* 0012643678201 *

MINISTRY OF EDUCATION, SINGAPORE
in collaboration with
CAMBRIDGE ASSESSMENT INTERNATIONAL EDUCATION
General Certificate of Education Ordinary Level

CANDIDATE NAME	Answer

CENTRE NUMBER	S						INDEX NUMBER				

9904392108

BIOLOGY

6093/03

Paper 3 Practical Test

October/November 2020

1 hour 50 minutes

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your Centre Number, index number and name on all the work you hand in.
Give details of the practical shift and laboratory, where appropriate, in the boxes provided.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE ON ANY BARCODES.

Answer **all** questions in the spaces provided on the Question Paper.

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

Shift
Laboratory

For Examiner's Use	
1	
2	
Total	

This document consists of **15** printed pages and **1** blank page.

Singapore Examinations and Assessment Board
Cambridge Assessment International Education

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1 You are advised to read the whole question before you start.

Blood is filtered in the kidneys to form glomerular filtrate. As filtrate passes through the nephrons in the kidney its composition changes.

Glucose is present in glomerular filtrate, but is rarely present in the urine of healthy people.

Urine samples are often tested for the presence of glucose in health checks.

You will investigate the concentration of glucose in urine samples taken from a sample of healthy and unhealthy people.

You will **not** use real urine. The 'urine' samples provided have been specially prepared using water and laboratory reagents.

You are provided with:

- two test-tubes labelled **1** and **2**
- five test-tubes labelled **A** to **E**
- a glucose solution
- Benedict's solution
- five samples of 'urine' labelled **A** to **E**
- a beaker to use for boiling water
- deionised water
- two 5 cm^3 syringes
- a 10 cm^3 syringe.

If Benedict's solution comes into contact with your skin, wash it off immediately. You are advised to wear eye protection throughout the investigation. Take care when using hot water.

Proceed as follows through steps 1 to 7:

Part 1

Step 1 Use the beaker to collect enough of the hot water supplied so that the water is approximately 4 cm deep.

Use the Bunsen burner to boil the collected water.

Step 2 Use a 5 cm^3 syringe to put 2 cm^3 of the glucose solution into the test-tube labelled **1**.

Step 3 Use the other 5 cm^3 syringe to put 2 cm^3 of deionised water into the test-tube labelled **2**.

Step 4 Use the 10 cm^3 syringe to put 2 cm^3 of Benedict's solution into each of the two test-tubes labelled **1** and **2**. Shake the test-tubes to mix the contents.

Step 5 Put test-tubes **1** and **2** into the beaker of boiling water and **immediately** start timing.

Step 6 Watch carefully for the first sign of a colour change at the top of the liquid in each test-tube. If a colour change occurs, record the time taken for this colour change to first occur in **1(a)**.

Step 7 Leave the test-tubes in the boiling water for a total of 2 minutes. Record the final colour of the contents of the test-tubes in **1(a)** and then turn off the gas to the Bunsen burner.

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(a) Record your results for test-tubes **1** and **2**.

test-tube 1 Time taken : 27s ;
Final colour : Brick-red ;

test-tube 2 Final colour : Blue ;

Note : Tube 1 glucose solution
Tube 2 deionised wate

[3]

Part 2

In Part 2, you will test the 'urine' samples of five different people and use a graph to find the concentration of glucose in each sample. The 'urine' samples are labelled **A**, **B**, **C**, **D** and **E**. Read through steps 1–9 and prepare a table for your results in **1(b)**.

Proceed as follows:

Step 1 If necessary, collect enough hot water to add to the beaker used in Part 1 so that the water is approximately 4 cm deep.

Step 2 Use the Bunsen burner to boil the collected water.

Step 3 Use a 5 cm^3 syringe to put 2 cm^3 of 'urine' sample **A** into the test-tube labelled **A**.

Step 4 Use the 10 cm^3 syringe to put 2 cm^3 of Benedict's solution into test-tube **A**. Shake the test-tube to mix the contents.

Step 5 Put test-tube **A** in the boiling water and immediately start timing.

Step 6 Watch carefully for the first sign of a colour change at the top of the liquid in the test-tube. If a colour change occurs, record the time taken for this colour change to first occur in **1(b)**. If there is no change in colour after 2 minutes, record the time taken as > 120 seconds.

