

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

INTERNATIONAL A-LEVEL BIOLOGY (9610)

Unit 5 Synoptic paper

Thursday 19 January 2023 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.

0 1

A plant leaf is an organ containing several types of tissue.

Figure 1 shows a transverse section (TS) of a leaf from a dicotyledonous plant as seen using the low power objective lens of a light microscope.

The scale bar represents a length of 100 μm

Figure 1



0 1

1

Draw a tissue map of the TS of the leaf shown in **Figure 1**.

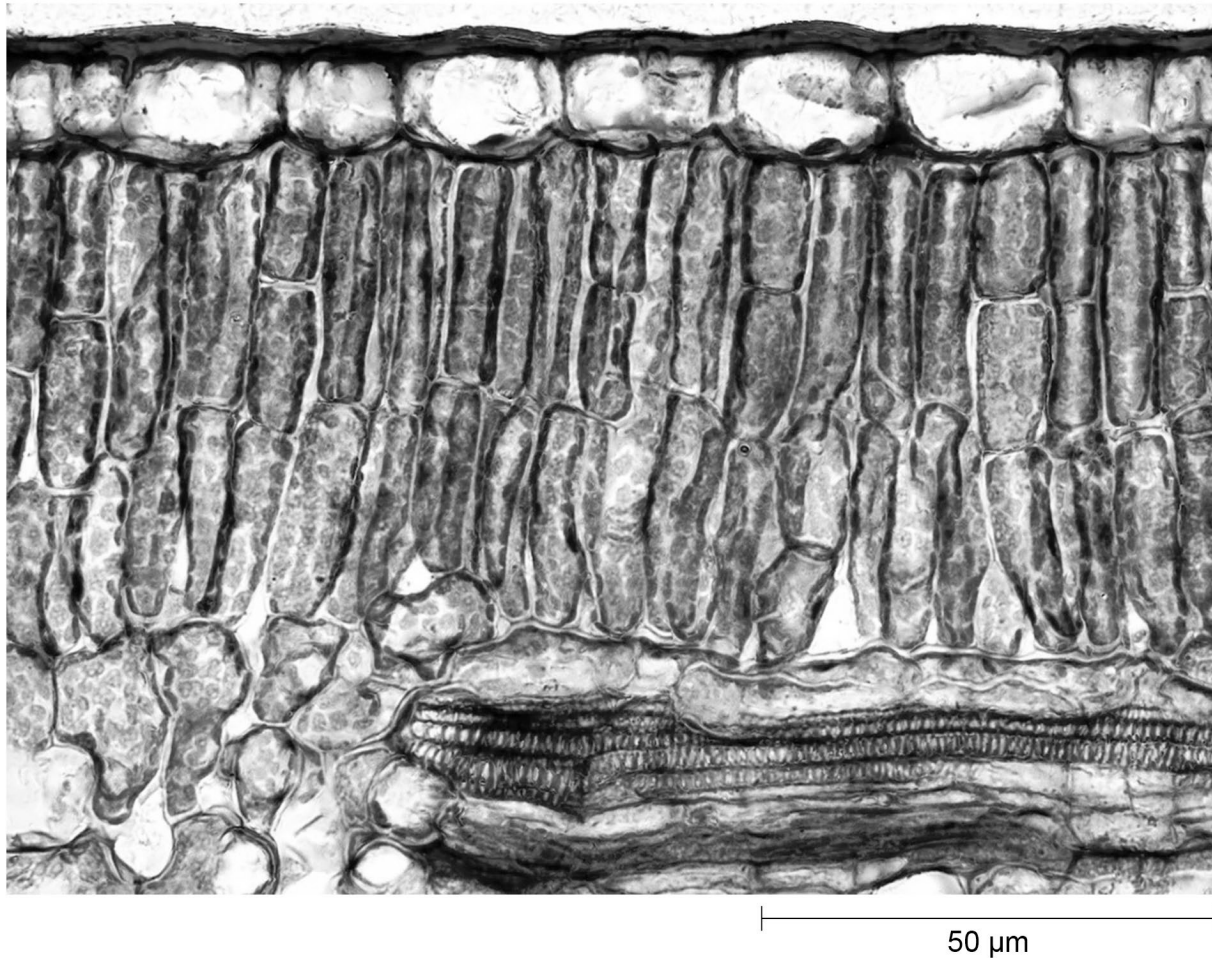
[3 marks]



Figure 2 shows part of the same leaf seen using the high power objective lens of the same microscope.

