

GCSE Combined Science

Biology Paper 2

Higher Tier

In addition to this paper you should have:

- A ruler.
- A calculator.

Centre name				
Centre number				
Candidate number				

Time allowed:

- 1 hour 15 minutes

Surname
Other names
Candidate signature

Instructions to candidates

- Write your name and other details in the spaces provided above.
- Answer **all** questions in the spaces provided.
- Do all rough work on the paper.
- Cross out any work you do not want to be marked.

Information for candidates

- The marks available are given in brackets at the end of each question.
- There are 70 marks available for this paper.
- You are allowed to use a calculator.
- You should use good English and present your answers in a clear and organised way.
- For Questions 4.4 and 7.5 ensure that your answers have a clear and logical structure, include the right scientific terms, spelt correctly and include detailed, relevant information.

Advice to candidates

- In calculations show clearly how you worked out your answers.

For examiner's use							
Q	Attempt N ^o			Q	Attempt N ^o		
	1	2	3		1	2	3
1				5			
2				6			
3				7			
4							
Total							

1 Most cells in the human body contain chromosomes.

1.1 How many pairs of chromosomes are there in a typical human body cell?

.....
[1 mark]

All of a human's genome is found within chromosomes.

1.2 Define the term **genome**.

.....
[1 mark]

Two chromosomes in each human body cell are sex chromosomes.

1.3 Describe how sex chromosomes differ between a male and a female.

.....
.....
[2 marks]

Sperm cells only have one copy of each chromosome.

1.4 Which process causes sperm cells to only have one copy of each chromosome?
Tick **one** box.

- differentiation
- mitosis
- meiosis
- mutation

[1 mark]

1.5 During sexual reproduction, a sperm cell and an egg cell fuse together to form a new cell. Describe how this new cell develops into a new organism.

.....
.....
.....
.....
[3 marks]

2 Diabetes is a condition in which the body cannot effectively control its blood glucose level.

2.1 Which organ in the body is responsible for monitoring the blood glucose level?

.....
[1 mark]

In 2015, it was estimated that **1 in 16** people in the UK had either Type 1 or Type 2 diabetes.

2.2 The English town of Derby had a population of approximately **260 000** people in 2015.

Calculate the approximate number of people in Derby who had either Type 1 or Type 2 diabetes at this time.

number of people =
[1 mark]

The number of people with **Type 2** diabetes in the UK has been rising for many years.

2.3 Suggest **one** reason why a rise in unhealthy diets may have led to an increase in the number of people with **Type 2** diabetes.

.....
.....
[1 mark]

2.4 Give **two** ways in which **Type 2** diabetes can be controlled.

1.
2.
[2 marks]

Question 2 continues on the next page

Turn over ►

A man has **Type 1** diabetes. He treats his condition by regularly injecting himself with insulin.

2.5 Explain why it is necessary for the man to regularly inject insulin.

.....

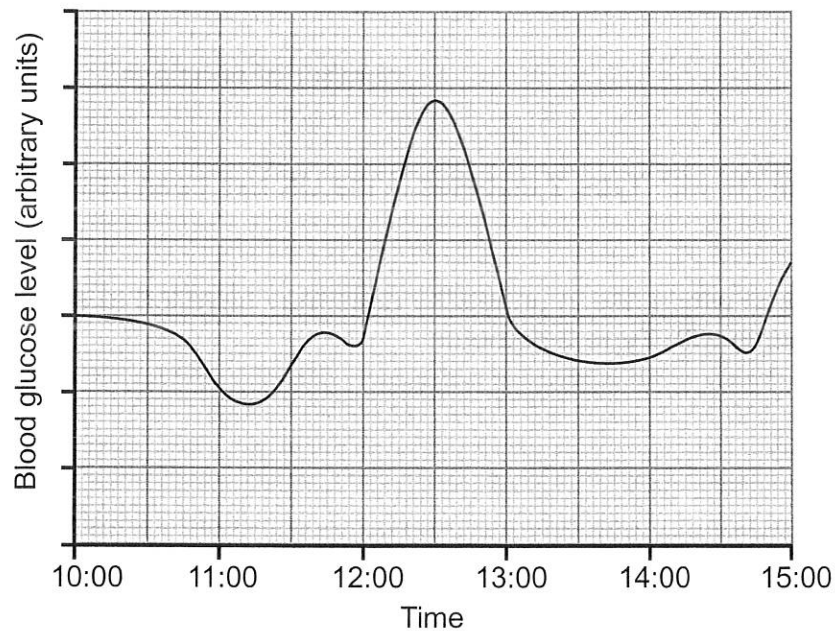
.....

