Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE
COMBINED SCIENCE: TRILOGY

H

Higher Tier
Biology Paper 2H

Friday 7 June 2024 Afternoon Time allowed: 1 hour 15 minutes

Materials

For this paper you must have:
- a ruler
- a scientific calculator.

Instructions
- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- 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).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

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

Information
- The maximum mark for this paper is 70.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

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ANSWER IN THE SPACES PROVIDED

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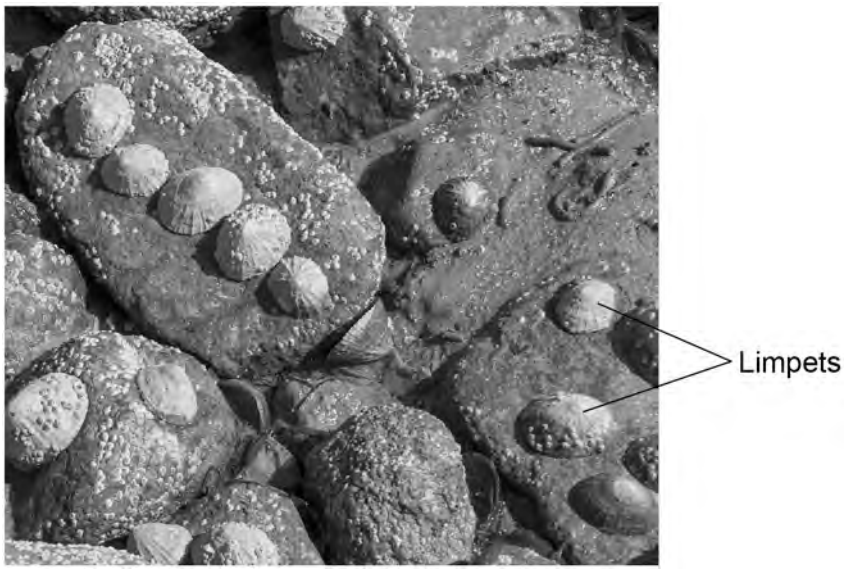
0 1 Limpets are small animals with shells.

Limpets attach to rocks on sea shores.

Figure 1 shows limpets on rocks.

Figure 1



0 1 . 1 Limpets eat algae.

Limpets are prey for crabs.

Give the food chain for algae, crabs and limpets.

[1 mark]

Question 1 continues on the next page

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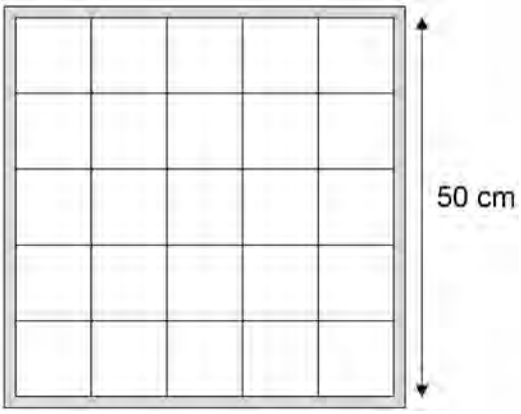
Students estimated the population of limpets on a sea shore.

The students were given a square quadrat.

Figure 2 shows the quadrat.

Figure 2



0 1 . 2 Calculate the area of the quadrat in m^2.

[2 marks]

Area of quadrat = _____ m^2

Do not write outside the box

0 1 . 3 The total area of the sea shore was 1800 m^2.

The students sampled 2% of the total area of the sea shore.

Calculate the number of times the students needed to use the quadrat for the 2% sample.

Use your answer from Question **01.2**

[2 marks]

Number of times = _____

0 1 . 4 Explain why throwing a quadrat is **not** a random method to estimate population size.

Do **not** refer to safety in your answer.

[2 marks]

Question 1 continues on the next page

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0 1 . 5 Describe **one** method the students could use to plan where the quadrat should be randomly placed each time.

[2 marks]

0 1 . 6 Suggest **one** hazard the students should be aware of when collecting data on the sea shore.

Do **not** refer to throwing quadrats in your answer.

[1 mark]

0 1 . 7 Populations of limpets are monitored to assess the impact of pollution in water.

Suggest **one** type of pollution in water that may affect the population of limpets.

[1 mark]

11

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0 2 Potatoes are a food crop.

0 2 . 1 Potato plants are classified as eukaryota.

What type of classification group is eukaryota?

[1 mark]

Tick (✓) **one** box.

Class ☐

Domain ☐

Kingdom ☐

Phylum ☐

0 2 . 2 Potato plants can reproduce by asexual reproduction.

Which statement is true for asexual reproduction?

[1 mark]

Tick (✓) **one** box.