The scale bar represents a length of 50 μm

Figure 2



0 1 . 2 The magnifying power of the **high power** objective lens is $\times 40$

Using the scale bars in **Figure 1** and **Figure 2**, calculate the magnifying power of the **low power** objective lens.

Give your answer to the nearest whole number.

[3 marks]

Magnifying power of the low power objective lens = _____

Turn over ►



0	1	.	3
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Explain how features you can see in **Figures 1** (on page 2) and **2** (on page 3) help a leaf:

- [6 marks]**

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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED**

Turn over ►

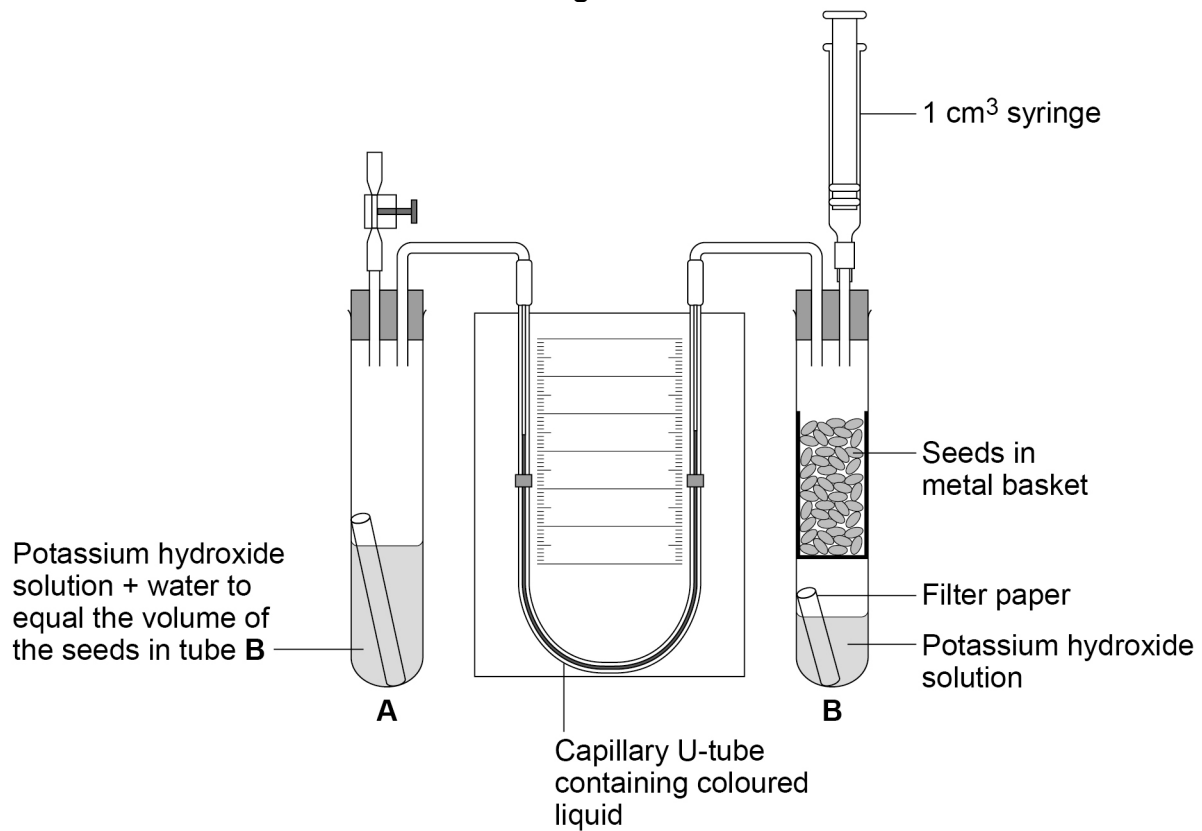


0 2

A student measures the rate of aerobic respiration in germinating barley seeds.

