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Other names

Pearson
Edexcel GCSE

Centre Number

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Candidate Number

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Biology

Unit B3: Using Biology

Higher Tier

Monday 19 June 2017 – Morning

Time: 1 hour

Paper Reference

5BI3H/01

You must have:

Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
– *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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Answer ALL questions

Some questions must be answered with a cross ☐.
If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

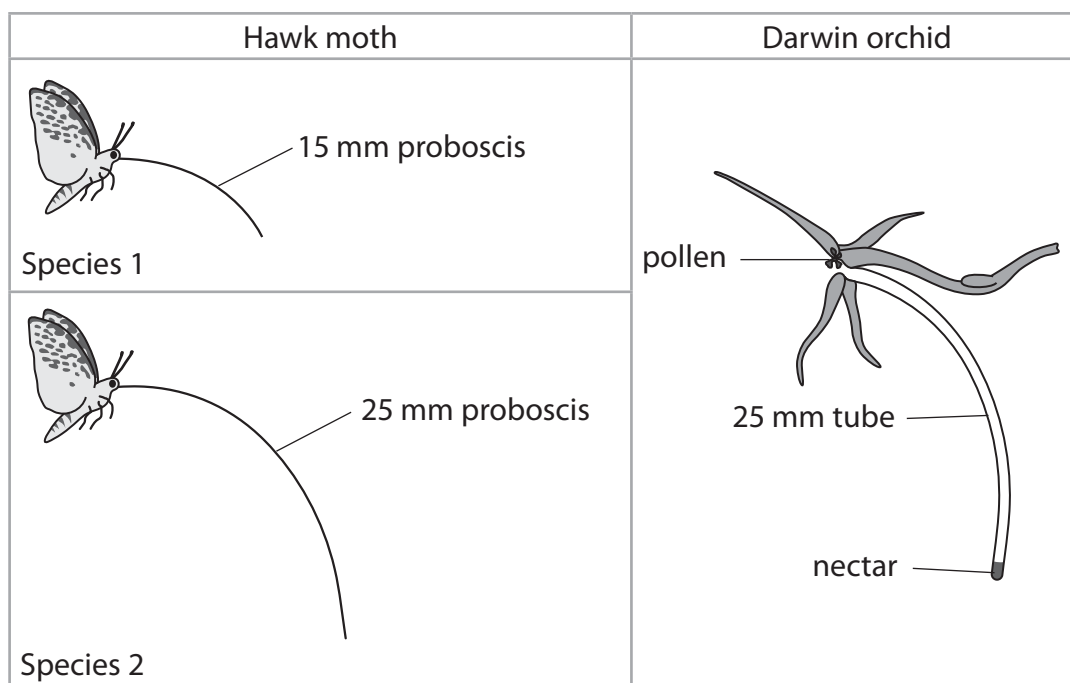
Co-evolution

- 1 The Darwin orchid, *Angraecum sesquipedale*, is a flower found in Madagascar. It is pollinated by a species of hawk moth.

Hawk moths feed from orchids using a long tube called a proboscis.

Pollen sticks to the head of the hawk moth when it attempts to feed.

The diagram shows a cross section of the orchid and two different species of hawk moth.



- (a) (i) Explain which species of hawk moth is likely to feed on the nectar.

(2)

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(ii) Which species of hawk moth could pollinate the orchid?

Put a cross (☒) in the box next to your answer.

(1)

- ☐ **A** species 1 only
- ☐ **B** species 2 only
- ☐ **C** both species 1 and species 2
- ☐ **D** neither species 1 nor species 2

(b) (i) Describe how the co-evolution of the orchid and the hawk moth could have occurred.

(3)

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(ii) Suggest a benefit of this co-evolution to the hawk moth.

(1)