Step 7 Leave the test-tube in the boiling water for a total of 2 minutes. Record the final colour of the contents of the test-tube in **1(b)**.

Step 8 Repeat steps **3** to **7** for the other 'urine' samples, **B** to **E**. Ensure the water in the beaker is approximately 4 cm in height, and top up the water if necessary.

Step 9 Use Fig. 1.1 to convert the time taken for each sample to change colour to a concentration of glucose. After testing the last 'urine' sample **E**, turn off the Bunsen burner.

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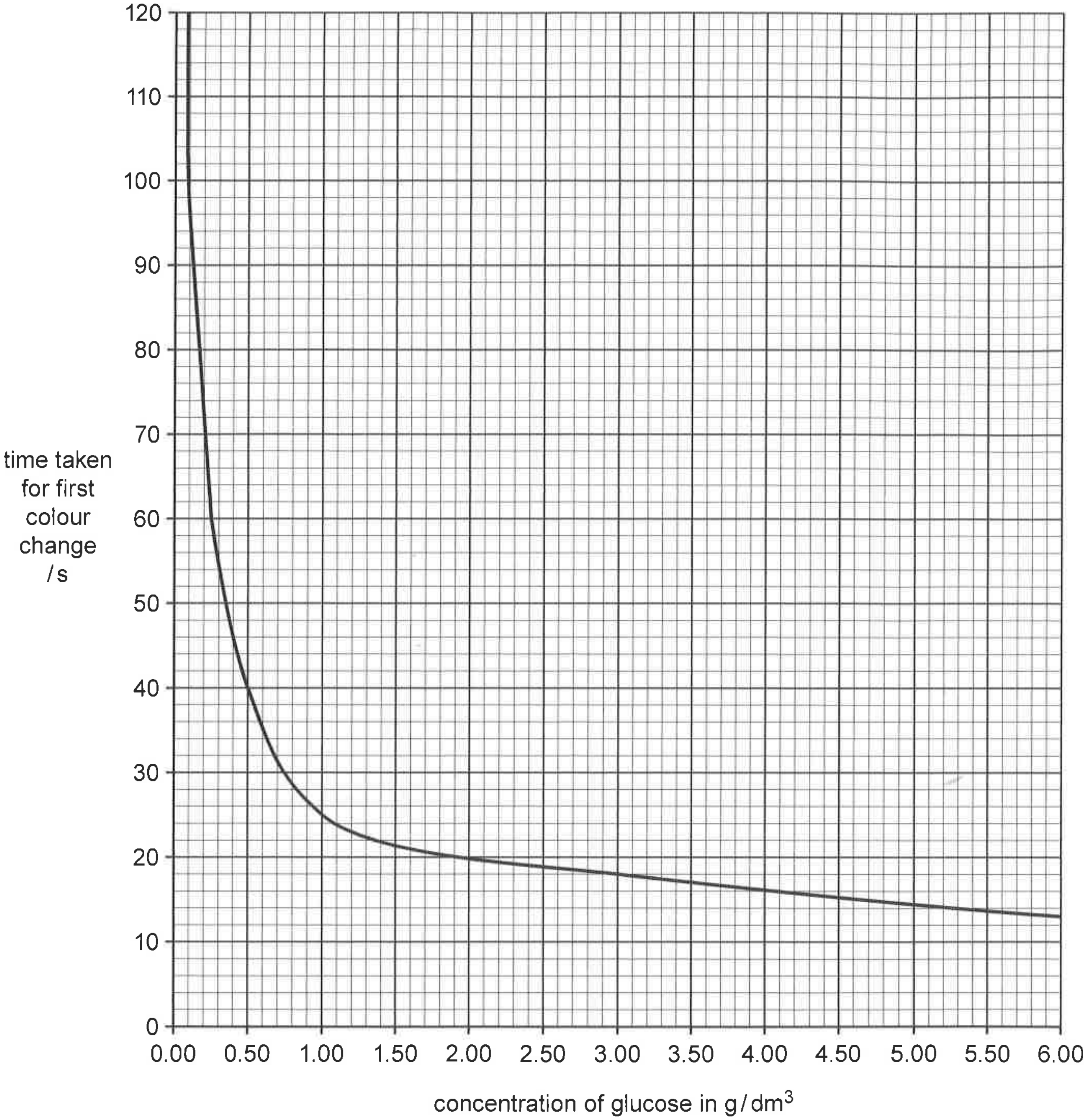

Fig. 1.1

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(b) Record your results for the five 'urine' samples **A**, **B**, **C**, **D** and **E** in a table. Record the time taken and final colour for each sample. Use Fig. 1.1 to determine the concentration of glucose for each sample and add this concentration to your table.

