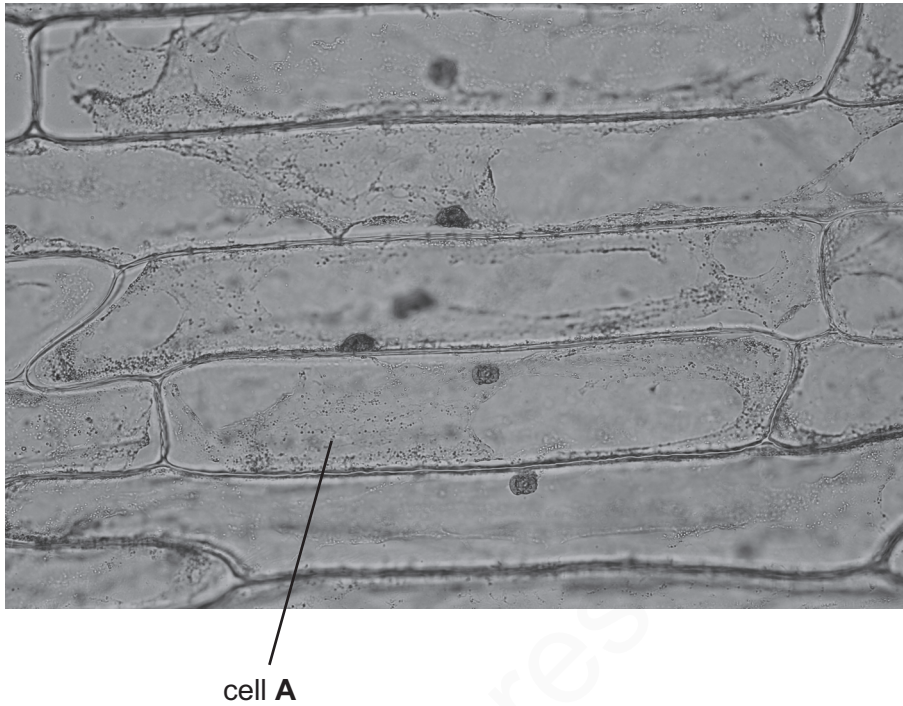# CHARACTERISTICS OF LIVING ORGANISMS-SET-1-QP-MS

1 A student is studying cells using a light microscope.

She prepares cells from an onion and stains them using iodine solution.

Fig. 4.1 shows a group of onion cells as seen under the microscope.

cell **A**

Fig. 4.1

(a) Make a large pencil drawing of cell **A** in the box provided. **Label** the nucleus and cell wall.

[3]

The student wants to measure the average length of these cells. She places a ruler with a millimetre scale on the stage of the microscope to find the diameter of the field of view. She looks down the microscope and sees the field of view shown in Fig. 4.2.
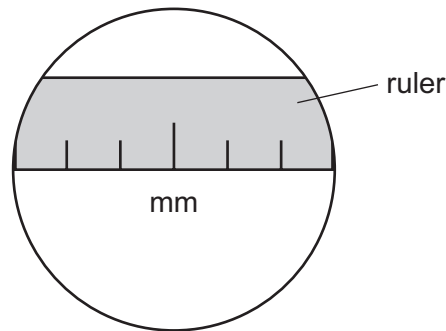
Fig. 4.2

(b) **(i)** Using the ruler in Fig. 4.2 state the width of the field of view of the microscope.

.... mm   [1]

(ii) She then replaces her slide and counts 15 cells across the field of view.

Calculate the average length of an onion cell using your answer from part **(b)(i)**.

Show your working.

average length of cell = ... mm   [1]

(iii) On your drawing in part **(a)** measure the length of cell **A** at the longest part.

length of cell **A** on the drawing = ... mm   [1]

(iv) Using the value for the average cell length from part **(b)(ii)** and the length of cell **A** on your drawing, calculate the magnification of your drawing.

magnification = ... [2]

(c) Name **one** structure normally present in a plant cell that is **not** visible in these onion cells.

