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

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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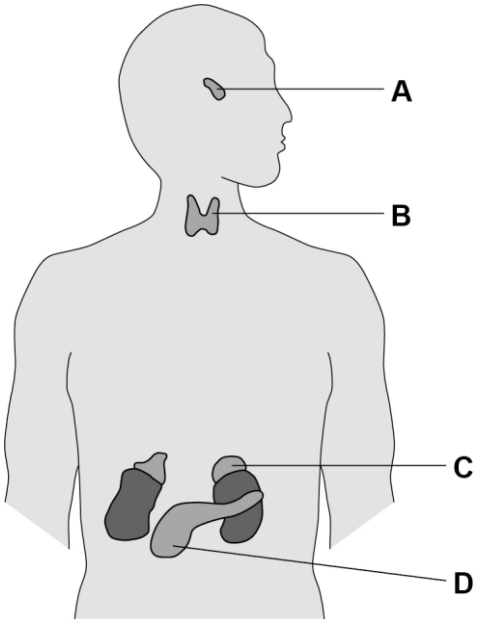
0 1 **Figure 1** shows glands in the human body.

Figure 1



0 1 . 1 Which organ system includes the glands shown in **Figure 1**?

[1 mark]

Endocrine system

0 1 . 2 Which gland produces insulin?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☑

0 1 . 3 Which gland produces hormones that stimulate the other glands to produce hormones?

[1 mark]

Tick (✓) **one** box.

A ☑ **B** ☐ **C** ☐ **D** ☐

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0 1 . 4 How do hormones travel from one gland to another gland?

[1 mark]

via blood

0 1 . 5 Name **two** glands involved in human reproduction.

Do **not** refer to glands shown on **Figure 1** in your answer.

[2 marks]

1 Ovary

2 Testis

0 1 . 6 Ovulation test kits can help women know when they are most fertile.

Ovulation test kits detect the increase in the hormone that stimulates ovulation.

Which hormone is detected by ovulation test kits?

[1 mark]

Tick (✓) **one** box.

- Follicle stimulating hormone (FSH) ☐
- Luteinising hormone (LH) ☑
- Oestrogen ☐
- Progesterone ☐

Turn over ►

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0 1 . 7 A new contraceptive drug for men is being tested.

The drug:

- is given in one injection
- stops sperm being able to fertilise eggs
- is effective for up to 13 years.

Evaluate the use of the new drug compared with existing contraceptive methods.

[6 marks]

Advantages • non-permanent like condom / diaphragm / IUDs / spermicides / abstinence or unlike surgical sterilisation • longer lasting than condom / diaphragm / IUDs / spermicides • no need to remember unlike oral contraceptive • one injection rather than surgery for sterilisation • surgery (for sterilisation) has risks, for example, infection • no other method of long-lasting contraception (rather than sterilisation) relies on men Disadvantages • no protection from sexually transmitted diseases unlike barrier methods or named barrier method • not as long lasting as (surgical) sterilisation • at clinical / drug trial stage, so unknown side effects • at clinical / drug trial stage, so unknown efficacy • do not know how long it will last (as info only states 'up to 13 years') • can stop taking a pill or using a condom if you change your mind / want to get pregnant, whereas have to wait 13 years with the injection • (minor) risk of infection posed with an injection compared to no risk with the oral contraceptive

