

Please write clearly in block capitals.

Centre number

Candidate number

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

INTERNATIONAL A-LEVEL BIOLOGY (9610)

Unit 5 Synoptic paper

Thursday 20 January 2022 07:00 GMT Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:

- a pencil
- a ruler with millimetre measurements
- a scientific calculator, which you are expected to use where appropriate.

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- All working must be shown.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 75.
- In Question 6, 2 marks will be awarded for the quality of your written communication. You will be marked on your ability to:
 - use good English
 - organise information clearly
 - use specialist vocabulary where appropriate.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
TOTAL	



Answer **all** questions in the spaces provided.

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0 1

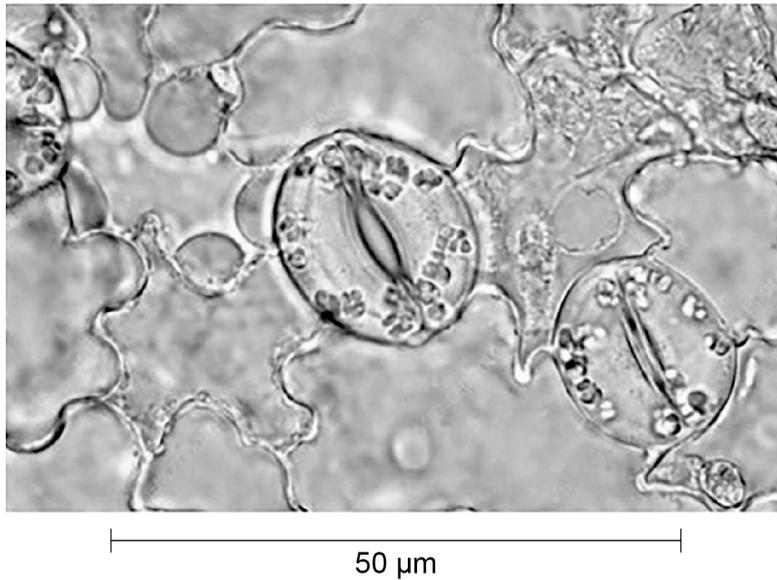
The surface of a plant leaf has many microscopic pores called stomata.

The functions of stomata are:

- to allow gas exchange
- to control the loss of water vapour.

Figure 1 shows part of a leaf surface as seen using a light microscope.

Figure 1



0 1 . 1

Make a large, clear drawing of the two guard cells that surround one stoma in **Figure 1**.

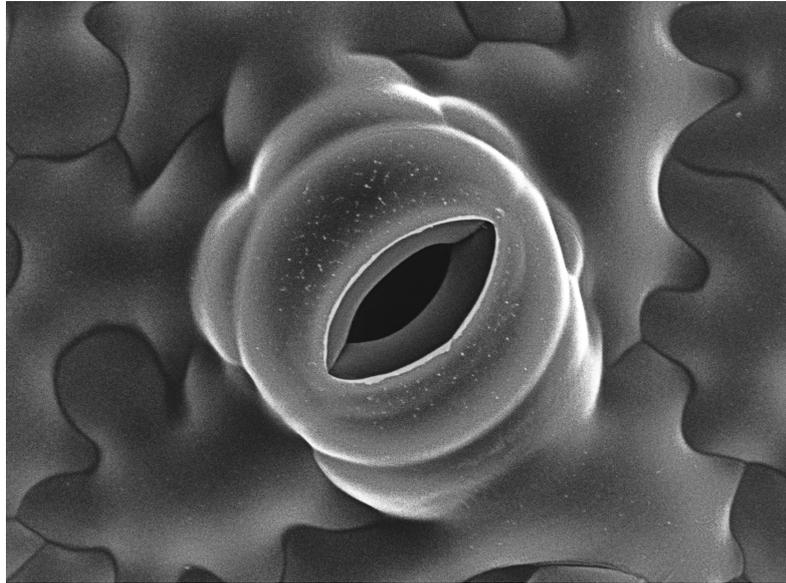
Include the connections to the leaf cells that are in contact with the guard cells.