.... [1]

(d) Another student uses a microscope to look at some cells in iodine solution. Some parts of the cell stain blue-black.

Explain this observation.

....

.... [1]

MARKING SCHEME

(a) good quality drawing of ONE complete cell only;
nucleus labelled correctly ;
cell wall labelled correctly ;   [3]

(b) (i) 6 mm ;   4   [1]

    (ii) $\dfrac{6}{15}$ = 0.4 mm ; (ecf)   [1]

    (iii) length taken from students drawing ; $\pm$ 2 mm   [

    (iv) magnification = $\dfrac{\text{length}}{0.4}$; (ecf)
       = correct calculation ; (no ecf if fraction inverted)   [2]

(c) vacuole or chloroplast ; (NOT chlorophyll)   [1]

(d) starch (present) ;   [1]

[Total: 10]

2 Fig. 1.1 is a photograph of a flower in section.

Fig. 1.1

(a) (i) In the box below make a pencil drawing of this flower to show the male and female parts and the petals. [2]

(ii) On your drawing, **label** a carpel and a stamen. [2]

(b) (i) Measure the line X – Y on Fig. 1.1 in mm.

length = ... mm   [1]

(ii) Measure the length of the same part on your drawing in mm.

length = ... mm   [1]

(c) Use these two measurements to calculate the magnification of your drawing.

Show your working in the space below.

magnification = ... [1]

(d) On your drawing, mark with a **Z** the structure that receives pollen during pollination.   [1]

(e) Describe the procedure you would use if you wanted to examine a sample of pollen from this flower.

....

....

....   [2]

MARKING SCHEME

(a) (i) good quality drawing ;
carpel, stamen and at least two petals drawn ;   [2]

   (ii) stamen correctly labelled ;
carpel correctly labelled ;   [2]

(b) (i) correct measurement from photograph – 68 (mm) ;   [1]

   (ii) correct measurement of drawing given ;   [1]

(c) magnification calculated by dividing the length of drawing by the length of the petal in photo (ensure both in the same units) ;   [1]

(d) stigma labelled **Z** ;   [1]

(e) select <u>anther</u> (allow top of stamen) ;
squash / cut to open anther ;
use a microscope to observe ;   [max 2]

[Total: 10]

3 *Daphnia* are transparent aquatic animals that can be viewed using a microscope allowing their heart rate to be measured and recorded. Fig. 4.1 shows a *Daphnia* viewed with a microscope.
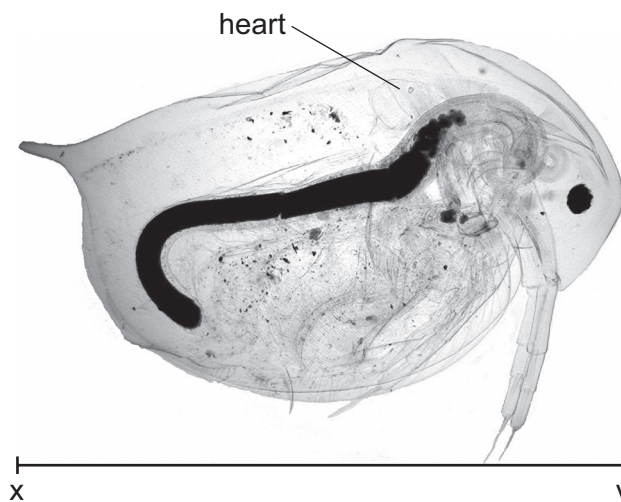
Fig. 4.1

A student investigates the effect of some solutions on the heart rate of *Daphnia*. His results are shown in Table 4.1.