.....

[2 marks]

The man was asked by his doctor to monitor his blood glucose level over the course of a day. **Figure 1** shows some of the data he collected.

Figure 1



In the time period shown on **Figure 1** the man injected himself with insulin once.

2.6 What time is the man most likely to have injected insulin?

Tick **one** box.

- 10:00
- 12:00
- 12:30
- 13:00

[1 mark]

3.3 The farmer notices that a small number of her selectively-bred raspberry plants have started to die from a disease.
Explain why she might be concerned that the disease will dramatically reduce the population size of her raspberry plants.

.....
.....
.....

[2 marks]

Crop plants with desirable characteristics can also be produced by genetic engineering.

3.4 Describe the basic process of genetic engineering.

.....
.....

[1 mark]

Genetic engineering is also useful in medicine.

3.5 Describe how genetic engineering is involved in the treatment of Type 1 diabetes.

.....
.....
.....

[2 marks]

4 A group of students are planning to carry out an experiment to investigate how listening to music at different volumes affects reaction time.

They plan to measure reaction time by measuring the distance a ruler drops before it is caught.

The students have recruited three volunteers to take part in their experiment.

Before they begin their investigation, the students test the reaction time of each volunteer when they are not listening to music.

Table 2 shows the results.

Table 2

Repeat	Distance ruler dropped (cm)		
	Volunteer 1	Volunteer 2	Volunteer 3
1	17	10	16
2	17	9	14
3	15	11	13
4	16	11	14
5	16	9	14
6	15	10	13
Mean	X	10	14

4.1 What is the modal distance the ruler dropped for **Volunteer 3**?

..... cm
[1 mark]

4.2 Calculate the value of **X** in **Table 2**.

X = cm
[1 mark]

4.3 Suggest why it is important to measure reaction time when the volunteers are not listening to music.

.....
.....
[1 mark]

Question 4 continues on the next page

Turn over ►

Reaction time depends on how quickly nerve impulses are transmitted in the body.

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blank

- 4.5** A nerve in one of the volunteer's arms is 0.5 metres long.
It takes 0.01 seconds for one impulse to travel the length of the nerve.
What is the speed of the impulse?
Tick **one** box.

- 0.5 metres/second
 50 metres/second
 0.005 metres/second
 0.02 metres/second

[1 mark]

Turn over for the next question

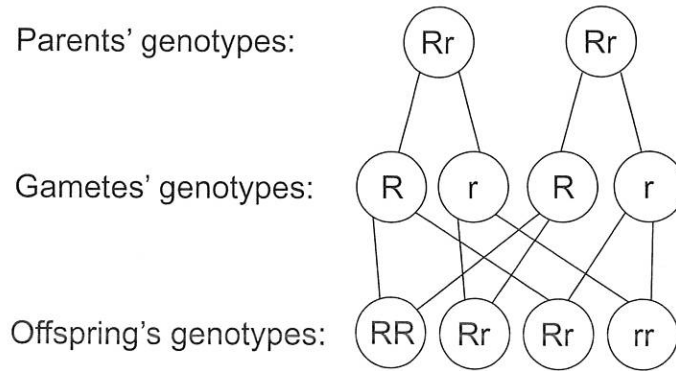
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5 Guinea pigs can have rough or smooth hair.

The gene that controls hair type has two alleles. Rough hair is controlled by the allele 'R' and smooth hair is controlled by the allele 'r'.