Meiosis occurs. ☐

Offspring are genetically identical. ☐

Pollen and egg cells are produced. ☐

Question 2 continues on the next page

Do not write outside the box

0 2 . 3 Flowers of potato plants contain gametes for sexual reproduction.

How is a gamete different from other cells in a potato plant?

[1 mark]

Tick (✓) **one** box.

A gamete contains one-quarter of the number of chromosomes. ☐

A gamete contains half of the number of chromosomes. ☐

A gamete contains double the number of chromosomes. ☐

0 2 . 4 Plants in the same genus as potatoes have been studied by scientists.

Describe **one** way a new plant species could be identified as being in the same genus as potatoes.

[1 mark]

Do not write outside the box

0 2 . 5 Scientists have collected and stored seeds from species in the same genus as potatoes.

In the future, these seeds may be used for genetic modification of potato plants.

Genetically modified potato plants could help supply food to the human population as the climate changes.

Explain why genetic modification of crop plants may be important for the human population to survive climate change.

[6 marks]

10

Turn over for the next question

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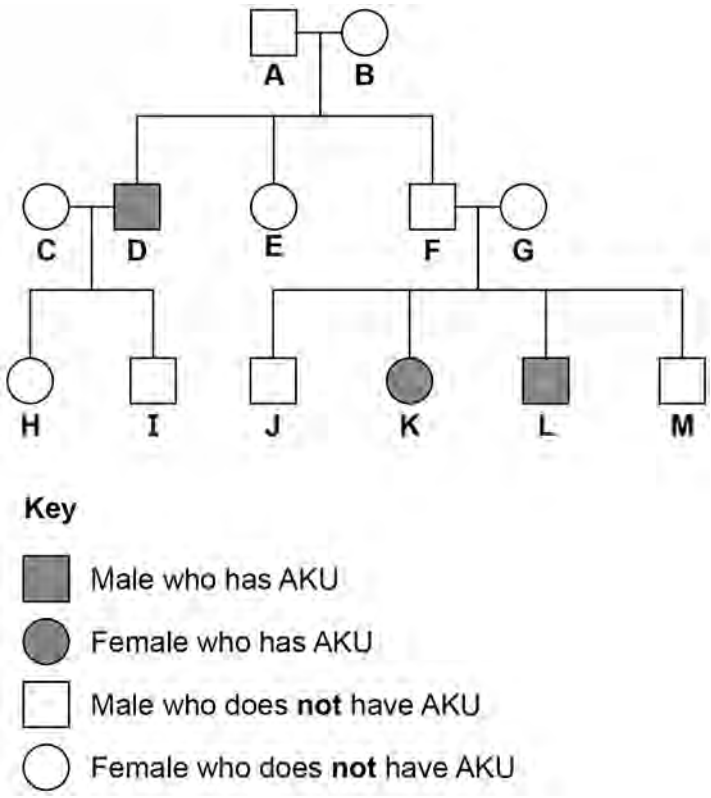
0 3 AKU is a genetic disorder.

Figure 3 shows the inheritance of AKU in one family.

Figure 3



0 3 . 1 Describe how **Figure 3** shows that the allele for AKU is recessive.

[1 mark]

0 3 . 2 Which person is **definitely** heterozygous for AKU?

[1 mark]

Tick (✓) **one** box.

C ☐ **D** ☐ **E** ☐ **G** ☐

Do not write outside the box

0 3 . 3 A female who has AKU and a male who is heterozygous for AKU plan to have a child.

Determine the probability that the child will have AKU.

You should:

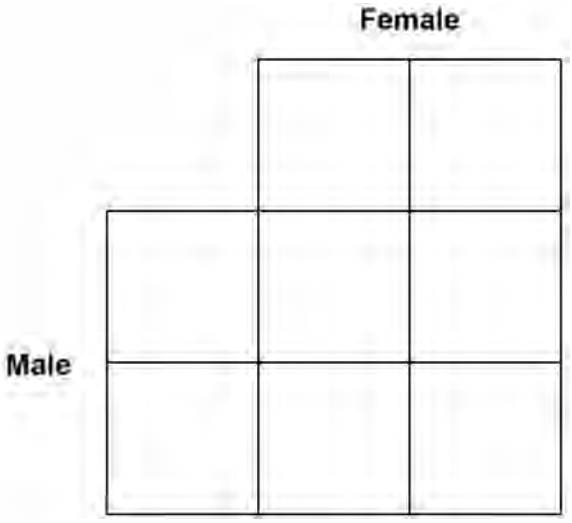
- complete **Figure 4**
- identify the phenotype of each offspring genotype
- use the symbols:

  A = dominant allele

  a = recessive allele.

[5 marks]

Figure 4



Probability that the child will have AKU = _____

Question 3 continues on the next page

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0 3 . 4 A mutation is a change in a gene.