Table 4.1

solution	heart rate in beats per minute			
	experiment **1**	experiment **2**	experiment **3**	average
pond water	213	312	300	275
cola	374	389	365	376
coffee	386	409	402	399
decaffeinated coffee	290	324	298	304

(a) (i) Explain how the student has made the investigation reliable.

.... [1]

(ii) The teacher suggests to the student that the average result for pond water is not reliable.

Explain the reason for this.

....

.... [1]

(iii) Suggest what the student can do to make the average result for pond water more reliable.

.... [1]

(b) Explain why pond water was used for the first set of experiments.

.... [1]

(c) (i) Cola and coffee contain a chemical called caffeine. Use the results in Table 4.1 to describe the effect that caffeine has on the heart rate of *Daphnia*.

.... [1]

(ii) The makers of decaffeinated coffee claim that all of the caffeine has been removed.
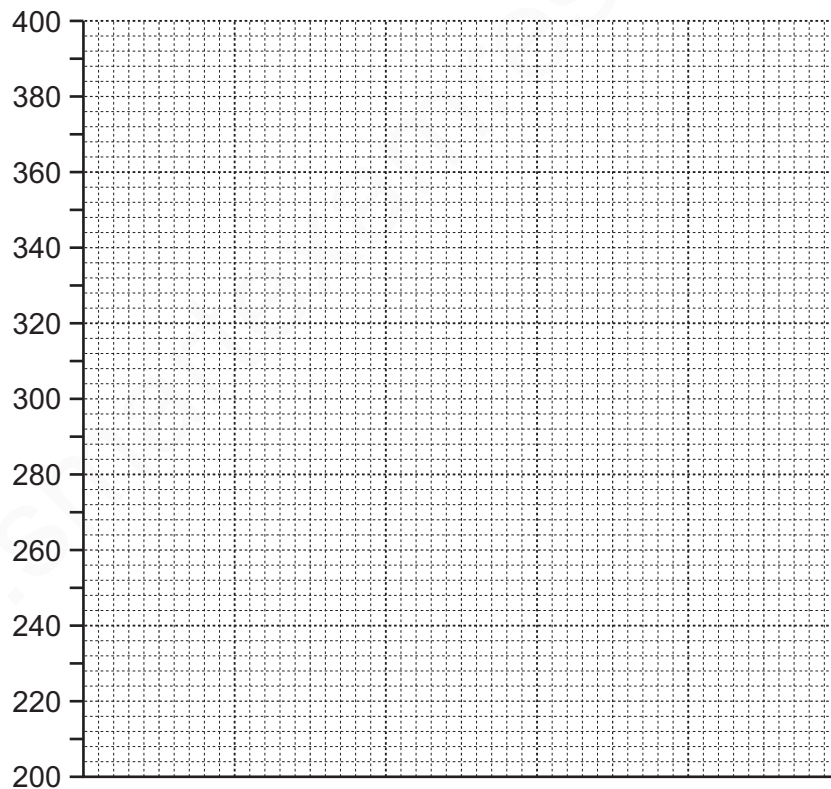
Use the results in Table 4.1 to comment on the accuracy of this claim.

agree / disagree with claim (delete as appropriate)

comment ....

.... [1]

(d) Using the grid below, draw a bar chart of heart rate on the vertical axis against solution.

[2]

(e) (i) Measure the line x – y on Fig. 4.1 in millimetres.

.... mm   [1]

(ii) The *Daphnia* is viewed using a magnification of ×40.

Use your measurement in **(e)(i)** to calculate the actual size of the *Daphnia*.

Show your working.