Heading + unit [1]

urine sample	time taken for colour chg/s	final colour	conc. of glucose/ g/dm^3
A	84	brick-red	0.15
B	39	brick-red	0.50
C	104	brick-red	0.10
D	>120	blue	~~0.09~~ ~~0.10~~ 0.00
E	85	brick-red	0.15

columns + rows [1]

shortest [1]

accurately recorded to 2 dp [1]

[1]

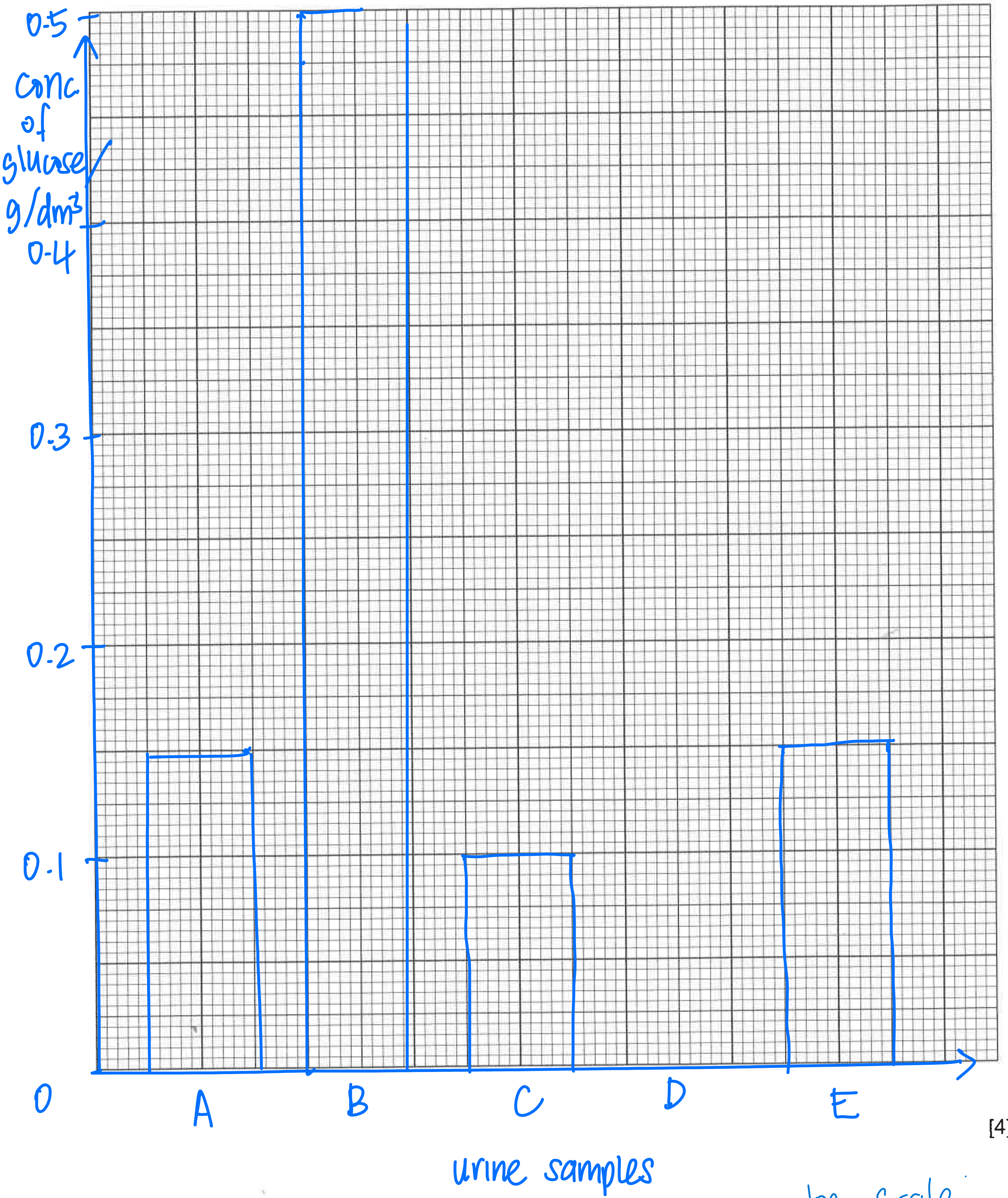
accurate colour [1]