People who have AKU have a mutation that causes the production of a non-functioning enzyme.

Enzymes are proteins.

Suggest how a mutation can result in the production of a non-functioning enzyme.

[2 marks]

0 3 . 5 Some people have In Vitro Fertilisation (IVF) treatment to increase the chance of becoming pregnant.

Describe how the process of IVF can result in pregnancy.

[4 marks]

Do not write outside the box

0 3 . 6 Embryos can be screened to detect inherited disorders.

Give **two** arguments **against** embryo screening.

Do **not** refer to religion in your answer.

[2 marks]

1 _____

_____

2 _____

_____

15

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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0 4 Rat populations can increase rapidly.

When rat populations are large there is competition between rats.

0 4 . 1 When rats compete, the basal metabolic rate of the rats increases.

Basal metabolic rate is controlled in the same way in humans and in rats.

Describe how basal metabolic rate is increased.

[2 marks]

Question 4 continues on the next page

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0 4 . 2 The size of a rat population can increase quickly.

One female rat and one male rat can produce 20 offspring every 2 months.

Warfarin is a poison that has been used to control rat populations.

Rat populations can become resistant to warfarin by the process of evolution.

A population of rats was given warfarin for 4 months.

Table 1 shows information about resistance to warfarin in the rat population for a year after warfarin was first given.

Table 1

Number of months since warfarin was first given	Was warfarin being given?	Percentage (%) of rat population resistant to warfarin
0	Yes	1
2	Yes	24
4	Yes	81
6	No	99
8	No	92
10	No	85
12	No	70

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Rats with resistance to warfarin have a smaller mean mass than rats that are **not** resistant to warfarin.

Smaller rats are often at a disadvantage when competing against larger rats.

Explain the trends in the data when warfarin was being given and when warfarin was no longer given.

Use **Table 1**.

[6 marks]

8

Turn over for the next question

Do not write outside the box

0 5 Otters are mammals that live in river ecosystems.

Figure 5 shows an otter.

Figure 5

0 5 . 1 Define the term 'ecosystem'.

[1 mark]

Do not write outside the box

0 5 . 2 Otters are an important species for the stability of the river community.

Describe **two** ways animal species may be important for the stability of a whole community.

[2 marks]

1 _____

_____

2 _____

_____

Question 5 continues on the next page

Do not write outside the box

Sewage was accidentally added to a river.

The sewage moved with the river water and affected:

- the number of bacteria in the water
- the concentration of dissolved oxygen in the water.

Samples of river water were analysed at different distances from where the sewage was added.

Table 2 shows the results.

Table 2

Distance from where sewage was added in km	**Number of bacteria × 1000/mm^3**	**Concentration of dissolved oxygen in mg/dm^3**
0.0	4	5.4
1.0	75	4.8
2.0	125	4.3
3.0	145	3.8
4.0	160	3.3
5.0	216	2.7

0 5 . 3 The number of bacteria at 5.0 km was greater than the number of bacteria where the sewage was added.

Calculate how many times greater.

[1 mark]

Number of times greater = _____

Do not write outside the box

0 5 . 4 A student concluded:

'number of bacteria ∝ concentration of dissolved oxygen'

Explain why the student's conclusion is **not** correct.

Use **Table 2**.

[2 marks]

0 5 . 5 Otters:

- live in water and on the land
- eat mainly fish.

The concentration of dissolved oxygen has decreased in a river where otters live.

Explain how the decrease in the concentration of dissolved oxygen in the river water will affect the population of otters.

[3 marks]

9

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0 6 Hormones are released from endocrine glands.

0 6 . 1 Which gland releases hormones to control other glands?

[1 mark]

Tick (✓) **one** box.

Adrenal ☐

Pituitary ☐

Thyroid ☐

Do not write outside the box

Several hormones can affect blood glucose concentration.

0 6 . 2 Adrenaline can increase blood glucose concentration.

What is **one** other effect of adrenaline?

[1 mark]

Tick (✓) **one** box.

Decreased breathing rate ☐

Decreased metabolic rate ☐

Increased blood flow to muscles ☐

Increased FSH production ☐

0 6 . 3 Cells in the pancreas detect changes in blood glucose concentration.

What type of cell in the body detects changes?

[1 mark]

_____

Question 6 continues on the next page

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Scientists investigated whether blood glucose concentration affects reaction time.

The reaction times of ten people with Type 1 diabetes were measured.

This is the method used.

1. Tell one person to drink a glucose solution.

2. Monitor the person's blood glucose concentration.

3. Record the person's reaction time when the person's blood glucose concentration is:
   - 16 mmol/dm^3
   - 6 mmol/dm^3
   - 3 mmol/dm^3

4. Repeat steps 1 to 3 for the nine other people.

0 6 . 4 People with Type 1 diabetes were selected for the investigation instead of people who did **not** have diabetes.