.... mm   [1]

MARKING SCHEME

(a) (i) repeats ; [1]

  (ii) (experiment 1 is) anomalous result / one result is different from the others / one result doesn't fit the pattern / range is high(est) / range 1 and 2 very high ; [1]

  (iii) do not include experiment 1 in average / carry out 4th experiment / repeat again ; [1]

(b) control / baseline / normal rate / needed for comparison / normal habitat ; [1]

(c) (i) increases heart rate ; [1]

  (ii) agree – similar / close to pond water result / removal of anomaly gives mean of 306 [max 1]
  OR
  disagree – 304 is an increased heart rate to 275 ;

(d) axes labelled with units ; [2]
  bar for each solution with heights correct ;

  (e) (i) 80 (mm) ; [1]

  (ii) 2 (mm) ; [1]

[Total: 10]

4 A scientist uses a microscope to view and measure some cells.

She observes the cells in Fig. 4.1.

Fig. 4.1

(a) Make a **large** pencil drawing in the box below of the cell labelled **D** in Fig. 4.1. [2]

(b) (i) Measure the length of the line **E**–**F** on Fig. 4.1 Record its length in millimetres.

length = ... mm [1]

(ii) Draw the line, **E**–**F**, on your cell drawing. Measure and record the length of this line in millimetres.

length = ... mm [1]

(iii) Use your measurements to calculate the magnification of your drawing. Show your working in the space below.

magnification = ... [1]

(c) The scientist then looks at the cells under a higher magnification, as shown in Fig. 4.2.
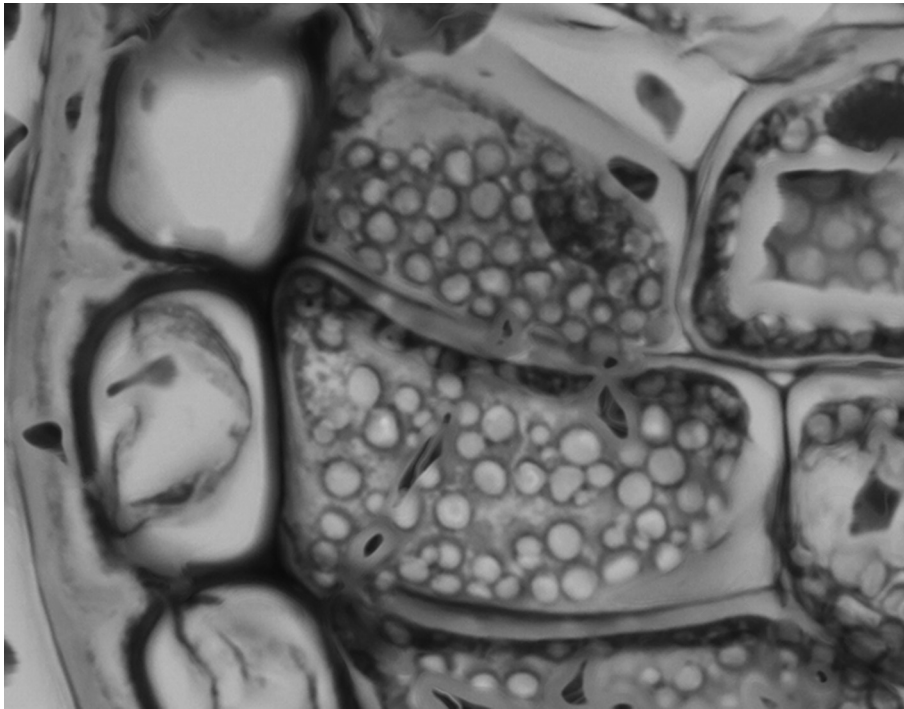

Fig. 4.2

(i) Use label lines to identify and name **three** visible features. [3]

(ii) The scientist identifies the cells as plant cells.

State whether you agree or disagree with the scientist. Give **two** reasons to support your answer.

statement ....

reason 1 ....

....

reason 2 ....

....