[3 marks]



Figure 2 shows part of the same leaf surface as seen using a different type of microscope.

Figure 2



0 1 . 2 Name the type of microscope used for producing **Figure 2**.

[1 mark]

0 1 . 3 Calculate the magnification of **Figure 2**.

Use information from the scale bar in **Figure 1** and from the lengths of the guard cells in **Figure 1** and **Figure 2**.

[3 marks]

Magnification of **Figure 2** = _____

Question 1 continues on the next page

Turn over ►



Stomata open and close at different times of the day.

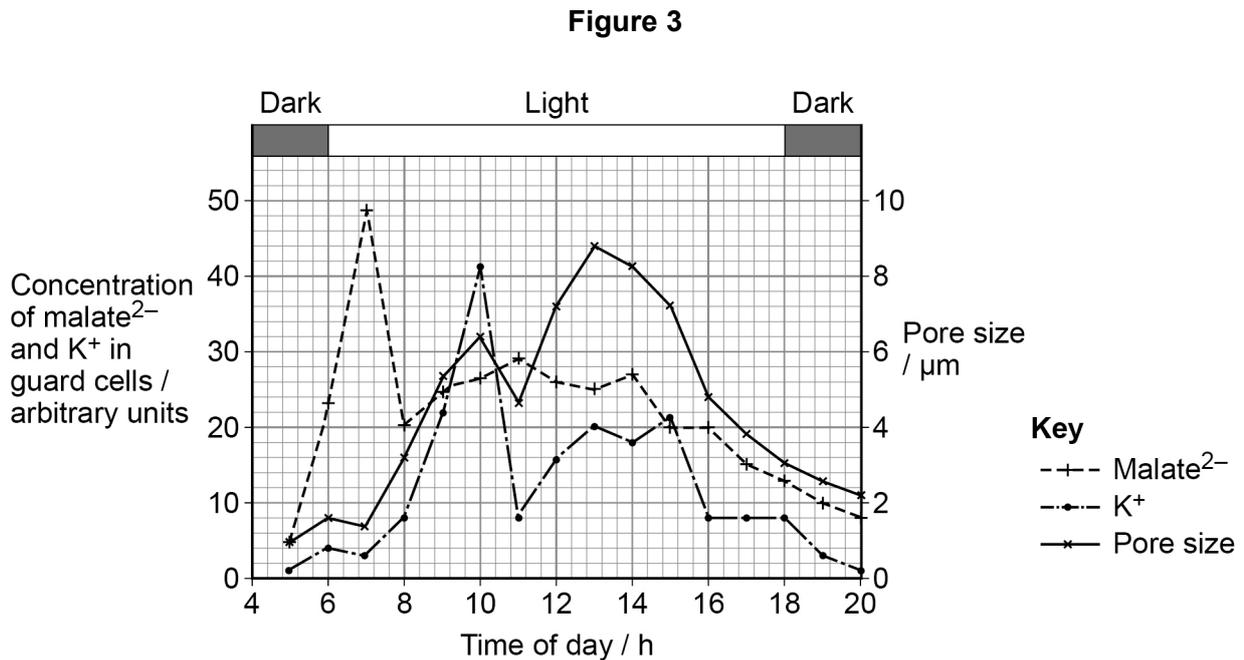
Scientists investigate the mechanism of stomatal opening.

The scientists measure:

- the concentration of malate ions (malate^{2-}) in the guard cells
- the concentration of potassium ions (K^+) in the guard cells
- the size of the stomatal pore.

The measurements are taken every hour for 15 hours.

Figure 3 shows the results.



0 1 . 4

The scientists conclude that the stomata open in the light because of increased concentrations of malate²⁻ ions and K⁺ ions in the guard cells.

