrong response
ora	or reverse argument
( )	the word / phrase in brackets is not required, but sets the context
<u>underline</u>	actual word given must be used by candidate (grammatical variants excepted)
max	indicates the maximum number of marks that can be given

Question	Answer	Marks
1 (a)	idea of withdrawing a sample to test ; aspect of appropriate method described ;	[2]
1 (b)	1 one table with ruled lines for at least 6 rows and 3 columns ; 2 a column / row, with header: time / min ; 3 two, columns / rows headings as, colour / observation, W / C ; 4 correct completion of information into table ;	[4]
1 (c) (i)	idea of equilibration ;	[1]
1 (c) (ii)	idea of minimising contamination ; idea of allowing simultaneous measurement ;	[max 1]
1 (d)	(blue-black shows) starch present at, 0 min / start ; (dark brown shows) some starch present at 2 min ; (orange-brown shows) no starch present, after 2 min / from 4 min ;	[3]

Question	Answer	Marks																		
1 (e)	yes : C stayed blue-black for longer / slower colour change ; ORA OR no : there is not a large enough range of temperatures ;	[max 1]																		
1 (f) (i)	drop / dropping pipettes, are imprecise / volume of amylase may vary ; shaking can, cause spillage / inconsistent mixing ;	[max 1]																		
1 (f) (ii)	appropriate apparatus to measure precise volume ; e.g. syringe / burette / graduated pipette / measuring cylinder ; appropriate apparatus to stir carefully / consistently; e.g. (magnetic) stirrer / glass rod / bung / test-tube shaker ;	[max 1]																		
1 (g)	<table><tr><th>Source of error</th><th>Improvement</th></tr><tr><td>experiment was done only once ;</td><td>repeat entire experiment (at least 3 times in total) to calculate an average ;</td></tr><tr><td>shaking, can cause spillage/ inconsistent mixing ;</td><td>(magnetic) stirrer / glass rod bung / flask to swirl;</td></tr><tr><td>drops / dropping pipettes, are imprecise / volume of amylase may not be the same ;</td><td>use syringe / burette / graduated pipette / measuring cylinder ;</td></tr><tr><td>(long) intervals between testing / AW ; A reaction finishes between points</td><td>test, more often / every minute / 30 seconds;</td></tr><tr><td>colour changes are subjective ; A endpoint hard to judge</td><td>colour chart / standards / control with no starch / colorimeter ;</td></tr><tr><td>trying to do, W and C simultaneously ;</td><td>do W and C separately / second person to do second tube ;</td></tr><tr><td>(water) temperature changes ;</td><td>insulate beakers / use (thermostatically controlled) water-bath ;</td></tr><tr><td>AVP ; e.g. contents in pipette might contaminate spotting tests</td><td>AVP ; e.g. use clean pipettes each time</td></tr></table>	Source of error	Improvement	experiment was done only once ;	repeat entire experiment (at least 3 times in total) to calculate an average ;	shaking, can cause spillage/ inconsistent mixing ;	(magnetic) stirrer / glass rod bung / flask to swirl;	drops / dropping pipettes, are imprecise / volume of amylase may not be the same ;	use syringe / burette / graduated pipette / measuring cylinder ;	(long) intervals between testing / AW ; A reaction finishes between points	test, more often / every minute / 30 seconds;	colour changes are subjective ; A endpoint hard to judge	colour chart / standards / control with no starch / colorimeter ;	trying to do, W and C simultaneously ;	do W and C separately / second person to do second tube ;	(water) temperature changes ;	insulate beakers / use (thermostatically controlled) water-bath ;	AVP ; e.g. contents in pipette might contaminate spotting tests	AVP ; e.g. use clean pipettes each time	[max 2]
Source of error	Improvement																			
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1 (h)	1 test at 40 °C ; 2 test at least one temperature below 40 °C and one above ; 3 use of water-bath (to maintain different temperatures) / AW ; 4&5 named controlled variables ;; 6 measure time taken until iodine becomes orange brown / no longer changes colour ; 7 by repeated sampling at interval of less than 2 mins ; 8 repeat entire experiment / replicates ; 9 relevant stated safety procedure ;	[max 6]																		
1 (i)	Benedict's solution turns (brick) red ; with heat ;	[2]																		
[Total: 24]																				