[2]

MARKING SCHEME

(a) good size drawing with clear lines ;
correct shape ; [2]

(b) (i) correct measurement (34 mm) ; [1]

(ii) correct measurement (from their drawing) ; [1]

(iii) correct calculation ; [1]

(c) (i) 3 correct labels ;;; [3]

(ii) (agree)
cell wall and nucleus = 1 mark ;
any **one** *from:* starch grain / vacuole / chloroplast ; [max 2]

[Total: 10]

5 A student is investigating one of the characteristics of living things using insects.
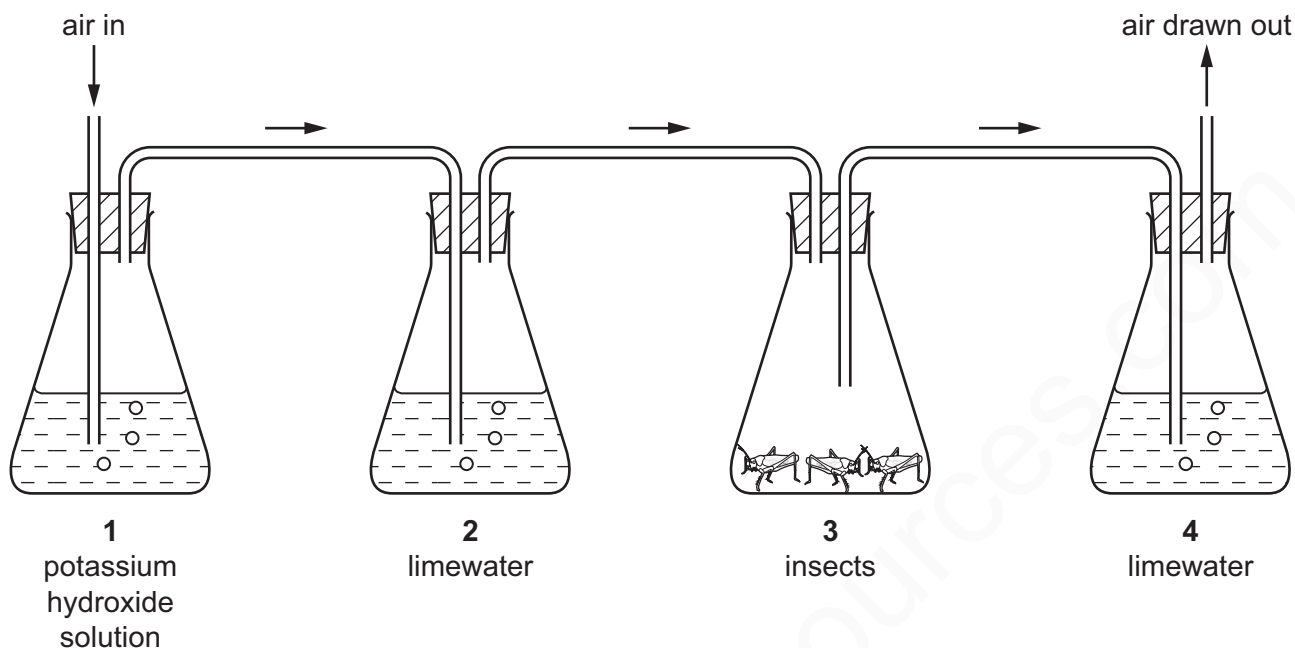
She sets up the apparatus as shown in Fig. 4.1.

Fig. 4.1

Air is drawn through the apparatus from left to right as shown. The potassium hydroxide in flask **1** removes any carbon dioxide from the air.

(a) (i) State the purpose of the limewater in flask **2**.

.... [1]

(ii) Predict the appearance of the limewater in flask **2** after 10 minutes.

.... [1]

(b) (i) State the purpose of the limewater in flask **4**.

.... [1]

(ii) Predict the appearance of the limewater in jar **4** after 10 minutes.

.... [1]

(c) Suggest a control for this experiment.

.... [1]

(d) (i) State the appearance of the liquid in flask **4** at the end of the experiment if it had contained water and Universal (full range) Indicator rather than the limewater.

[1]

(ii) Explain your answer to **(d)(i)**.

