

# 1: Cells and cell processes – Topic questions

## Paper 5

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	52
1	2016	November	53
2	2016	June	51

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** You are going to investigate 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.

You will measure the time taken for the iodine solution to stay orange-brown at two different temperatures.

**Amylase can irritate the skin and damage the eyes. Use the eye protection and gloves provided.**

Read through steps 1 to 11 **before** starting the experiment.

Step 1 Label a test-tube **W**, add 3 cm<sup>3</sup> of starch solution and place it into the beaker of warm water.

Step 2 Label a test-tube **C**, add 3 cm<sup>3</sup> of starch solution and place it into the beaker of iced water.

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

Step 4 Use the marker pen to draw a line which divides the white spotting tile into two equal halves. Label one half **W** and the other half **C**.

Step 5 Put one drop of iodine solution into each of the wells of the spotting tile.

Step 6 Transfer one drop of the liquid in test-tube **W** to the first well in the half of the spotting tile labelled **W**. Observe any colour change.

Step 7 Transfer one drop of the liquid in test-tube **C** to the first well in the half of the spotting tile labelled **C**. Observe any colour change.

**(a)** State any colour changes observed in steps 6 and 7.

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

Read through steps 8 to 11 and prepare a results table in part **1(b)**. **Do not start step 8 until you have drawn your results table.**

Step 8 Add 20 drops of amylase solution to each of test-tubes **W** and **C**, and stir gently.

Step 9 Start the timer.

Step 10 **Immediately**, transfer one drop of liquid from test-tube **W** to the second well in the half of the spotting tile labelled **W**. Return the remaining liquid in the pipette to test-tube **W** and then place the dropping pipette back into test-tube **W**. **Immediately**, transfer one drop of liquid from test-tube **C** to the second well in the half of the spotting tile labelled **C**. Return the remaining liquid in the pipette to test-tube **C** and then place the dropping pipette back into test-tube **C**.

Observe any colour changes and record your results in the table you prepared in part **1(b)**.

Step 11 Repeat step 10 after 2, 4, 6 and 8 minutes, using different wells in the spotting tile in each case. Record your observations in the table you prepared in part **1(b)**.

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

[6]

**(c)** Suggest reasons for using separate dropping pipettes for test-tubes **W** and **C**.

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.....[1]

(d) Explain your results for test-tube **W**.

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.....[3]

(e) Another student carried out the same investigation as you and they 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) State **two** sources of error in the method used in your investigation.

Suggest how to improve the method to minimise these sources of error.

error 1 .....

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improvement 1 .....

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error 2 .....

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improvement 2 .....

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.....[4]

**(g)** 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 1–11.

[6]

**(h)** Amylase breaks starch down into reducing sugars.

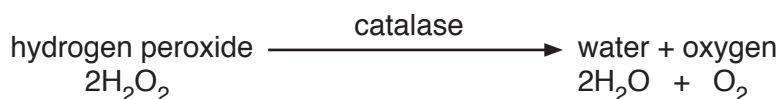
Outline how the students could show that reducing sugars are present in a solution.

.....[2]

**[Total: 24]**

**Read through all the questions on the paper carefully before starting work.**

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



You are going to investigate the effect of surface area on the breakdown of hydrogen peroxide by catalase.

You will use potato as a source of catalase. You will vary the surface area of the potato and measure the volume of oxygen produced by the break down of the hydrogen peroxide.

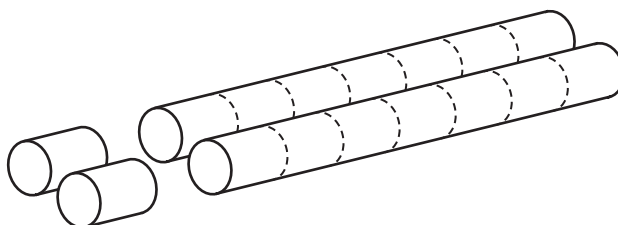
**Read all instructions but DO NOT CARRY THEM OUT until you have drawn a table for your results in the space provided in 1(a).**

You should use the gloves and eye protection provided while you are carrying out the practical work.

Step 1 Lay the six potato sticks next to each other on the white tile.

Cut each potato stick to exactly 4 cm in length.