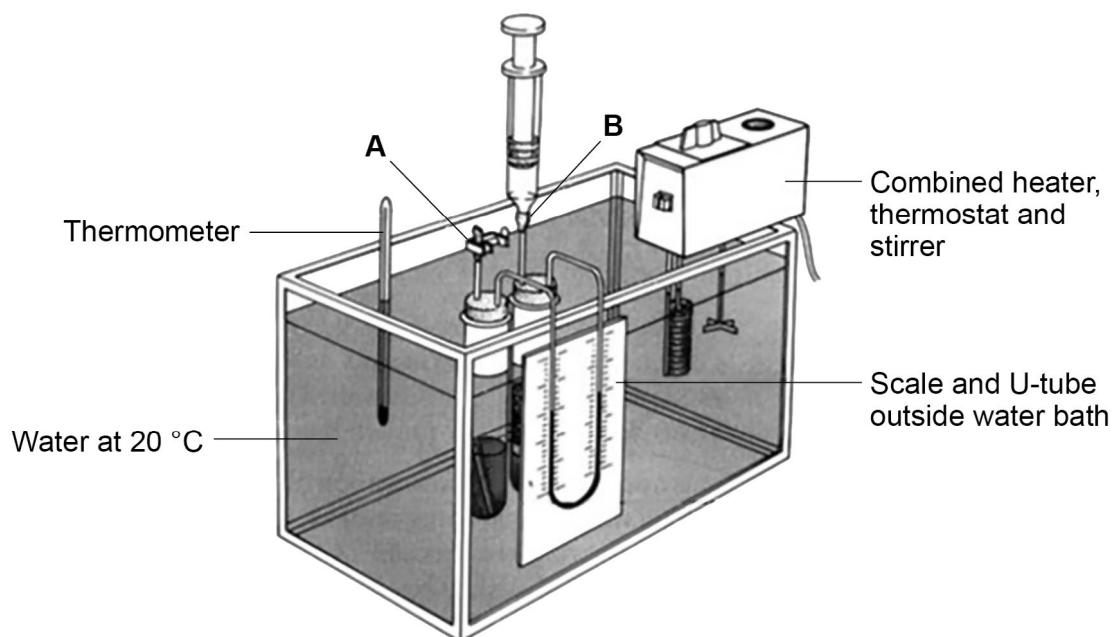
Figure 3 shows the apparatus the student uses.

Figure 3



The student places the apparatus into a thermostatically-controlled water bath, as shown in **Figure 4**.

Figure 4



0 2 . 1

Give **two** reasons why the student puts many seeds into tube **B** and not just one seed.

[2 marks]

1

2

0 2 . 2

Tubes **A** and **B** are kept in the water bath at a constant temperature of 20 °C

Give **two** reasons why a constant temperature is necessary.

[2 marks]

1

2

The apparatus measures the volume of oxygen taken in by the seeds.

As the seeds take in oxygen, the pressure inside tube **B** is reduced. This causes the liquid in the U-tube to move upwards on the right-hand side and downwards on the left-hand side.

The students can use the syringe to push air into tube **B** and return the liquid in the U-tube to the starting level shown in **Figure 3**.

0 2 . 3

The potassium hydroxide solution absorbs carbon dioxide from the air in tubes **A** and **B**.

Explain why removal of carbon dioxide is necessary.

[2 marks]

Turn over ►



0 2 . 4

Explain how tube **A** in **Figure 3** (on page 6) cancels out the effect of any external changes in temperature and pressure that might occur during the investigation.

[2 marks]