Figure 2 shows a genetic cross between two rough-haired guinea pigs.

Figure 2



5.1 What is the expected ratio of rough-haired guinea pigs to smooth-haired guinea pigs in the offspring of the cross shown in **Figure 2**?

..... [1 mark]

A heterozygous female guinea pig was crossed with a male guinea pig homozygous for smooth hair. They had a litter of 6 offspring.

5.2 Calculate the number of offspring you would expect to have smooth hair. Draw a Punnett square to explain your answer.

Expected number of offspring with smooth hair: [5 marks]

6 The menstrual cycle is controlled by several reproductive hormones.
One of these hormones is LH.

6.1 Describe the role of LH in the menstrual cycle.

.....
.....
[1 mark]

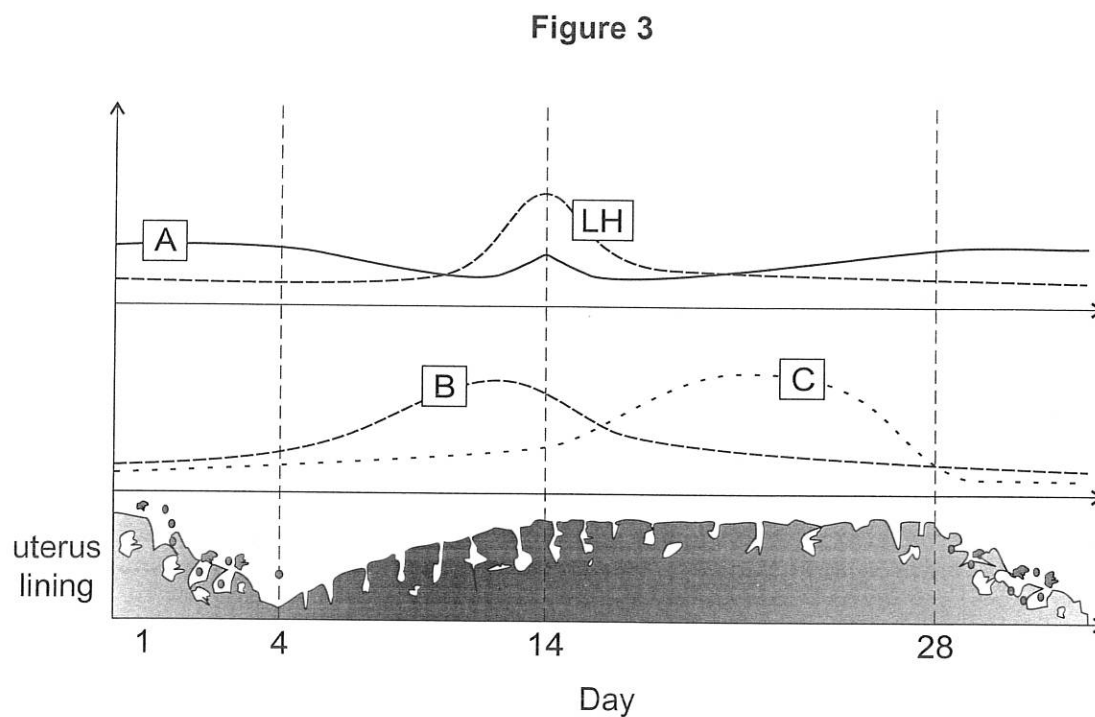
6.2 LH is produced by the pituitary gland in the brain.
Explain why the pituitary gland is also known as the 'master gland'.

.....
.....
.....
[2 marks]

Question 6 continues on the next page

Turn over ►

Figure 3 shows the levels of four different hormones during a 28 day menstrual cycle. It also shows the changes that take place in the thickness of the uterus lining.



6.3 Name the hormone represented by line **B** in **Figure 3**. Explain your answer.

Hormone:

Explanation:

.....

.....

[3 marks]

6.4 Suggest why, if a fertilised egg implants in the uterus wall, the level of hormone **C** remains high and does not decrease.