Question	Answer	Marks
1 (a)	table with two / three columns and two / three rows and result recorded in each cell of the table; headings for dependant variable volume of oxygen / gas produced with unit in the header only (cm <sup>3</sup> ); headings for the independent variable; correct values transferred from Fig. 1.3; i.e. 9.6 and 4.8 ± 0.1 cm <sup>3</sup>	[4]
1 (b) (i)	1.6; 3.2;	[2]
1 (b) (ii)	increased / AW	[1]
1 (b) (iii)	<i>description</i> greater oxygen production with cut potato / larger surface area; use of data; <i>explanation</i> a greater surface area / more catalase, in contact with the hydrogen peroxide / substrate;	[3]
1 (c)	the 10 cm <sup>3</sup> measuring cylinder could be read with greater accuracy / precision / AW;	[1]
1 (d)	total length / diameter / width / volume of potato cylinder; concentration / volume of hydrogen peroxide; time; shaking every 30 seconds / at regular intervals;	[2]
1 (e)	<i>error</i> – loss of gas while connecting the bung; <i>improvement</i> – idea of closed system / three-way tap / doing quickly;  <i>error</i> – pieces sticking together reduces surface area; <i>improvement</i> – shake continuously;  <i>error</i> – (inconsistent) shaking; <i>improvement</i> – sensible suggestion for regular shaking;  <i>error</i> – potato not measured so not cut into equal sized pieces; <i>improvement</i> – measure 5 mm slices;  <i>error</i> – dilution of peroxide due to washing; <i>improvement</i> – use a new large test tube each time;  <i>error</i> -sticks not from same potato / same variety of potato / different mass / density; <i>improvement</i> – use sticks from the same potato / variety of potato / age of potato / measure mass;  <i>error</i> – temperature fluctuation; <i>improvement</i> – water bath;  <i>error</i> – only one trial ; <i>improvement</i> – repeat at least 2 more time ;  AVP e.g. pH, contamination of tubes	[4]

Question	Answer	Marks
1 (f)	keep (all) variables the same / AW; substitute plant material for inert material e.g. glass beads / leave out potato; idea of collecting gas produced solely by decomposition and subtracting this value/ AW;	[2]
1 (g)	1 use the same size (surface area) of plant; 2 carry out experiment at the same temperature / pH; 3 other variable from previous method; 4 measure volume of oxygen produced; 5 plans to repeat experiment; 6 calculate the mean; 7 comparison of volumes for different food plants; 8 reference to relevant safety feature;	[5]
1 (h)	<b>A</b> (xes) – labelled with units, y-axis even scale; <b>S</b> (ize) – occupies at least half the grid; <b>P</b> (lot) – all bars plotted accurately $\pm \frac{1}{2}$ square; <b>B</b> (ars) – ruled lines, have an equal gap between each component and are equal width;	[4]
1 (i)	add Benedict's solution; heat; red / brown / green / yellow precipitate indicates reducing sugars present;	[3]
<b>[Total: 31]</b>		
2 (a) (i)	Outlines – all lines single, clear and unbroken ; Size – occupies at least half of the space provided ; Detail – oval shape + phloem + 1 other area ; two other areas shown ; Label – line to correct area on drawing to show position of xylem ( vessel) and line labelled "xylem"	[5]
2 (a) (ii)	measurement of AB = 58 mm; line on their drawing and length measured with correct unit ; correct magnification calculation;	[3]
2 (a) (iii)	(xylem) walls thick(er) / large (er) / wide(er); (xylem vessels) round(er) ; (xylem) has large(r) cross section area / big(ger) ;	[max 1]
2 (b)	1 use of any suitable plant material; 2 put stem / material chosen in (red) dye / add dye to cut (stem) surface; 3 time for absorption of dye; 4 cut (sections) of stem or material chosen; 5 (red stained xylem) will indicate position of vascular bundle	[max 4]
<b>[Total: 13]</b>		