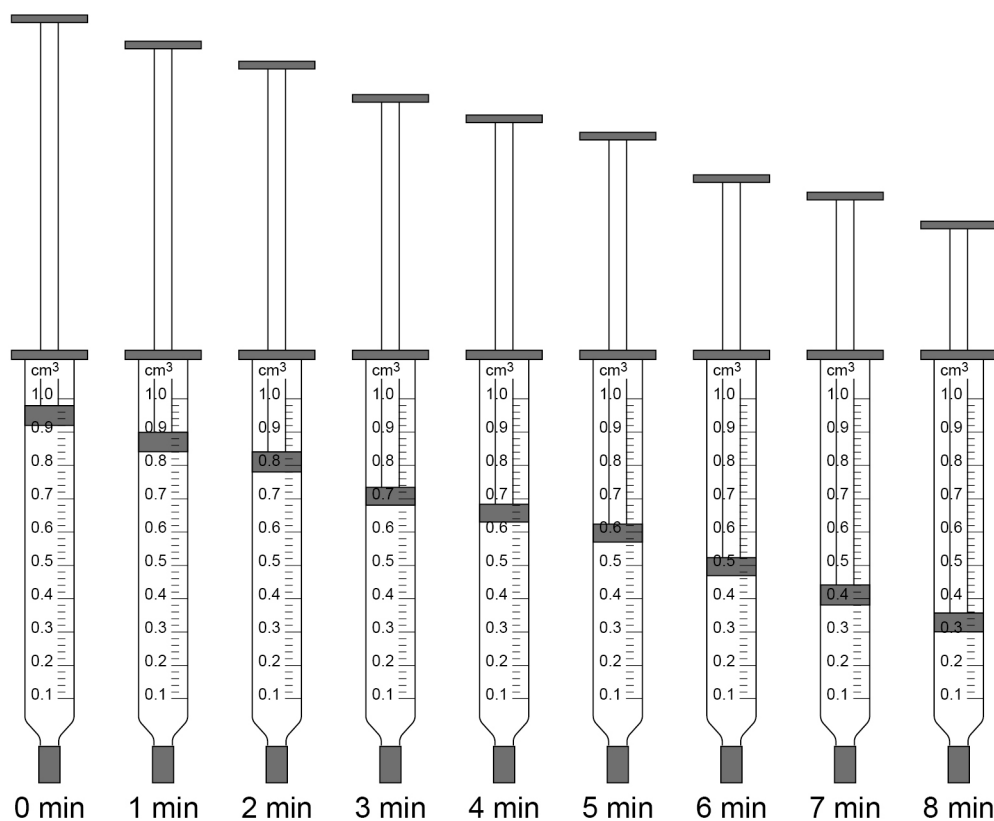
The student takes measurements of oxygen consumption by the barley seeds.

The student:

1. adjusts the syringe so that the level of the fluid on each side of the U-tube is the same
2. records the volume measurement on the syringe scale
3. repeats steps 1 and 2 at 1-minute intervals for 8 minutes.

Figure 5 shows the results.

Figure 5



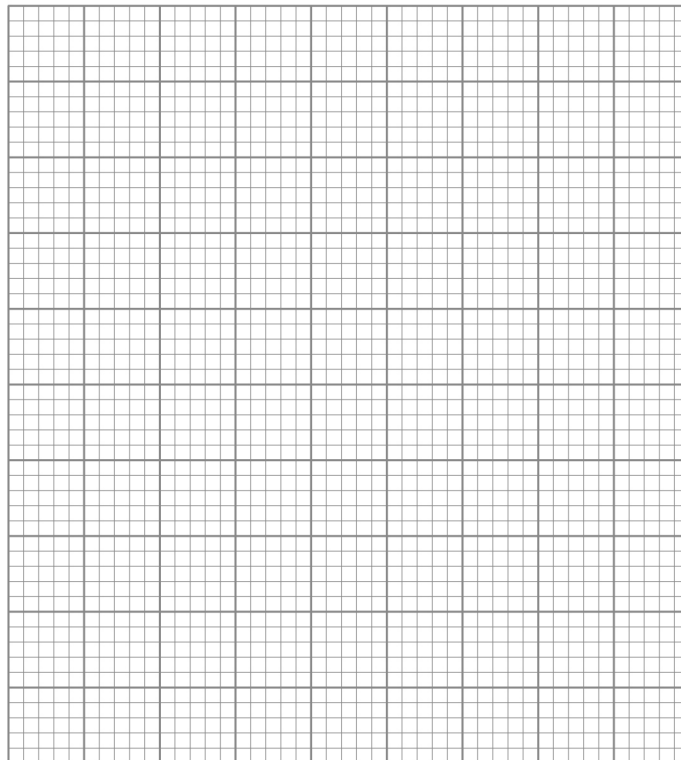
0 2 . 5 Record the student's results in a suitable table.

[2 marks]

0 2 . 6 Draw a graph of the results from your table in Question **02.5**.

Draw a line of best fit on your graph.

[4 marks]



Turn over ►



0 2 . 7

The student used 8.2 grams of seeds to obtain the results in **Figure 5** (on page 8).