Explain why.

[2 marks]

Do not write outside the box

0 6 . 5 Control variables between the different people in the investigation included:

- age
- sex
- food and drink consumed before and during the test.

Suggest **two other** control variables that should be used in the investigation.

[2 marks]

1 _____

_____

2 _____

_____

0 6 . 6 It was important for the scientists to monitor the health of each person during the investigation.

Suggest **one** reason why.

[1 mark]

_____

_____

Question 6 continues on the next page

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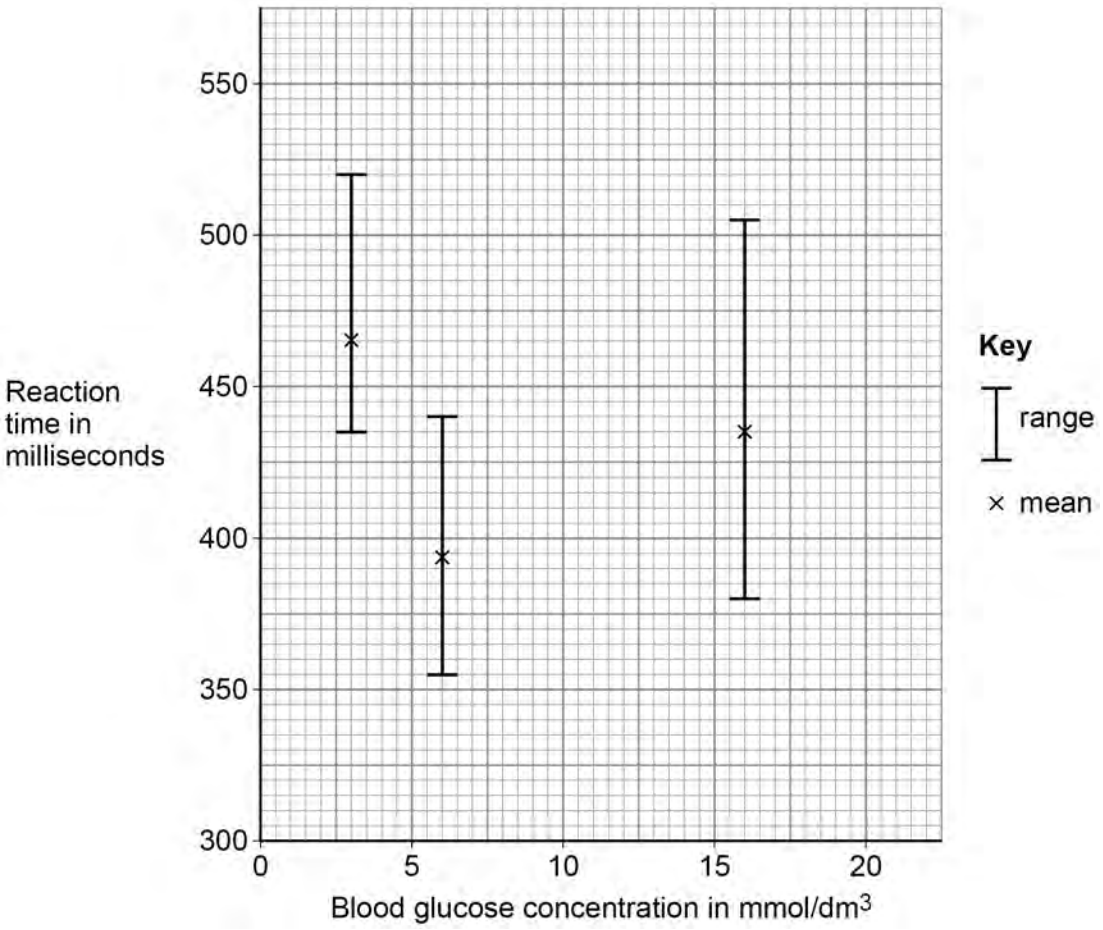
Figure 6 shows the results.

Figure 6



0 6 . 7 People who do **not** have diabetes usually have a blood glucose concentration in the range of 4.0 mmol/dm^3 to 7.8 mmol/dm^3.

Describe how the results in **Figure 6** show the importance of homeostasis.

[2 marks]

Do not write outside the box

0 6 . 8 Describe how blood glucose concentration is maintained within narrow limits in people who do **not** have diabetes.

[5 marks]

0 6 . 9 The scientists gave the hypothesis:

'Optimum blood glucose concentration increases the production of chemicals that diffuse across synapses.'

Describe how an increase in the chemicals could decrease reaction time.

[2 marks]

17

END OF QUESTIONS

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