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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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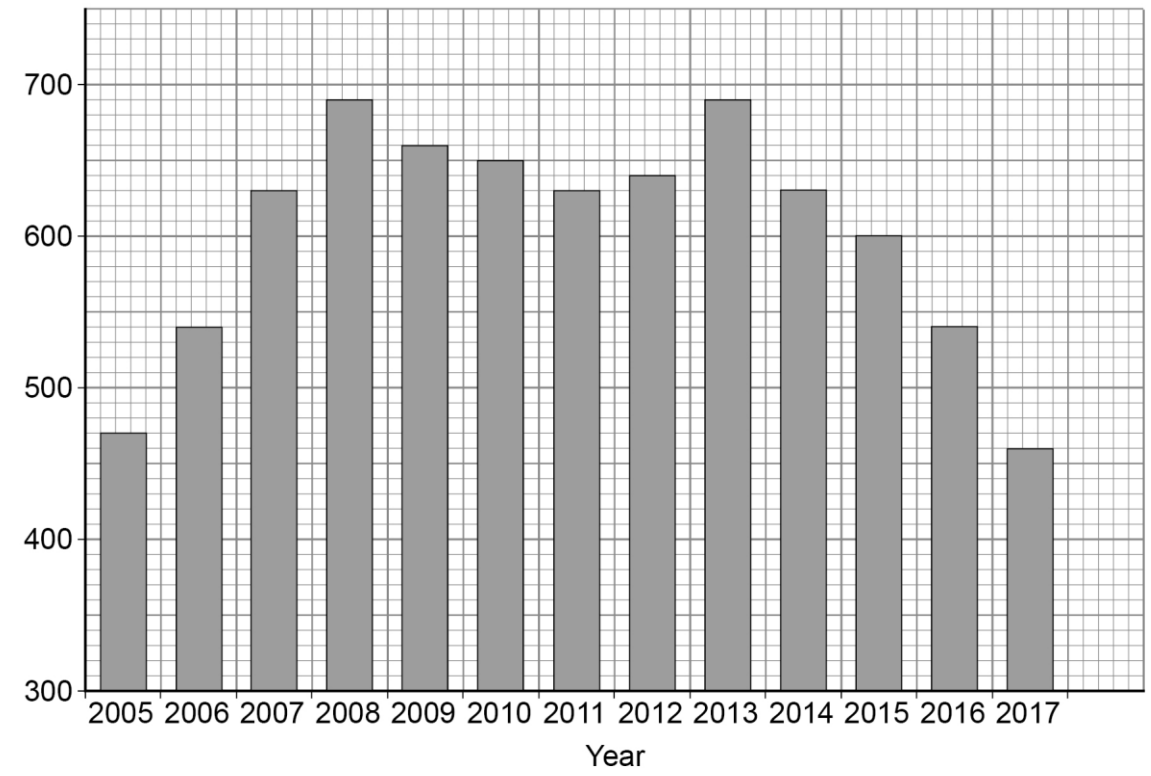
0 2 **Figure 2** shows the money spent on conserving biodiversity in the UK by the government.

Figure 2



0 2 . **1** Describe the trends in the money spent on conserving biodiversity from 2005 to 2011.

Use data from **Figure 2** in your answer.

[2 marks]

increases (from 2005) to 690 million or increases to 2008 decreases (from 2008) to 630 million

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0 2 . 2 Calculate the percentage decrease in the money spent on conserving biodiversity from 2013 to 2017.

Use the equation:

$$\text{percentage decrease} = \frac{\text{change in money spent from 2013 to 2017}}{\text{money spent in 2013}} \times 100$$

Give your answer to 2 significant figures.

[3 marks]

690(million) − 460(million) 690(million) × 100 33.3 (%) 33 (%)

Percentage decrease (2 significant figures) = _____ %

0 2 . 3 Conservation of peat bogs can help maintain biodiversity.

Give **two** uses of peat taken from peat bogs.

[2 marks]

1 Compost

2 Burning

Question 2 continues on the next page

Turn over ►

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0 2 . 4 Describe **two** ways to **increase** biodiversity in the UK.

Do **not** refer to money spent or to peat in your answer.

[2 marks]

1 Reduce pollution

2 plant Trees

9

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0 3 A fossil was found in rocks. The rocks were formed from mud.

The fossil is of the fungus *Ourasphaira giraldae.*

0 3 . 1 What is the genus of the fungus?

[1 mark]

Ourasphaira

0 3 . 2 Why was the mud important during the formation of the fossil?

[1 mark]

Tick (✓) **one** box.

- The fungus completely decayed in the mud. ☐
- The mud stopped oxygen reaching the fungus. ☑
- There was water in the mud around the fungus. ☐

Question 3 continues on the next page

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The estimated age of the fossil is in the range from 8.9×10^8 years old to 1.1×10^9 years old.