[3]

(e) Name the process inside living cells that is responsible for the changes that are observed in this experiment.

[1]

MARKING SCHEME

(a) (i) to confirm all the carbon dioxide has been removed from the air / to see if
carbon dioxide still in air / to test for CO_2 ;   [1]

  (ii) colourless ;   [1]

(b) (i) to see if carbon dioxide has been produced ;   [1]

  (ii) milky ;   [1]

(c) flask **3** would have no insect / empty ;   [1]

(d) (i) red / orange / yellow ;   [1]

  (ii) carbon dioxide ;
  <u>dissolves</u> ;
  production of acid (changes colour of the indicator) / owtte ;   [3]

  (e) <u>respiration</u> ;   [1]

   **[Total: 10]**

6

In a flower, ripe stigmas produce a fluid containing sugar. The sugar stimulates pollen grains that land on a stigma to grow *pollen tubes*. These pollen tubes allow the nucleus from the pollen to travel to the egg (ovum) in the ovary so that fertilisation can take place.

Pollen tubes can be observed using a light microscope. Fig. 4.1 shows a photograph of some of these pollen tubes.

0.2 mm
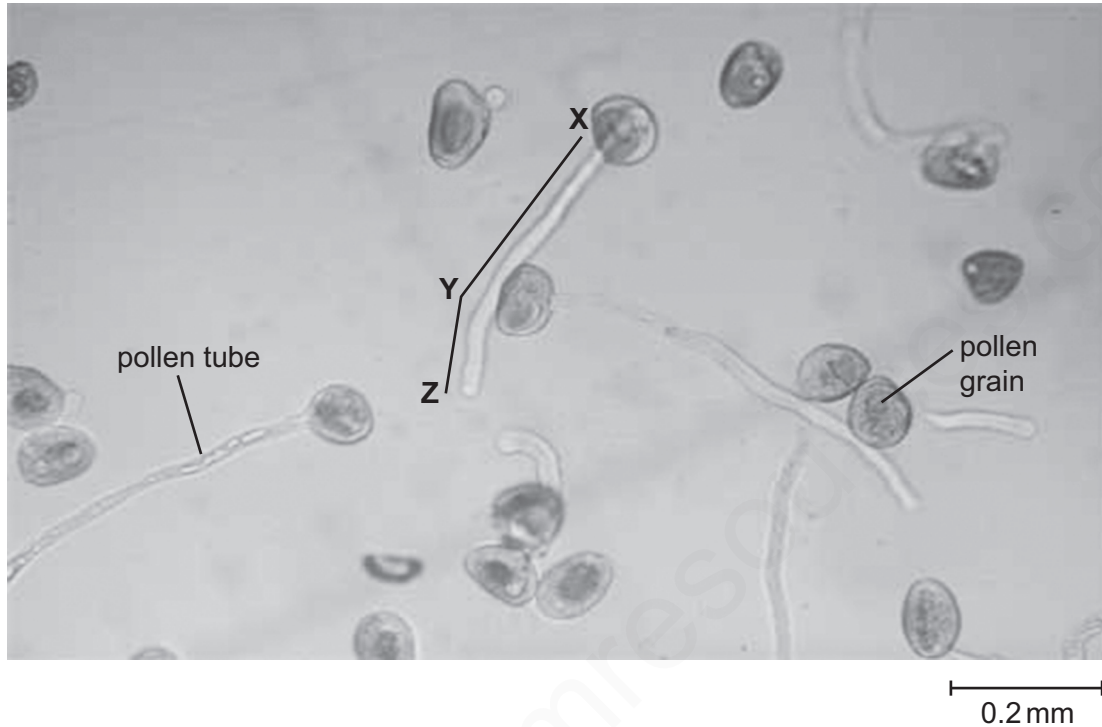
Fig. 4.1

(a) Measure and record the total length of the pollen tube as indicated by the line **X**-**Y**-**Z** on Fig. 4.1. With the help of the scale bar on the side of Fig. 4.1, calculate the actual length of the pollen tube.