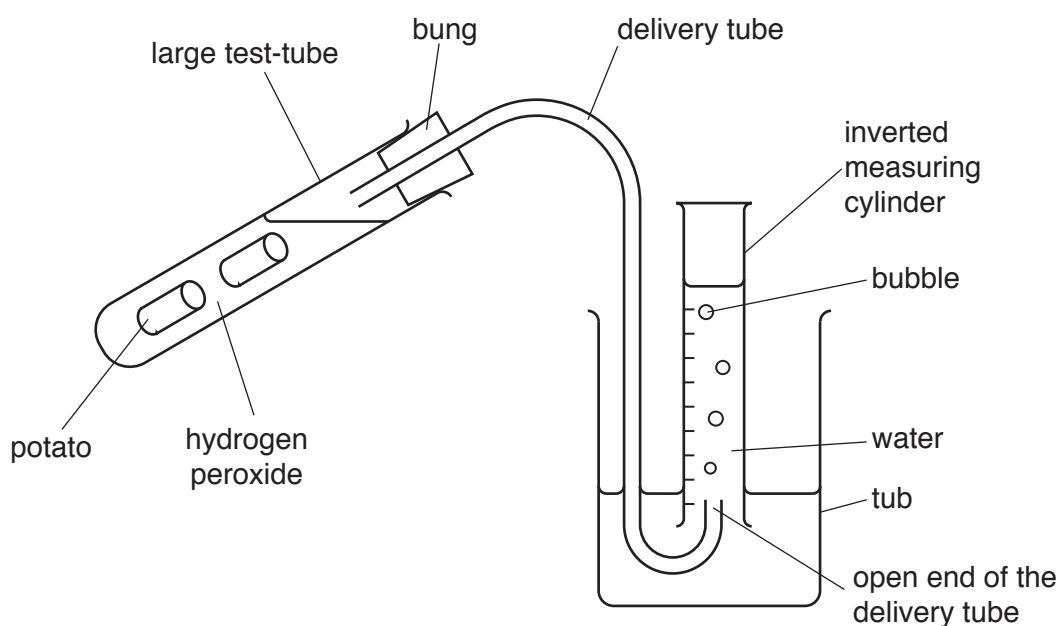
Step 2 Take two of the potato sticks and cut each one into eight equal pieces as shown in Fig. 1.1.



**Fig. 1.1**

Step 3 Repeat step 2 with two more potato sticks. Leave the last two potato sticks whole.

Step 4 Submerge the 25 cm<sup>3</sup> measuring cylinder in the tub of water and allow it to fill with water. Turn the measuring cylinder upside down keeping the open end under the water in the tub as shown in Fig. 1.2.



**Fig. 1.2**

You are going to carry out a practice experiment using two of the potato sticks that have been cut into 8 (a total of 16 pieces). Record the results of this experiment in the space provided in **1(c)**.

- Step 5 Place the open end of the delivery tube into the inverted measuring cylinder in the tub of water.
- Step 6 Use the syringe to add 20 cm<sup>3</sup> of hydrogen peroxide to the large test-tube.
- Step 7 Add the 16 pieces of potato that you cut in Step 2 to the large test-tube and immediately place the bung, attached to the other end of the delivery tube, into the large test-tube.
- Step 8 Start the timer and carefully shake the large test-tube briefly every 30 seconds for three minutes.
- Step 9 Record the volume of oxygen gas collected in the measuring cylinder for your practice experiment in **1(c)**.
- Step 10 Remove the bung and pour the used hydrogen peroxide solution and potato into the beaker labelled **waste**.
- Step 11 Rinse the large test-tube with the washing water provided.

Use the results of your practice experiment to choose the most appropriate size of measuring cylinder to use to measure the volume of oxygen gas produced in three minutes. Record your choice in **1(c)**.

- Step 12 Repeat Steps 4 to 8 using the 16 pieces of potato that you cut in Step 3 and your chosen measuring cylinder. Record in your table in **1(a)**, the volume of oxygen gas collected in the measuring cylinder after three minutes.
- Step 13 Repeat Steps 4 to 8 using the remaining two whole potato sticks in Step 7 and your chosen measuring cylinder. Record the volume of oxygen gas collected in the measuring cylinder after three minutes in your table in **1(a)**.

(a) Prepare a table to record your results.

[4]

(b) (i) Calculate the rate of oxygen gas production for each of the values in your table. Give your answer in  $\text{cm}^3$  per minute to one decimal place.

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.

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

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

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.....  
.....  
.....[3]



(c) Complete the following:

Practice volume of oxygen produced .....

Size of the measuring cylinder used for Steps 12 and 13 .....

Explain why you chose that size.

Explanation .....

.....

.....[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 .....

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improvement .....

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error .....

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improvement .....

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[4]

- (f)** Hydrogen peroxide breaks down slowly without catalase enzyme being present.  
Describe a suitable control for this investigation.

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.....[2]

- (g)** Another student wanted to investigate the amount of catalase present in different food plants.  
Describe a method that the student could use to carry out this investigation.