0 3 . 3 Calculate the size of the range of the estimated age of the fossil.

[1 mark]

Size of range = 210000000 years

0 3 . 4 Humans did **not** exist when the fungus was alive.

Suggest **one** other reason why an accurate estimation of when this species of fungus existed is not known.

[1 mark]

Dating method are not precise.

Carl Woese developed the three-domain system of classification.

0 3 . 5 Fungi are **not** in the domain Archaea.

Which domain are fungi classified in?

[1 mark]

Eukaryota

Do not write outside the box

0 3 . 6 Which **two** characteristics are features of organisms in the domain Archaea?

[2 marks]

Tick (✓) **two** boxes.

Can only survive in light	
Can survive in extreme environments	✓
Cells contain chloroplasts	
Cells do not have a cell wall	
Cytoplasm contains DNA	✓

0 3 . 7 Carl Linnaeus lived in the 1700s.

Carl Linnaeus classified living things into groups depending on their appearance.

Give **three** types of evidence that are used **now** to classify living things.

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

[3 marks]

1 chemical analysis

2 DNA

3 Studies of evolutionary relationships

10

Turn over for the next question

0 4 **Figure 3** shows one species of bird on a bird feeder.

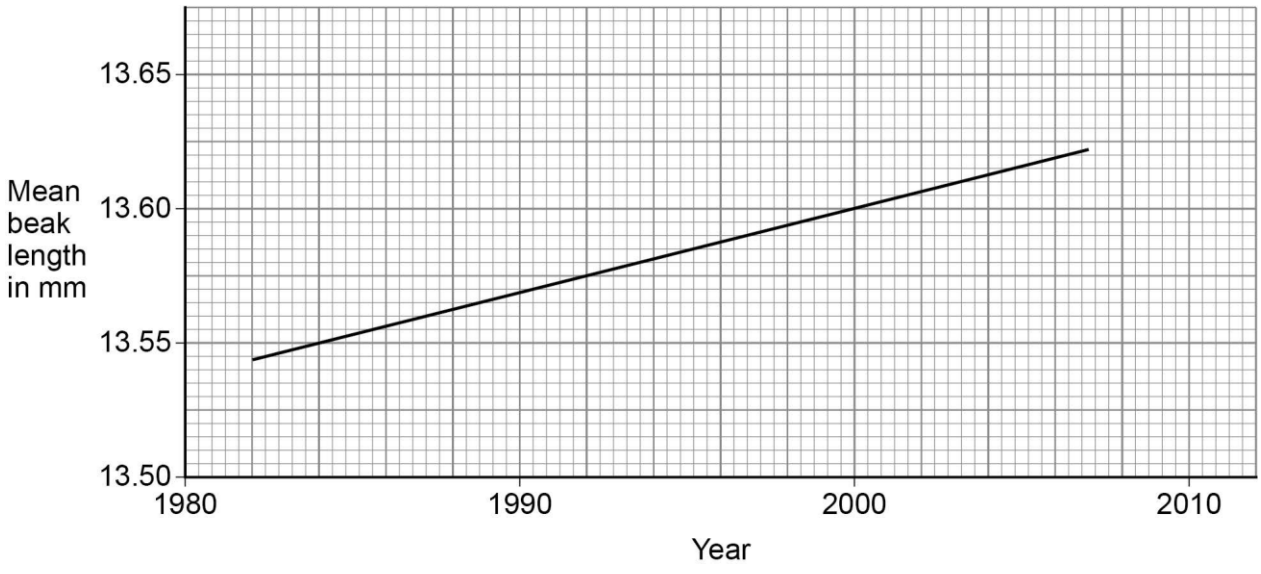
Figure 3

The birds use their beaks to reach nuts inside the bird feeder.

Figure 4 shows the mean beak length of this species of bird in the UK.

This species of bird often visits bird feeders.

Figure 4



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0 4 . 1 Determine the rate of change in beak length from 1984 to 2000.

