OXFORD
INTERNATIONAL
AQA EXAMINATIONS

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

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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	

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

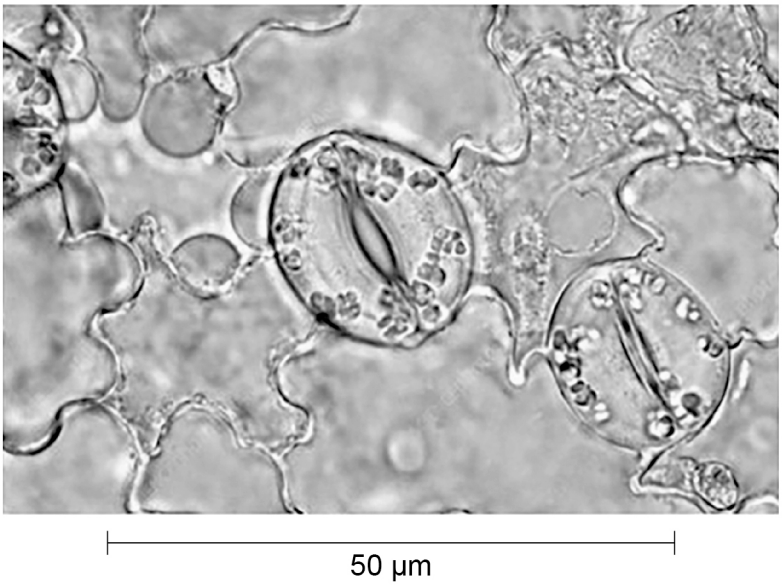
0 1 The surface of a plant leaf has many microscopic pores called stomata.

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]

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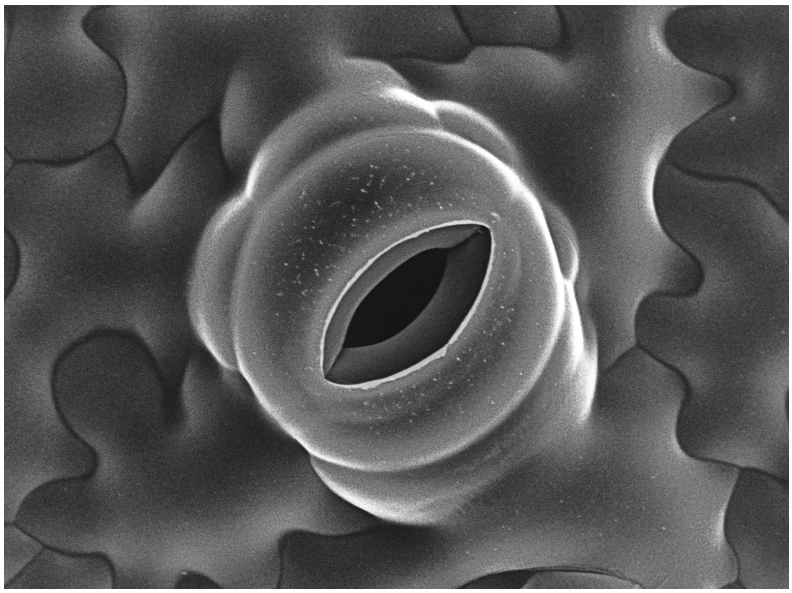
Figure 2 shows part of the same leaf surface as seen using a different type of microscope.

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

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Stomata open and close at different times of the day.

Scientists investigate the mechanism of stomatal opening.

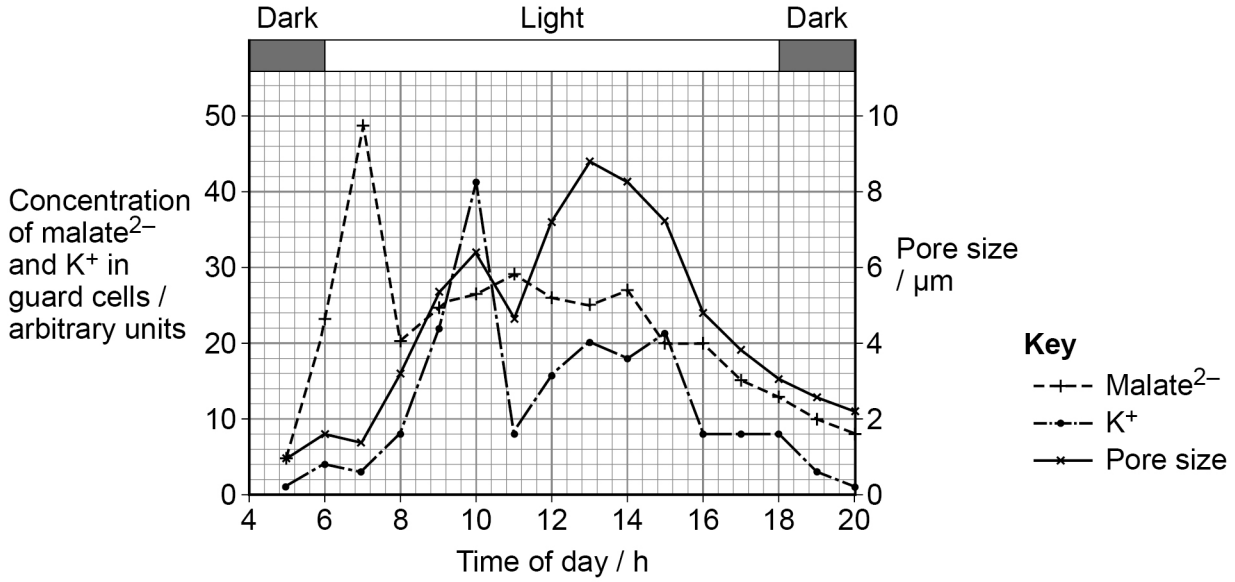
The scientists measure:

- 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.