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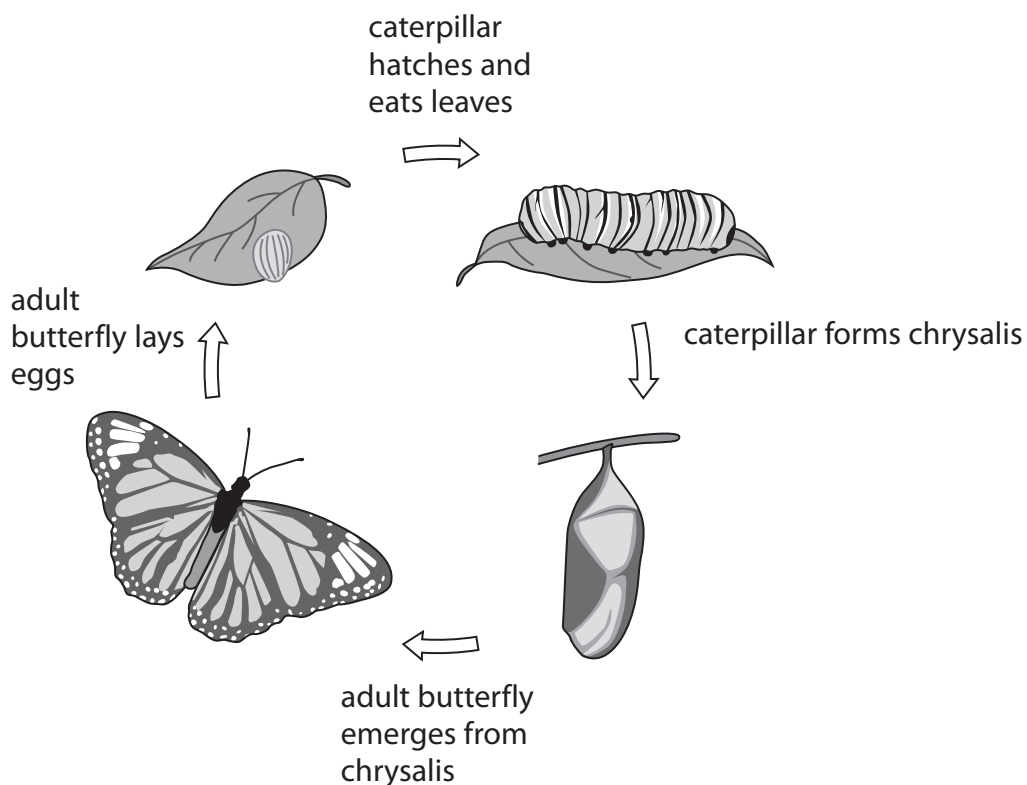
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(Total for Question 1 = 7 marks)



Behaviour

- 2 The diagram shows the life cycle of a butterfly.



- (a) This species of butterfly lays eggs on the underside of leaves.

Explain why this behaviour is beneficial to the survival of this species of butterfly.

(2)

- (b) (i) Eating leaves provides food for caterpillars.
Some caterpillars eat leaves containing chemicals that make the caterpillars taste bad.

Suggest one advantage to these caterpillars of eating leaves that make them taste bad.

(1)



(ii) Humans extract some of these chemicals from plant leaves for use in medicine.

Which of the following is a medical use of these chemicals?

Put a cross (X) in the box next to your answer.

(1)

- ☐ A as a hormone to treat infertility
- ☐ B to relieve symptoms of disease
- ☐ C to produce hybridoma cells
- ☐ D as an antigen

(c) Some butterflies close their wings when they sense an animal approaching.

Explain the advantage of this behaviour.

(2)

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(d) Police horses are trained using conditioning.

Giving horses rewards during training decreases the time taken for them to learn new skills.

(i) State the term used to describe this type of conditioning.

(1)

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(ii) Police horses attend events where flags are waved by crowds.

Describe how a horse could become habituated to flags being waved.

(2)

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(Total for Question 2 = 9 marks)

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Control systems

3 Humans produce hormones to control reproductive cycles and to control urine production.

(a) After fertilisation an embryo is implanted in the lining of the uterus.

(i) Describe how the sex of the embryo is determined at fertilisation.

(2)

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(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

Progesterone levels remain high after fertilisation.
Progesterone is produced by the

- ☐ **A** corpus luteum
- ☐ **B** lymphocytes
- ☐ **C** pituitary gland
- ☐ **D** hypothalamus

(b) A female who is a carrier for haemophilia and a non-haemophiliac male are having a child.

Use the Punnett square to calculate the probability that the child will be a male with haemophilia.

Use X^H for the normal allele and X^h for the haemophilia allele.

(3)

		male	
female			

probability of a male haemophiliac

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(c) The levels of the hormone ADH vary in the human body.