Note: A : 3.0 g/dm^3 glucose
B : 5.0 g/dm^3 glucose
C : 1.5 g/dm^3 glucose
D : water
E : 3.0 g/dm^3 glucose

1m – correct heading with units
1m – conc. column
1m – data/trend
1m – 2dp for conc. of glucose
1m – clear table

[5]

(c) Plot a bar chart to show the concentration of glucose in the five 'urine' samples, **A** to **E**.



[4]

1m - axes & units
1m - bar charts ~ equal widths and spaces
1m - height drawn correctly
1m - scale

(d) State **one** variable that was kept the same when testing the samples of 'urine' for glucose with Benedict's solution.

Explain why it was important to keep this variable the same.

variable volume of urine sample / volume of Benedict's sol^n / temp of water bath / first colour change that was timed

explanation a difference in volume will affect the time taken for the colour change to be recorded an increase in volume may decrease the time taken for colour change

[2]

(e) Use the results in your bar chart to explain whether each of the 'urine' samples comes from healthy or unhealthy people.

Urine samples A, B, C and E contained glucose, with sample B having the highest amount of glucose at 0.5 g/dm³. ; (data) [1]

These samples came from unhealthy people These people may have kidney problems or diabetes; [1] (link to info)

Urine sample D came from a healthy person as it has no glucose at all; indicating that the kidneys are functioning [1]

[3]

(f) Suggest **two** key sources of error that apply to this investigation and in each case explain how you would improve the procedure that you followed.

Difficult to see when colour change began

source of error Syringe re-used to draw out volume of urine sample

improvement use different syringe for each urine sample to prevent cross-contamination

source of error one set of data collected

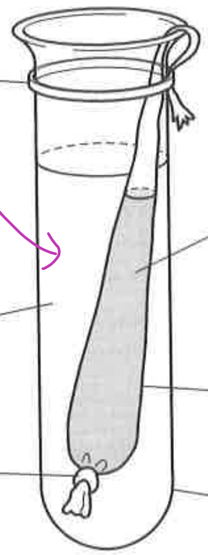
repeat & calculate mean time

improvement repeat the experiment and find the average time taken for colour change to find a more reliable conc. of glucose

[2]

(g) Visking tubing is similar to the tubing used in kidney dialysis. Glucose diffuses through Visking tubing. A student set up the apparatus shown in Fig. 1.2 to investigate the effect of temperature on the rate of diffusion of glucose.

must have water bath at diff temps.



After a given time (10mins?), test water in TT for glucose (Benedict's test)

record time taken for 1st colour change to be observed.

use graph to det [glucose] that diffuse into water at that temp.

Fig. 1.2

Plan an investigation based on the apparatus in Fig. 1.2 to determine the effect of temperature on the rate of diffusion of glucose through Visking tubing.

independent variable : temperature of water bath at which the set-up is placed in (at least 5 values, regular) 0°c, 20°c, 40°c, 60°c, 80°c [1m]

dependent variable : time taken for colour change [1m]

[2m] must show constant variable at least 2

① Leave set-up in water bath of temp. 0°c for 20 minutes (time)

② At end of 20min, draw out 2cm³ (volume) of water from the test-tube (around the visking tubing)

③ test sample with Benedict's solution

④ record time taken for first colour change

⑤ repeat steps 1 – 4 for water bath at different temperature

⑥ use the graph to find the conc. of glucose in each sample.

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(7) a higher concentration of glucose indicates that rate of diffusion is higher at that temperature. [4]

[Total: 23]

Temperature of water bath / °C	Time taken for 1st colour change / s	Conc of glucose in sample / g/dm³
0		
20		
40		
60		
80		

2 You are going to study the structure of a fruit of the lime tree.

Fig. 2.1 shows a section through a lime fruit.