Use **Figure 4**.

[3 marks]

13.60 mm

$\frac{13.60 \text{ mm} - 13.55 \text{ mm}}{2000 - 1984}$

Rate of change = 3.125×10^{-3} mm/year

0 4 . 2 Explain the process of evolution that could cause the trend in **Figure 4**.

[6 marks]

- there is variation in beak length (in this bird population)
- variation is due to mutations
- beak length is controlled by gene(s)
- birds with longer beaks can reach more nuts / food or birds with longer beaks can fight with or outcompete birds with shorter beaks
- therefore have more energy from food
- so can produce more offspring or reproduce more
- those offspring that inherit the long beak allele more likely to survive
- which is natural selection
- pass allele / gene (for long beak) on
- repeated over many generations
- birds are evolving to have longer beaks

Do not write outside the box

Turn over ►

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0 4 . 3 Birds of this species:

- live for about 3 years
- produce up to 24 eggs every year.

Explain why evolution is easier to study in this species of bird than in humans.

[3 marks]

shorter life cycle / span more offspring (so) the genetics of the population changes faster

0 4 . 4 Birds of this species are found in different parts of the world.

Describe evidence that would show two individual birds are the same species.

[3 marks]

similar / same phenotype similar genotype / DNA (profile) (can reproduce / breed and) produce fertile offspring

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0 5 Caffeine is a drug that decreases reaction time.

A group of sixteen students investigated the effect of caffeine on reaction time.

The students were all 15-year-old girls.

The group was divided into 8 pairs of students.

This is the method used.

1. Student **A** starts two stopwatches at the same time.
2. Student **A** then gives one of the stopwatches to Student **B**.
3. Student **A** says "stop" at the same time as stopping her stopwatch. Student **B** stops her stopwatch as quickly as possible after Student **A** says "stop".
4. The difference in time shown on the two stopwatches is recorded. This is the reaction time of Student **B**.
5. Student **B** drinks a caffeinated drink.
6. The students wait 15 minutes and then repeat steps 1 to 4.

0 5 . 1 Suggest **one** control variable the students should have used in the investigation.

Do **not** refer to age or sex in your answer.

[1 mark]

Body mass

Do not write outside the box

0 5 . 2 Suggest **two** sources of random error when using this method to measure a person's reaction time.

[2 marks]

1 Stopwatch malfunction

2 Student B could be distracted

Question 5 continues on the next page

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Table 1 shows the results.

Table 1

Student pair	Decrease in reaction time after drinking the caffeinated drink in seconds
1	0.039
2	0.021
3	0.027
4	0.041
5	0.022
6	0.036
7	0.024
8	0.097

0 5 . 3 Why can a mode **not** be determined for the data in **Table 1**?

[1 mark]

All the values are different

0 5 . 4 The students decided the result from pair **8** was anomalous.

The students calculated that the mean decrease in reaction time was 0.030 seconds.

Describe how the students calculated the mean decrease in reaction time.

[1 mark]

Added the other 7 results and divided by 7

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0 5 . 5 Caffeine causes the release of adrenaline.

Adrenaline affects heart rate.

Explain how the effect of adrenaline on heart rate might cause reaction time to decrease.

[4 marks]

adrenaline) increases heart rate (which) increases oxygen / glucose to brain / muscle (cells) (which) increases rate of respiration (so) releasing more energy for (faster / more) muscle contraction

Question 5 continues on the next page

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Adenosine is a different chemical made by the body.