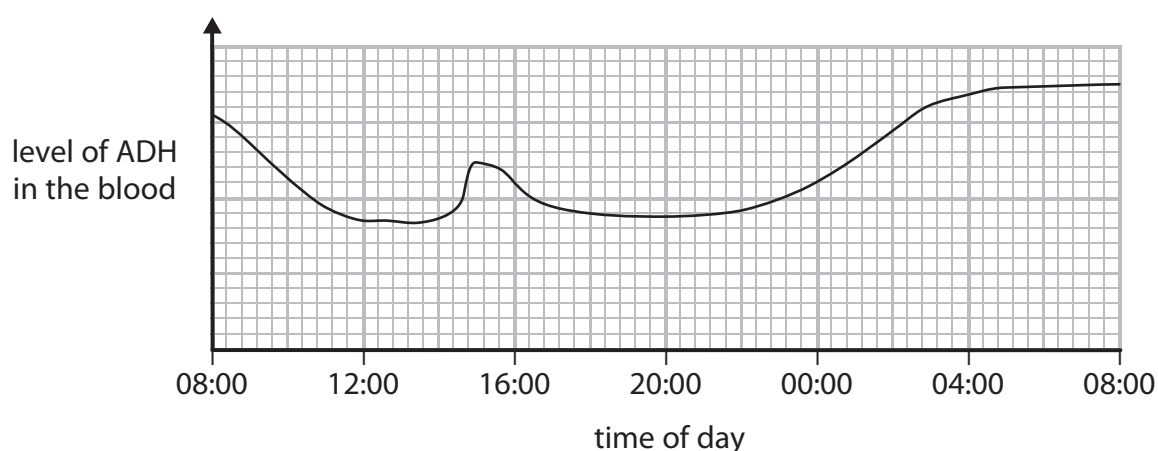
(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

ADH affects the collecting duct by

- ☐ **A** increasing its permeability to water, decreasing urine production
- ☐ **B** decreasing its permeability to water, decreasing urine production
- ☐ **C** increasing its permeability to water, increasing urine production
- ☐ **D** decreasing its permeability to water, increasing urine production

(ii) The graph shows the level of ADH in the blood of one person during one day.



State a reason for the level of ADH production at 15:00 hours.

(1)

(d) Urine contains the waste product urea.

State how and where urea is produced.

(2)

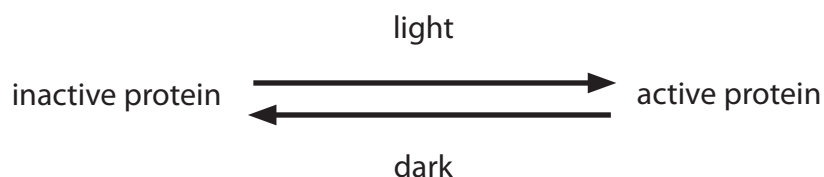
(Total for Question 3 = 10 marks)



Plants

- 4 (a) Flowering plants produce a protein that is sensitive to light.

The diagram shows the effect of light on this protein.



In long-day plants the active protein promotes flowering.

In short-day plants the active protein inhibits flowering.

- (i) Complete the sentence by putting a cross (X) in the box next to your answer.

(1)

This behavioural response of plants to different day lengths is

- ☐ A photosynthesis
- ☐ B conditioning
- ☐ C photoperiodicity
- ☐ D inheritance

- (ii) Short-day plants flower when there are fewer hours of daylight.

Explain why fewer hours of daylight cause short-day plants to flower.

(2)

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- (iii) Sugar cane is a short-day plant.

Sugar cane that has not flowered can be used to produce biofuels.

Suggest how flowering can be inhibited in sugar cane.

(1)

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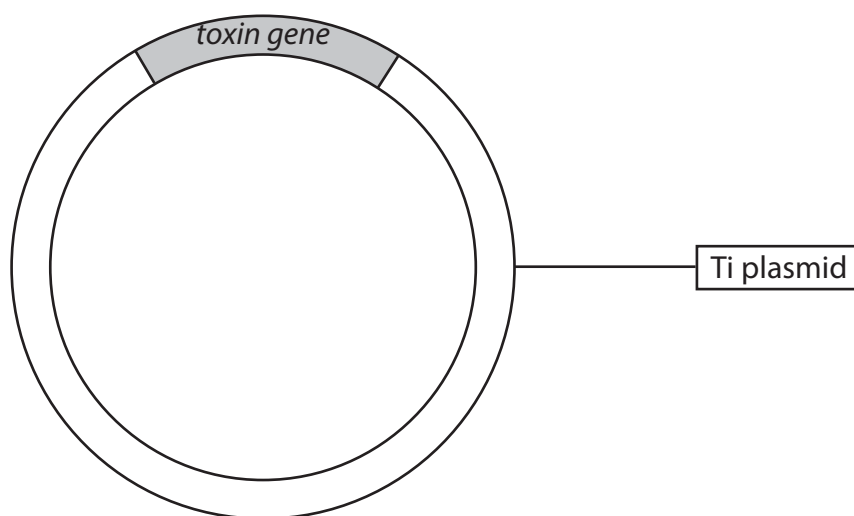


(b) Explain why biofuels can be described as carbon neutral.