Figure 3



0 1 . 4 The scientists conclude that the stomata open in the light because of increased concentrations of $malate^{2-}$ ions and K^+ ions in the guard cells.

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

[2 marks]

Do not write outside the box

0 1 . 5 Explain how changes in the concentrations of malate^{2-} 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

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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.

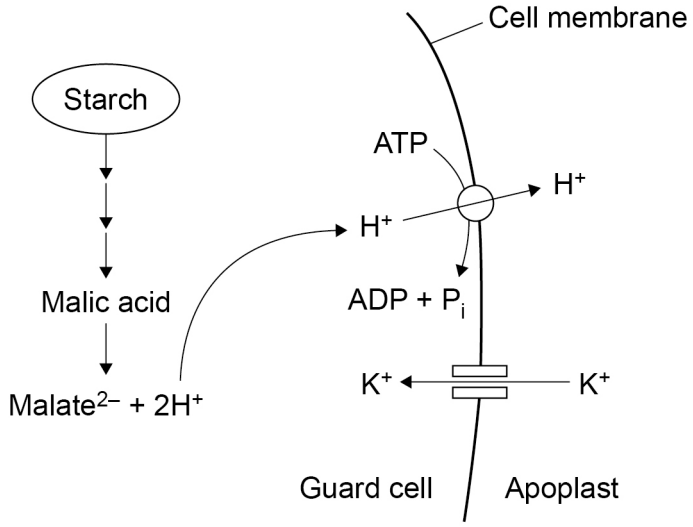
Table 1 shows the results.

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.

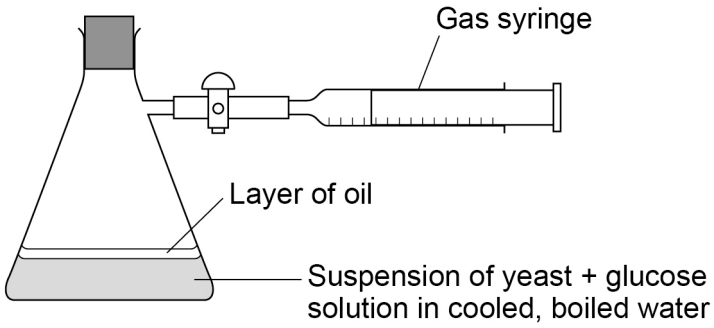
The students boil some water for 5 minutes and allow it to cool.

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

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0 2 . 2 Describe how the students should use the apparatus shown in **Figure 5**.

Include how the students could make sure that the results of the investigation are valid.

[5 marks]

Question 2 continues on the next page

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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 respires 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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13

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0 3 **Figure 6** is a map of the Channel Islands near the coast of California, USA.

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*)

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About 16 000 years ago, the sea level was much lower and some of the ancestors of the modern foxes migrated to what are now the Channel Islands.

0 3 . 1 Explain how the Island Fox and the Gray Fox could have evolved into different species from a common ancestor.

[6 marks]

Question 3 continues on the next page

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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

Turn over for the next question

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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.

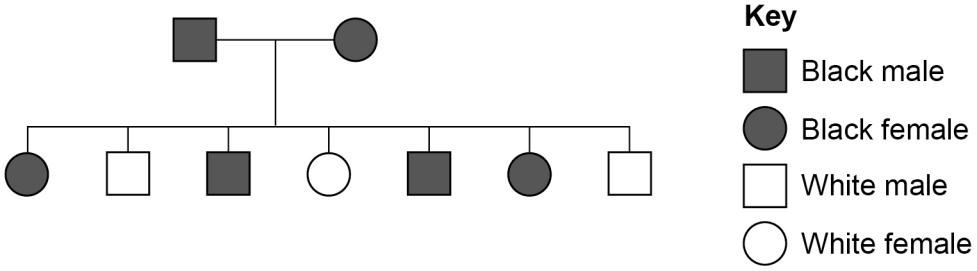
0 5 . 1 Define **dominant allele**.

[1 mark]

A black male mouse mates with a black female mouse.

Figure 8 shows the results.

Figure 8



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

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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]

_____

_____

_____

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6

Turn over for the next question

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You are reminded that **2** marks will be awarded for the quality of your written communication in **Question 6**.

0 6 Recombinant DNA technology involves the transfer of DNA from one organism to another organism.

0 6 . 1 Bacteria can be genetically modified and used for making useful products such as insulin.

Describe how the gene for human insulin can be transferred into bacteria so that the bacteria can produce large amounts of human insulin.

[7 marks]

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0 6 . 2 Before the technique of genetic modification was developed, insulin was extracted from the pancreases of animals, including pigs and cattle, that had been killed to provide meat.

Explain the benefits of producing insulin using genetically modified bacteria instead of extracting insulin from animals.

[5 marks]

Question 6 continues on the next page

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0 6 . 3 Sometimes only a small sample of a particular type of DNA is available – such as the DNA in blood cells at the scene of a crime.

Scientists can use the polymerase chain reaction (PCR) to produce many copies of a small sample of DNA.

Explain the principles involved in each stage of the PCR process.

[6 marks]

20

Quality of written communication [2 marks]

END OF QUESTIONS

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