Give evidence for the scientists' conclusion from **Figure 3**.

[2 marks]



0 1 . 5

Explain how changes in the concentrations of malate²⁻ ions and K⁺ ions in the guard cells would cause the stomata to open as shown in **Figure 3**.

[3 marks]

Question 1 continues on the next page

Turn over ►

The scientists measure the pH and the concentration of K^+ ions in the apoplast around the guard cells in the dark and in the light.

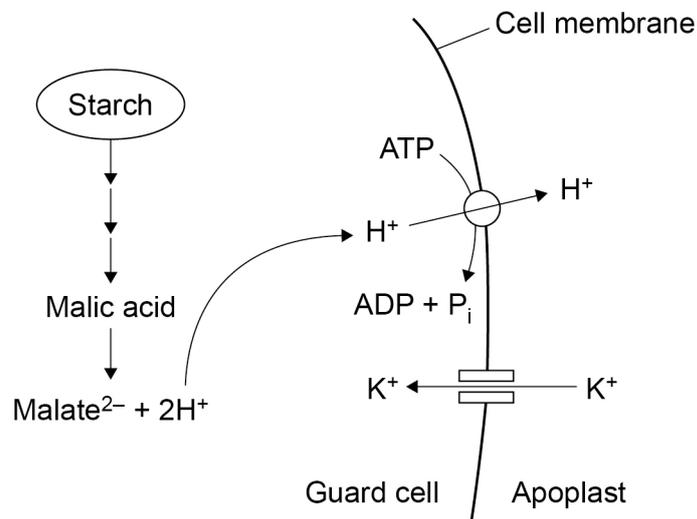
Table 1 shows the results.

Table 1

Conditions in apoplast	Dark	Light
pH	5.5	5.1
Concentration of K^+ ions / mmol dm^{-3}	10	3

The scientists suggest the model shown in **Figure 4** for the opening of stomata in the light.

Figure 4



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0 1 . 6

Explain how the data in **Figure 3** and **Table 1** support the scientists' model for the opening of stomata shown in **Figure 4**.

[3 marks]

0 1 . 7

In a drought, there is not much water available to a plant. The plant's roots increase the production of abscisic acid (ABA).

Explain how the increased production of ABA by the plant's roots helps the plant to survive.

[3 marks]

18

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0 2

Students investigate the effect of temperature on the rate of anaerobic respiration in yeast.

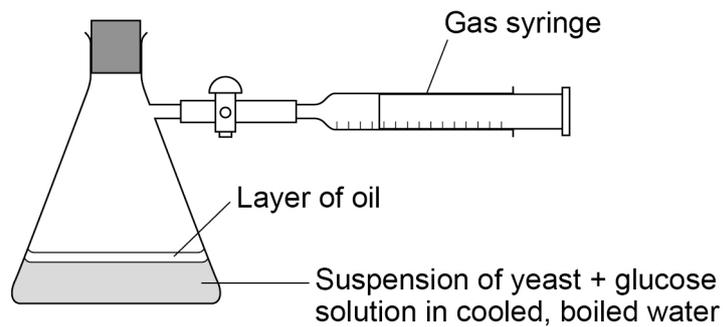
The students boil some water for 5 minutes and allow it to cool.

The students then use the cooled, boiled water to prepare:

- a suspension of yeast cells
- a solution of glucose.

Figure 5 shows the apparatus the students use.

Figure 5



0 2 . 1

Explain why it is important that the students first boil the water **and** then cover the surface of the liquid in the flask with a layer of oil.

[2 marks]

Table 2 shows the students' results.

Table 2

Temperature / °C	Volume of carbon dioxide released in 30 min / cm ³
10	6
20	12
30	20
40	13
50	7
60	2



0 2 . 3

The students draw a graph of the results shown in **Table 2** (on page 8).

State the type of graph the students should draw.

Give the reason for your answer.