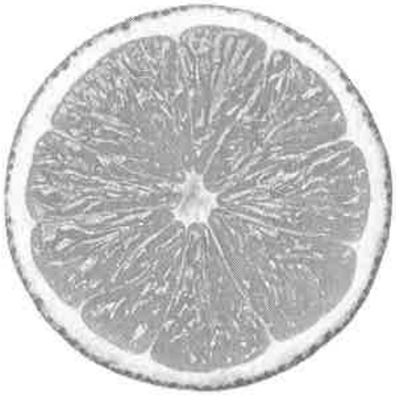

Fig. 2.1

You are provided with a whole lime fruit. Use the knife provided to cut the lime fruit approximately in half so that the cut section appears as in Fig. 2.1. **Take care when using the knife.**

(a) **(i)** Make a large drawing of the cut section of your lime fruit, including seeds, if any, in the space below.

Size and accuracy [1]
Clear, continuous lines [1]
double skin layer [1]
clear triangular shaped segments [1]

[4]

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(ii) Measure the maximum diameter of the cut section of your lime fruit and record your measurement.

....

Measure the maximum diameter of your drawing of the cut section of the lime fruit and record your measurement.

Must be shown on drawing.

.... [2]

(iii) Use the measurements in **(ii)** to calculate the magnification of your drawing to 2 significant figures.

working [1]

2 sig fig [1]

$\frac{\text{Drawing}}{\text{actual}}$

magnification = × .... [2]

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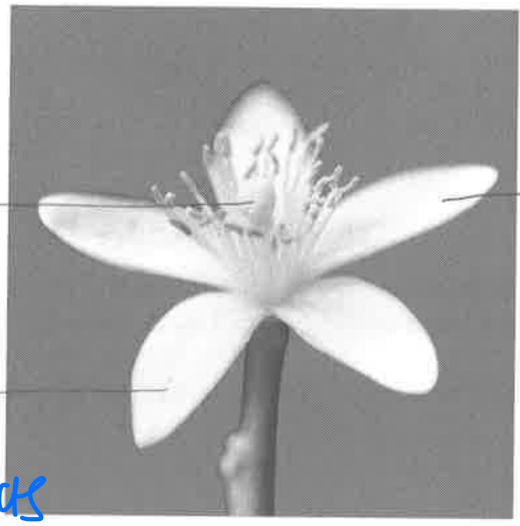
(b) Fig. 2.2 shows a photograph of a flower of the lime tree, *Citrus*, which is insect-pollinated.



stigma shorter than anther

nectar guides
to guide insects to nectar

large petals
large petals to allow insects to land on

need to annotate reasons

Fig. 2.2

(i) Draw label lines to the flower in Fig. 2.2 and annotate your labels to identify adaptations for insect-pollination. [3]

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Fig. 2.3 shows a photograph of two grass flowers of *Bromus*, which is wind-pollinated.

Fig. 2.3

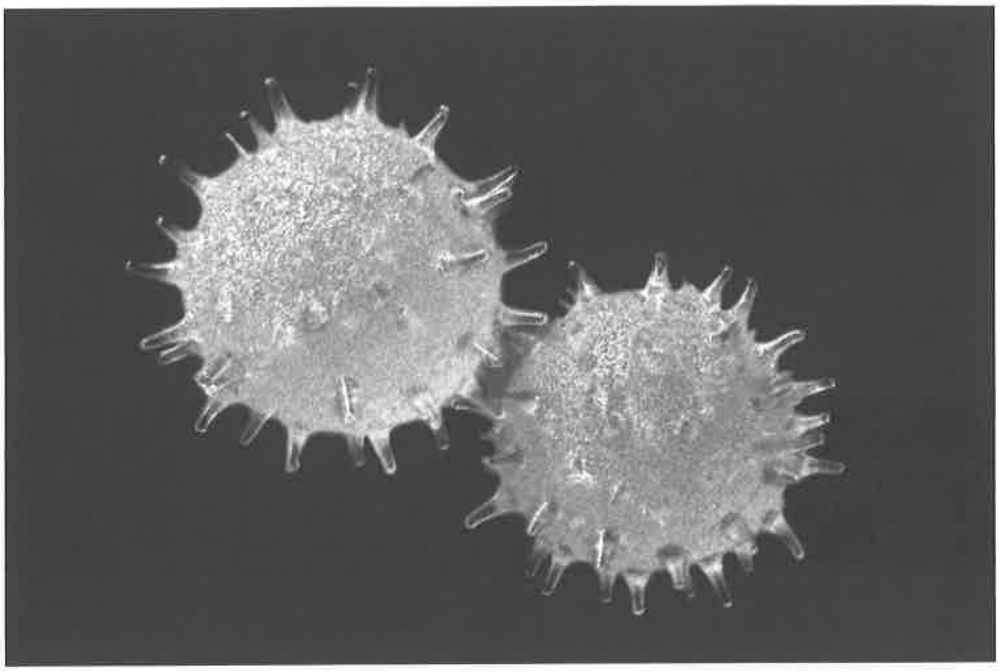
(ii) Draw a table to show three **visible** differences between the structures of the flowers of *Citrus* and *Bromus*.