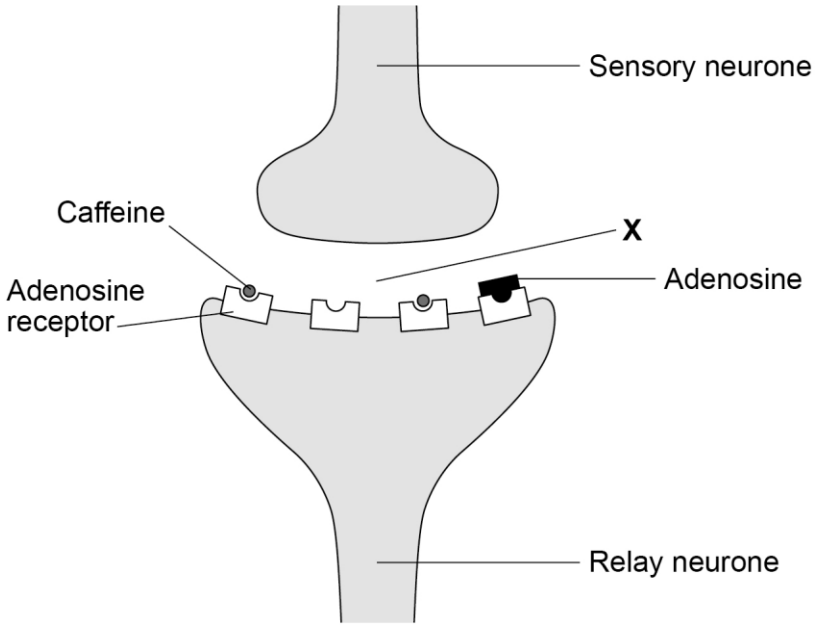
Adenosine binds to receptors on relay neurones.

Adenosine decreases the number of impulses in relay neurones.

Figure 5 shows how caffeine binds to adenosine receptors on a relay neurone.

When caffeine binds to adenosine receptors it blocks the receptor so adenosine cannot bind.

Figure 5



0 5 . 6 Label **X** shows the gap between the sensory neurone and the relay neurone.

What is the name of the gap labelled **X**?

[1 mark]

Synapse

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0 5 . 7 Suggest why reaction time decreases when caffeine binds to adenosine receptors.

[2 marks]

adenosine has no / less effect on the (relay) neurone therefore impulses in relay neurone are more frequent

12

Turn over for the next question

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0 6 This question is about genetic disorders.

0 6 . 1 Some people are heterozygous for a genetic disorder.

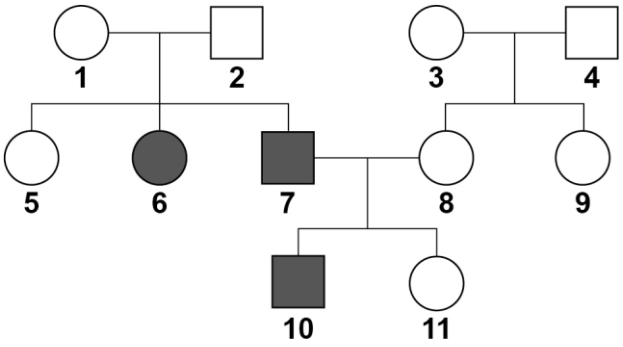
Define the term 'heterozygous'.

[1 mark]

Having two different alleles for a gene

0 6 . 2 **Figure 6** shows the inheritance of a genetic disorder in a family.

Figure 6



Key

- Female who does **not** have the disorder
- Male who does **not** have the disorder
- Female who has the disorder
- Male who has the disorder

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Person **7** and person **8** plan to have another child.

Determine the probability that the child will be a **male** who has the disorder.

You should:

- draw a Punnett square diagram
- identify the genotype of person **7** and the genotype of person **8**
- identify the phenotype of each offspring genotype
- use the symbols:
  H = dominant allele
  h = recessive allele

[6 marks]

Father / person 7 hh
Mother / person 8 Hh

hh (x2)
Hh (x2)

hh = has the disorder
Hh = Doesnot have the disorder

0.5

Probability of having a male child with the disorder = 0.25

Question 6 continues on the next page

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0 6 . 3 Polydactyly is a different inherited disorder.

Two parents do **not** have any alleles for polydactyly in their ordinary body cells.

These parents produced a child with polydactyly.

Explain how polydactyly suddenly occurred in this family.

[4 marks]

caused by mutation during meiosis causing a change in amino acid sequence causing a different (specific) protein to be produced or causing none of a (specific) protein to be produced

11

END OF QUESTIONS

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