Use your graph in Question **02.6** to calculate the rate of respiration of the seeds.

Give your answer in mm³ oxygen consumed per gram of seeds per hour, to 3 significant figures.

[3 marks]

Rate of respiration = _____ mm³ oxygen g⁻¹ h⁻¹

0 2 . 8

The student repeats the investigation at 25 °C instead of 20 °C

Predict how the graph would be different at 25 °C

[1 mark]



The student wants to calculate the respiratory quotient (RQ) of the germinating barley seeds.

- uses the same apparatus as in the previous investigation
- replaces the potassium hydroxide solution in tubes **A** and **B** with water.

[4 marks]

[illegible]

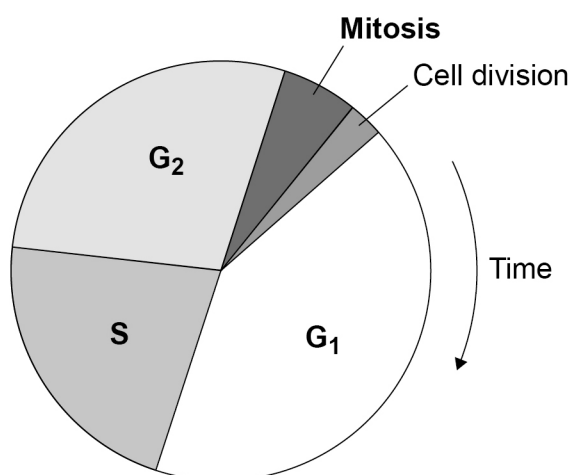
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0 3

Eukaryotic cells that can divide have a cell cycle.

Figure 6 shows the cell cycle.

Figure 6



0 3 . 1

Name the process that occurs in the **S**-phase and give the reason why this process is important in the cell cycle.

[2 marks]

Process _____

Reason _____

0 3 . 2

In which phase does the cell **not** contain pairs of chromatids joined by centromeres?

[1 mark]

Tick (✓) **one** box.

G₁

☐

G₂

☐

Mitosis

☐

S

☐


0	3	.	3
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A typical body cell in a mouse takes about 24 hours to complete the cell cycle.

In cells lining the ileum of the mouse, the cell cycle takes only 1 hour.

Suggest why cells lining the ileum need to divide at a rapid rate.

[1 mark]

4

Turn over for the next question

Turn over ►



0 4

Exenatide is a drug for the treatment of Type 2 diabetes. The drug is injected under the skin twice each day.

Doctors carry out a trial of exenatide on 1446 patients with Type 2 diabetes:

- 480 patients receive doses of 5 μg exenatide
- 483 patients receive doses of 10 μg exenatide
- 483 patients receive a placebo.

The trial lasts for 30 weeks.

The trial is double-blind and placebo-controlled. Double-blind means that neither the doctors nor the patients know who is given the drug, or which dose, and who is given the placebo. The placebo is an injection of the same volume of solution as the drug but the solution does **not** contain the drug.

0 4 . 1

Explain why a double-blind trial is used for testing the effectiveness of the drug.

[2 marks]

0 4 . 2

Suggest **one** ethical implication of this type of study.

[1 mark]

The doctors measure the concentration of a substance called HbA1c as an indicator of the concentration of glucose in each person's blood.

Some of the glucose in the blood combines with haemoglobin in the red blood cells to form the compound HbA1c.

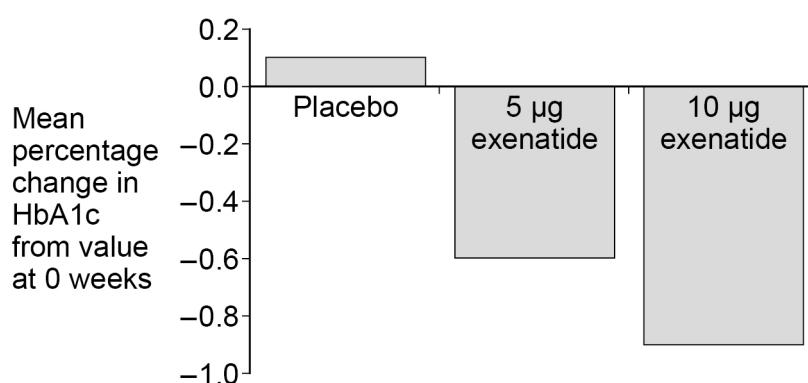
HbA1c is stable, so the percentage of HbA1c in a blood sample is a measure of the glucose concentration during the previous few weeks.