Citrus

Structure	Citrus	Bromus
pendulous stamen	non-pendulous	pendulous
stigma	large, round stigma	hairy/feathery stigma
petals	large petals	absent of petals

[3]

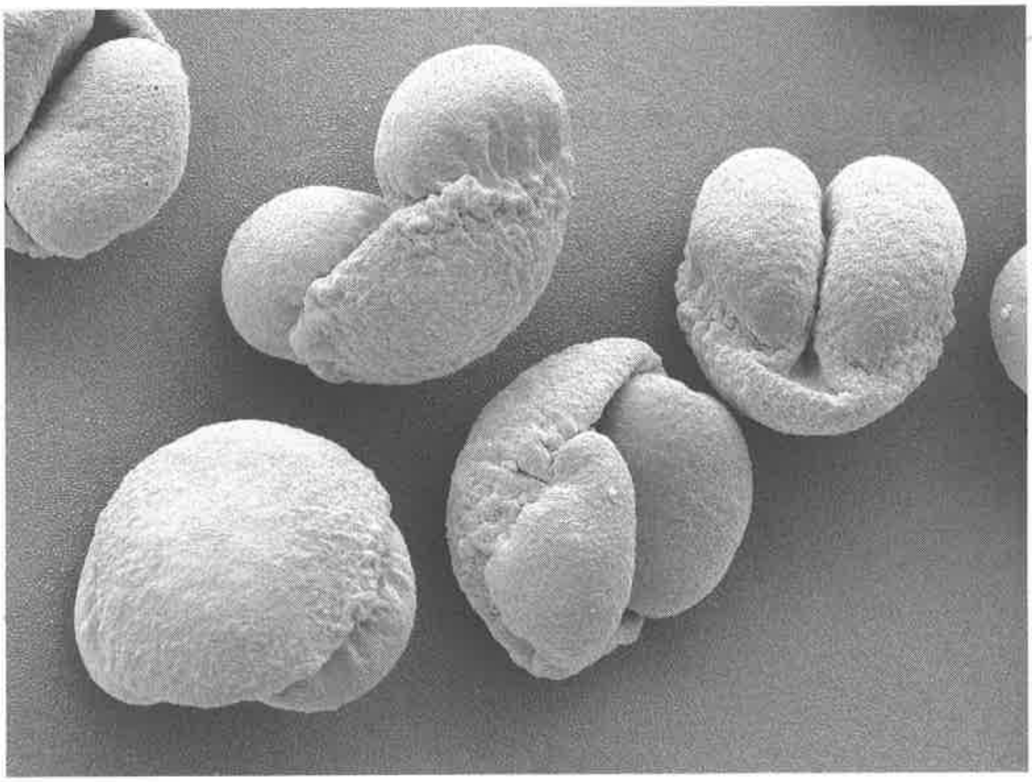
(c) Fig. 2.4 is a photomicrograph of two pollen grains of *Hibiscus*.



0.11 mm

Fig. 2.4

Fig. 2.5 is an electronmicrograph of some pollen grains of *Pinus.*



0.07 mm

Fig. 2.5

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Explain how the pollen grains in Fig. 2.4 and Fig. 2.5 are adapted for pollination.

Hibiscus pollen grains large and ~~have hooks~~ (1) are rough to cling onto ~~Infect pollinated able to~~ the body of insects. (1)

(1) Pinus pollen grains are smaller than hibiscus hence they will be easier to be blown away by wind.

[3]

[Total: 17]

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