Show your working.

Total length of pollen tube on image (**X**-**Y**-**Z**) = ... mm   [2]

Actual length of **X**-**Y**-**Z** = ... mm   [2]

(b) A student investigates the effect of different strength sugar solutions on the growth of pollen tubes.

- He places a drop of sugar solution on a microscope slide and adds pollen grains to it.

- He leaves the slide in a warm place for an hour and then looks at the slide using the microscope.

- He counts the number of pollen grains that he can see and then calculates the percentage that have pollen tubes.

His results are shown in Table 4.1.

Table 4.1

concentration of sugar solution (mol/dm^3)	% of pollen grains with pollen tubes			
	experiment **1**	experiment **2**	experiment **3**	average
0	0	0	0	0
0.25	36	28	32	
0.50	72	68	76	
0.75	49	41	45	
1	10	7	13	

Complete the last column of Table 4.1.   [1]

(c) (i) Use Table 4.1 to plot on the grid below a graph of average percentage of pollen grains with tubes (vertical axis) against sugar concentration. Draw a best-fit curve.
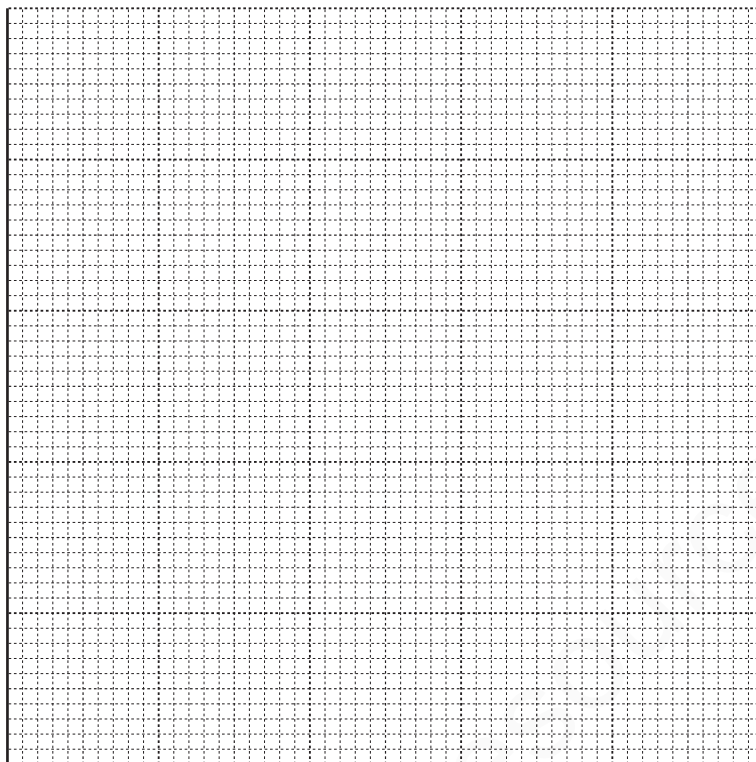
[4]

(ii) Use your graph to suggest the best concentration of sugar for pollen tube growth.

.... [1]

MARKING SCHEME

(a) (i) 39 ± 2 (mm) ;;   [2]
*(**OR** (for max 1): 39 ± 4 (mm)* **or** 3.9 ± 0.2/ (cm))

(ii) shows measurement of the scale bar in working $20\,mm \pm 1\,mm$;
answer = 0.4 (mm) ;   [2]

(b) 32
72
45
10 *(all four numbers to be correct)* ;   [1]

(c) (i) axes labelled with units;
suitable linear scale;
at least 4 plots correct $\pm$ half small square;
best-fit line peaking at or above $0.5\,mol/dm^3$;   [4]

(ii) read from peak of graph $\pm$ half small square ;   [1]

[Total: 10]