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[3 marks]

6.5 Hormones are involved in *in vitro* fertilisation (IVF). Describe the process of IVF.

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[4 marks]

6.6 Describe **two** downsides of using fertility treatment such as IVF to try to have a baby.

1.

2.

[2 marks]

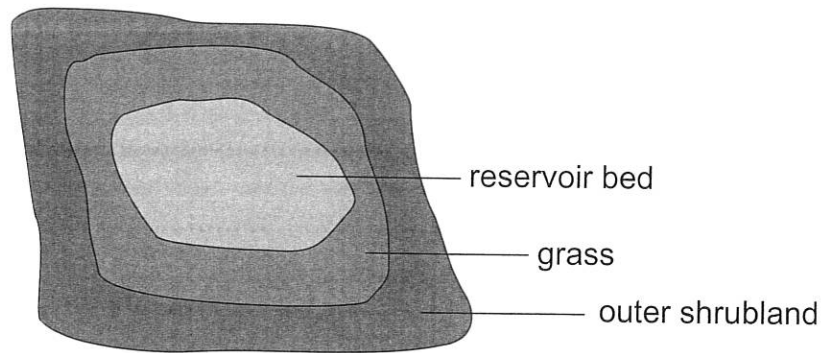
Turn over for the next question

Turn over ►

- 7 An investigation was carried out into the abundance of earthworms around a dried up reservoir. **Figure 4** shows the study area as seen from above.

Leave
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Figure 4



This is the method the scientists used:

1. They placed ten 0.5 m² quadrats randomly in the area.
2. At each quadrat, they dug down to a depth of 0.3 m and collected the soil they removed.
3. They then searched through each soil sample and recorded the number of earthworms they found at each quadrat.

- 7.1 Describe what the scientists should have done next in order to calculate the abundance of earthworms in the reservoir bed.

.....
.....
.....

[2 marks]

- 7.2 Suggest **one** way that the scientists could have got a more accurate estimate of the abundance of earthworms.

.....
.....

[1 mark]

- 7.3 Suggest **one** way the scientists could have ensured they were working ethically in this investigation.

.....
.....

[1 mark]

7.4 Suggest **one** source of error in the scientists' investigation.

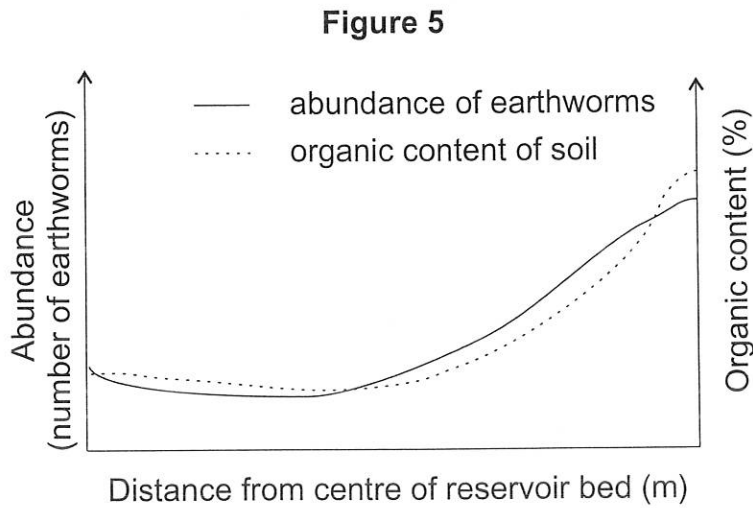
.....

.....

[1 mark]

The scientists also collected data about the organic material contained in the soil from the centre of the reservoir bed to the outer shrubland.

A summary of their results is shown in **Figure 5**.



7.5 Evaluate whether the results shown in **Figure 5** provide valid evidence that the organic content of the soil affects the abundance of earthworms. Include a justified conclusion to your evaluation.

.....

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.....

.....

[4 marks]

Question 7 continues on the next page

Turn over ►