The doctors take blood samples from each patient at intervals during the 30 weeks of the trial.



Figure 7 shows the results at the end of the 30 weeks.

Figure 7



0 4 . 3

The doctors state that the mean result for each concentration of exenatide has a probability, $P < 0.05$

Suggest how the doctors could determine that $P < 0.05$

[2 marks]

0 4 . 4

Explain why the doctors prefer to measure HbA1c concentration rather than the concentration of glucose dissolved in the blood plasma.

[2 marks]



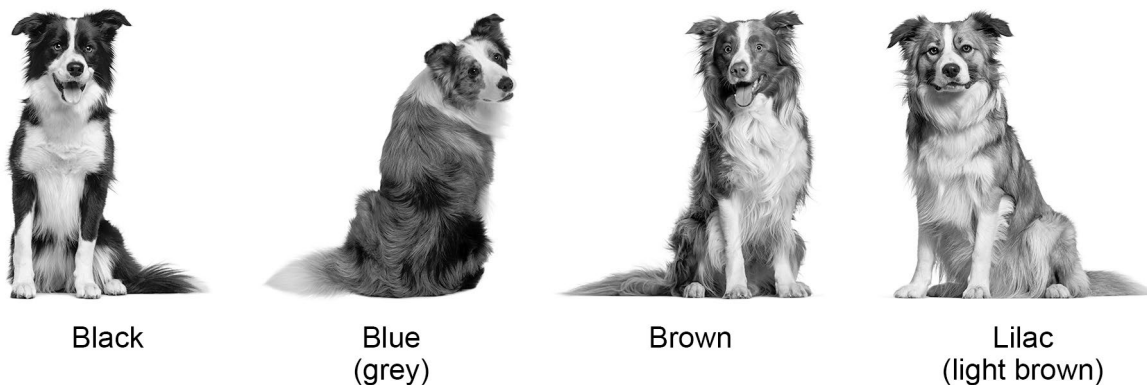
0 5

The border collie is a breed of dog. Farmers use border collies for herding sheep.

Most border collies have black and white fur.

Figure 8 shows four varieties of border collie, with different coloured fur.

Figure 8



The colour of the fur is determined by two pairs of alleles:

B = allele for black fur
b = allele for brown fur

N = allele for normal, full colour of the fur
n = allele for a lighter colour of fur

A dog breeder crossed a male with black fur and a female with brown fur.
The breeder repeated the cross 4 times in 5 years using the same 2 parent dogs.

Table 1 shows the results.

Table 1

Cross number	Number of offspring in each cross			
	Black	Blue	Brown	Lilac
1	2	2	3	–
2	3	–	1	1
3	2	1	2	1
4	3	1	2	–
Total	10	4	8	2

The total number of offspring in **Table 1** is 24

The breeder expected a ratio of black:blue:brown:lilac = 3:1:3:1



0 5 . 1

Complete **Table 2** to show the total number of dogs of each colour the breeder had expected in the 24 offspring.

[1 mark]

Table 2

Expected total number of dogs of each colour			
Black	Blue	Brown	Lilac

0 5 . 2

Complete the genetic diagram to explain why the breeder had expected the 3:1:3:1 ratio.

[4 marks]

Parental phenotypes: Black male Brown female

Parental genotypes: _____ _____

Male gametes				
Female gametes				

Phenotype	Genotypes of offspring
Black	
Blue	
Brown	
Lilac	

Question 5 continues on the next page

Turn over ►



[illegible]

10



0	6
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0	6	.	1
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Use examples of different homeostatic mechanisms in your answer.

[6 marks]

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The enzyme catalase breaks down hydrogen peroxide into oxygen and water:



[7 marks]

[illegible]

Other enzymes are involved in the breakdown of food molecules in the digestive system.

Describe how carbohydrates are broken down by enzymes in the human digestive system.

[5 marks]

[illegible]

Quality of written communication [2 marks]

END OF QUESTIONS

20



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