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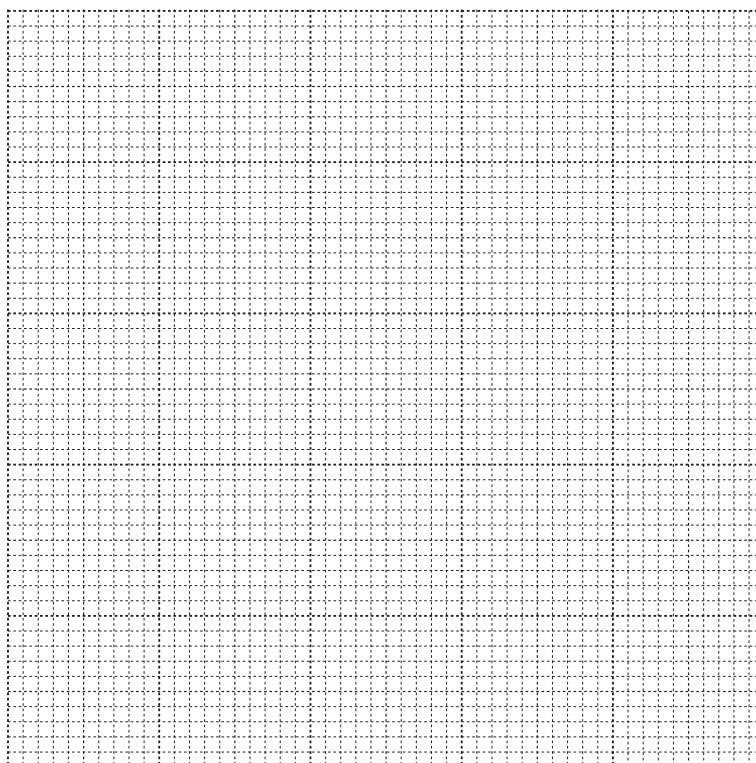
.....[5]

- (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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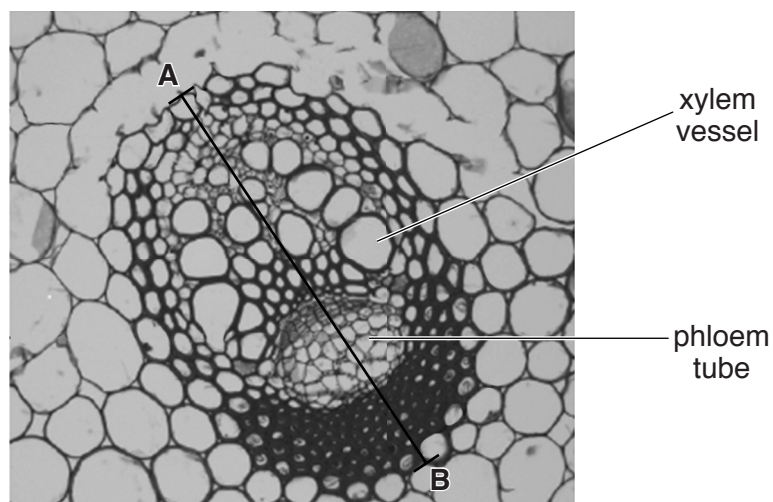
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.....[3]

**[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]

### 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)	change to blue-black	[1]
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 ; 5 W – start is blue-black, gradual change through dark brown to orange-brown ; 6 C – start is blue-black, remains blue-black for longer than W, may turn brown towards the end ;	[6]
1 (c)	idea of minimising contamination ; to measure simultaneously ;	[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]
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]

Question	Answer	Marks																		
1 (f)	<p>any two errors with two matching improvements:</p> <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 ; Accept method without equipment</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 ; Accept method without equipment	(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 4]
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1 (g)	<p>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&amp;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 ;</p>	[max 6]																		
1 (f)	<p>Benedict's solution turns (brick) red ; with heat ;</p>	[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 trend in values (cut potato higher than uncut);	[4]
1 (b) (i)	calculates rate by dividing by 3; two correct answers to 1 d.p.;	[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)	<i>either</i> (25 cm <sup>3</sup> ) the volume of gas produced was greater than 10 cm <sup>3</sup> / the 10 cm <sup>3</sup> measuring cylinder did not hold all of the gas produced; <i>or</i> (10 cm <sup>3</sup> ) the 10 cm <sup>3</sup> measuring cylinder could be read with greater accuracy / precision;	[1]
1 (d)	total length / diameter / width / volume of potato cylinder; concentration / volume of hydrogen peroxide; time;	[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;	[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>		