[2 marks]

Type of graph _____

Reason _____

0 2 . 4

The students estimate that the optimum temperature for anaerobic respiration in yeast is 30 °C.

Describe how you would obtain a more accurate value for the optimum temperature.

[2 marks]

0 2 . 5

In this investigation, the yeast respire anaerobically.

Explain why the volume of gas in the gas syringe changes during anaerobic respiration but would **not** change during aerobic respiration.

[2 marks]



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0 3

Figure 6 is a map of the Channel Islands near the coast of California, USA.

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Figure 6



The Island Fox, *Urocyon littoralis*, lives on these islands. The Island Fox is very similar to the Gray Fox, *Urocyon cinereoargenteus*. The Gray Fox lives in mainland California.

Figure 7 shows the Island Fox and the Gray Fox.

Figure 7

Island Fox (*Urocyon littoralis*)



Gray Fox (*Urocyon cinereoargenteus*)



0 3 . 2

The Island Foxes on each island are slightly different from each other.

Scientists believe the foxes on the different islands are **not** separate species but are varieties of the same species.

Suggest how the scientists could confirm that the foxes on the different islands belong to the same species.

[2 marks]

0 3 . 3

Suggest **one** reason why the different varieties of Island Fox have **not** developed into different species.

[1 mark]

9



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0 4

Acquired Immune Deficiency Syndrome (AIDS) is caused by the Human Immunodeficiency Virus (HIV).

0 4 . 1

Describe the structure of HIV.

[3 marks]

Doctors can treat patients infected with HIV by using drugs.

Two types of anti-HIV drugs are:

- reverse transcriptase inhibitors
- protease inhibitors.

0 4 . 2

Explain how each drug can interrupt HIV replication.

[3 marks]

Reverse transcriptase inhibitor _____

Protease inhibitor _____



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0 4 . 3

HIV frequently mutates.

If a person infected with HIV is treated with only one type of drug, a random mutation may make the virus resistant to that drug.

Explain why treatment with two types of drug at the same time is more effective than treatment with one drug.

[3 marks]

9

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0 5

Fur colour in mice is controlled by one pair of alleles. One allele is dominant and the other allele is recessive.

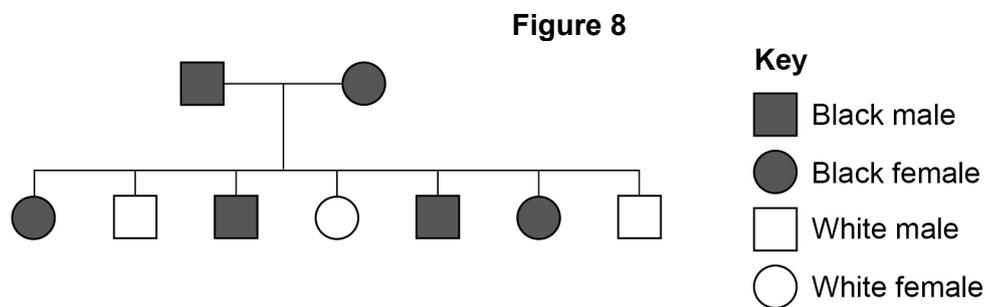
0 5 . 1

Define **dominant allele**.

[1 mark]

A black male mouse mates with a black female mouse.

Figure 8 shows the results.



0 5 . 2

Draw a genetic diagram to explain how the cross shown in **Figure 8** resulted in some black offspring and some white offspring.

[2 marks]

Use the following symbols:

A = the dominant allele

a = the recessive allele



A student uses a statistical test to see if the results in **Figure 8** are significantly different from the theoretical results.

0 5 . 3 Name a statistical test the student could use.

[1 mark]

0 5 . 4 The statistical test gives a probability, $P = 0.25$

Explain what this probability value shows about the results in **Figure 8**.

Use the words **chance** and **significant** in your answer.

[2 marks]

6

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2 8



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