(2)

(c) Genetic modification can be used to increase the yield of crops.

The diagram shows a Ti plasmid containing a gene for producing a toxin.



Explain how this plasmid can be used to create transgenic plants.

(4)

(Total for Question 4 = 10 marks)



Immunisation

- 5 HIV is a virus that damages white blood cells.

Immunisation could protect people from infection with HIV.

In a clinical trial, 16 000 healthy volunteers at risk of contracting HIV were split into equal sized groups and given either:

- an injection with the ALVAC® HIV immunisation followed by the AIDSVAX® immunisation two weeks later
- two placebo injections two weeks apart.

After three years, the number of volunteers testing positive for HIV was recorded. The results are shown in the table.

volunteers with HIV after immunisation	0.625%
volunteers with HIV after placebo injection	0.925%

- (a) (i) A placebo injection contains no antigens.

Suggest why a placebo injection was used as part of the trial.

(1)

- (ii) Calculate how many more volunteers contracted HIV after being injected with the placebo compared with those volunteers who were immunised.

(3)

..... volunteers



(iii) Explain why this data shows that further research is needed to produce an effective immunisation against HIV.

(2)

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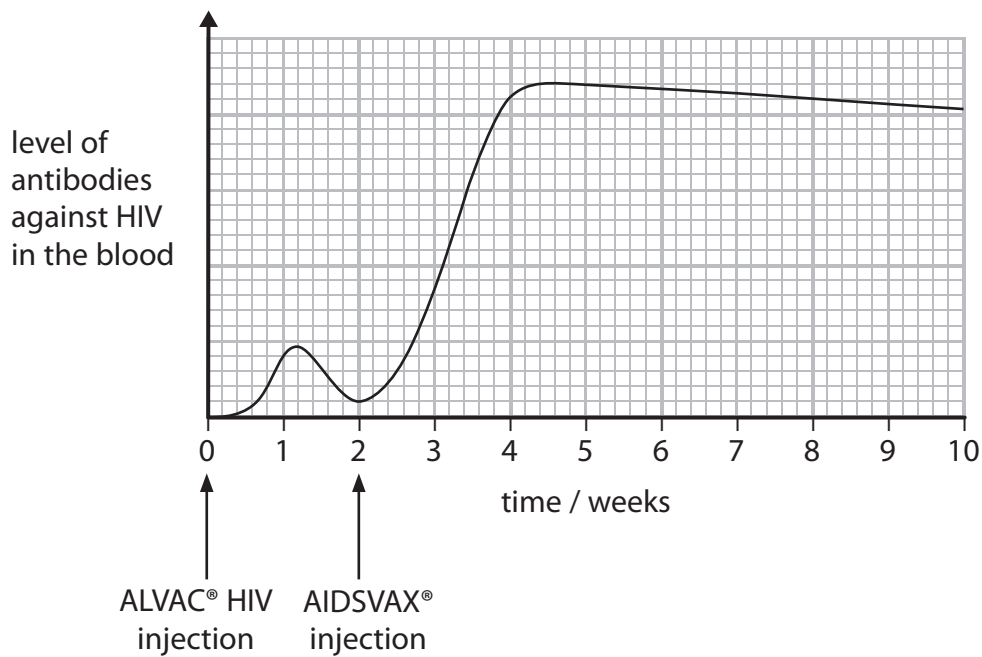
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*(b) The level of antibodies against HIV in the blood of an immunised volunteer was measured during the clinical trial.



Explain the effect of this immunisation on the level of antibodies against HIV in the blood.

(6)



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(Total for Question 5 = 12 marks)



Enzymes

- 6 Enzymes are used to make many food products including sweets, cheese and lactose-free milk.

- (a) (i) The enzyme invertase is used in the production of sweets with soft centres.

What reaction does invertase catalyse?

Put a cross (X) in the box next to your answer.

(1)

- ☐ A sucrose $\longrightarrow$ glucose + lactose
- ☐ B glucose $\longrightarrow$ sucrose + fructose
- ☐ C sucrose $\longrightarrow$ glucose + fructose
- ☐ D glucose $\longrightarrow$ lactose + sucrose

- (ii) State the name of the yeast that produces invertase.

(1)

- (b) Explain how enzymes are used to produce vegetarian cheese.

(4)



*(c) Explain how enzymes can be immobilised and used to produce lactose-free milk.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS



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